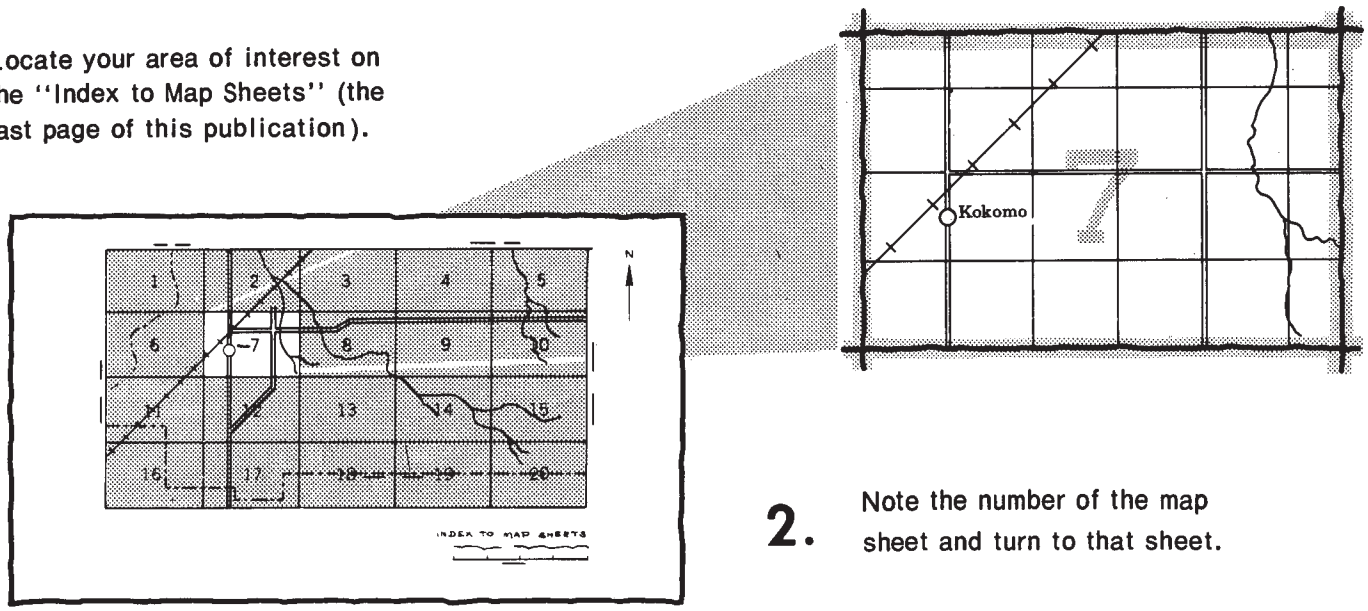
SOIL SURVEY of

PUTNAM COUNTY, INDIANA

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

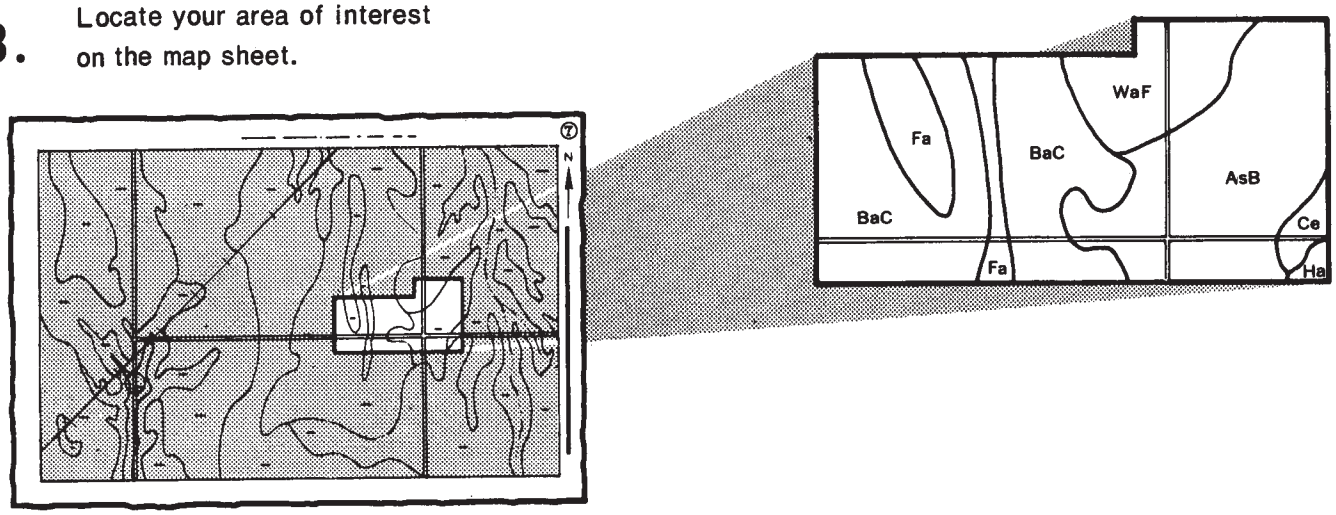
HOW TO USE

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

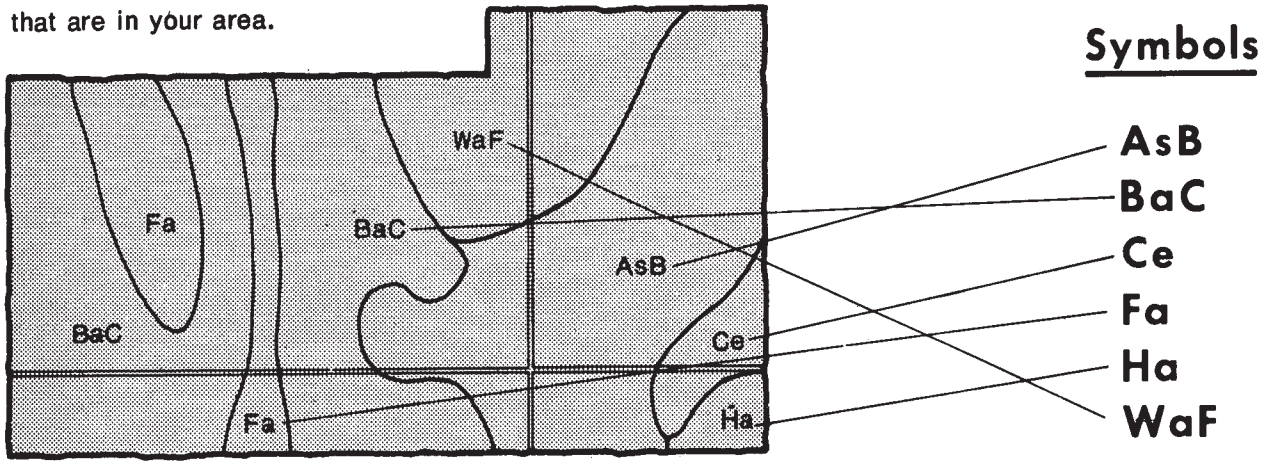


2. Note the number of the map sheet and turn to that sheet.

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

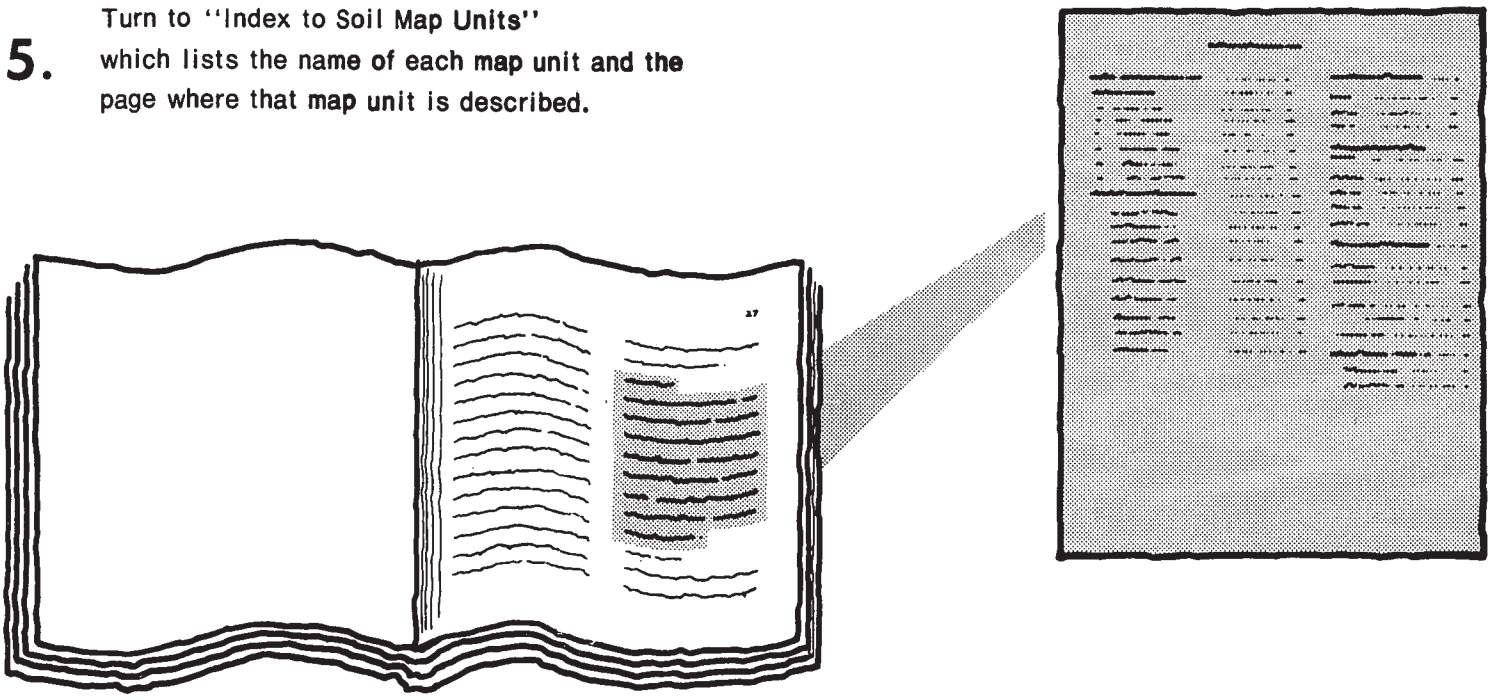


4. List the map unit symbols that are in your area.

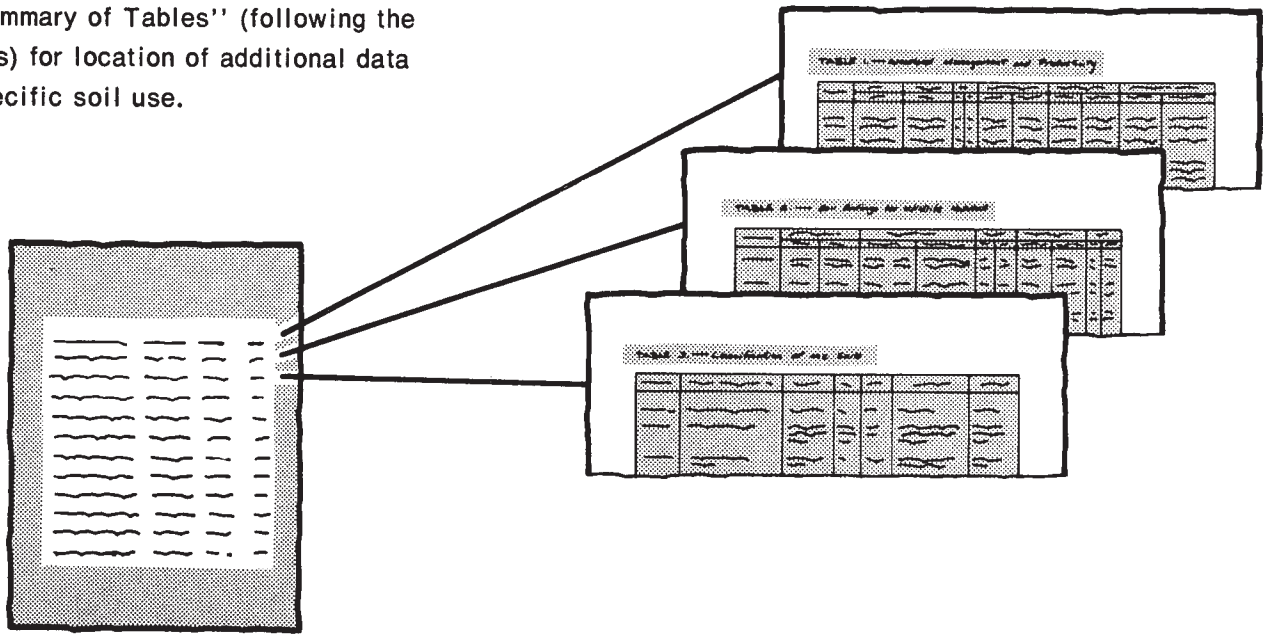


THIS SOIL SURVEY

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



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



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

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

This survey was made cooperatively by the Soil Conservation Service, Purdue University Agricultural Experiment Station, and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Putnam County Soil and Water Conservation District. Financial assistance was made available by the county council and county commissioners and the Indiana Department of Natural Resources. Major fieldwork was performed in the period 1975-78. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in Putnam County.

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.

contents

soil series

Issued September 1981

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summary of tables

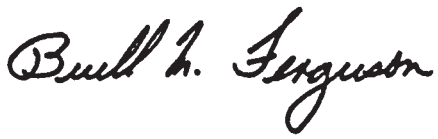
foreword

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

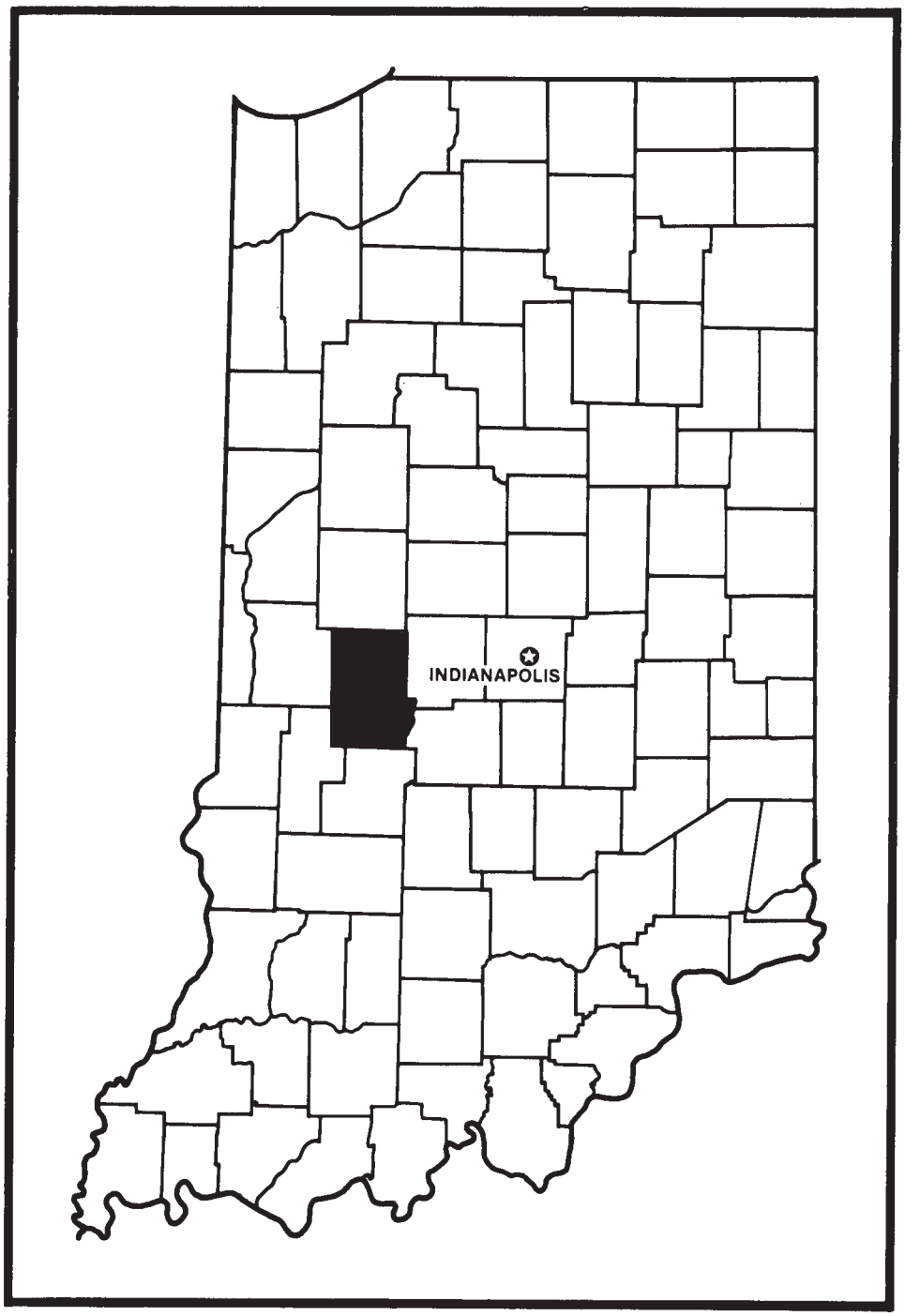
This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey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

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

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



Buell M. Ferguson
State Conservationist
Soil Conservation Service



Location of Putnam County in Indiana.

Soil survey of
Putnam County, Indiana

By Mac H. Robards, Soil Conservation Service

Fieldwork by Mac H. Robards, George J. McElrath, Travis Neely, and John M. Robbins, Jr.
United States Department of Agriculture, Soil Conservation Service and
Steven W. Neyhouse and Terry L. Stephenson
Indiana Department of Natural Resources, Soil and Water Conservation Committee

United States Department of Agriculture, Soil Conservation Service
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PUTNAM COUNTY is in the west-central part of Indiana. It has an area of 313,600 acres, or 490 square miles. It extends 27 miles from north to south and 18 miles from east to west.

general nature of the survey area

This section gives general information concerning relief, water supply, climate, transportation, population and land use, and manufacturing and services for agriculture in the county.

relief

The highest point in Putnam County, 980 feet above sea level, is in Monroe Township. The lowest point, 590 feet, is in Washington Township.

Putnam County is generally part of an undulating or gently rolling plain broken by streams. Some interstream areas are marked by flat areas, prominent ridges and knobs. The ridges and rounded knobs, which may contain limestone sink holes, are scattered over the region south and west of a line extending through northern Madison Township and Greencastle to the southeast corner of the county. The flat areas are the broad plains and terraces in the stream valleys of Eel River, Deer Creek, Big Walnut Creek, Little Walnut Creek, and Mill Creek. In some areas there are deep, narrow gorges or V-shaped valleys.

Most of the watersheds slope to the southwest. The central part of the county is transversed by Big Walnut Creek from the northeast corner to within a few miles of the southwest corner where the waters of Little Creek join to form the Eel River. The northwest part is drained by Big Raccoon Creek and the southeast part by Deer Creek and Mill Creek.

water supply

Wells are the main source of water in Putnam County. The major wells are in the valleys of Big Walnut Creek, Little Walnut Creek, Deer Creek, and Mill Creek. The water is good, but it has a high content of calcium, magnesium, and iron.

The principal sources of ground water are (1) rocks of Mississippian and Pennsylvanian age; (2) sandstone faces of the siltstones of the Mississippian age; (3) sand and gravel in the large buried preglacial bedrock channel in the northern part of the county; (4) sand and gravel deposits interbedded and overlain by till in the preglacial

bedrock channels; and (5) sand and gravel interbedded with lake sediments (*6*).

climate

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

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Greencastle in the period 1951 to 1974. 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 30 degrees F, and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Greencastle on February 2, 1951, is -20 degrees. In summer the average temperature is 74 degrees, and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred at Greencastle on July 15, 1954, is 107 degrees.

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

The total annual precipitation is 40 inches. Of this, 24 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 21 inches. The heaviest 1-day rainfall during the period of record was 6.5 inches at Greencastle on June 22, 1952. Thunderstorms occur on about 45 days each year, and most occur in summer.

Severe thunderstorms and tornadoes occur occasionally. These storms are usually local and of short duration and cause damage in a variable pattern.

Average seasonal snowfall is 29 inches. The greatest snow depth at any one time during the period of record was 14 inches. On the average of 15 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in March.

transportation

A network of federal and state highways and many all-weather county roads cross the county. Interstate 70 passes through the southern part from east to west.

A small airport 2 miles southeast of Greencastle serves privately owned airplanes.

The Baltimore and Ohio Railroad, the Louisville and Nashville Railroad, and the Conrail System also serve the county.

population and land use

The population of Putnam County in 1970 was approximately 26,932, an increase of 7.5 percent from 1960. Greencastle, the county seat and the largest town, had a population of approximately 8,852 in 1970.

Farming is one of the leading enterprises in the county. Cash grain and livestock dominate farming. Swine are the dominant livestock. A few beef and dairy herds are scattered throughout the county. The acreage used for farmland is decreasing as the acreage used for urban development is increasing. In 1974, approximately 73 percent of the acreage in the county was used for agriculture. That was a decrease of 7.8 percent from 1969. Cropland decreased by 1.9 percent, grassland by 1 percent, and woodland by 0.3 percent.

manufacturing and services for agriculture

Manufacturing plants for agricultural limestone and tile and a few suppliers of farm machinery, fertilizer, and seed are in the county. A corporation that constructs farm buildings is also available.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some

are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

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

The general soil map 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 map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of each map unit as a percentage of the survey area. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, woodland, urban uses,* and *recreation areas*. Cultivated crops are those grown extensively in the survey area. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic. Extensive recreation areas are those used for nature study and as wilderness.

The names, descriptions, and delineations of soils on the general soil map of this county do not always agree or join fully with those of adjoining counties published at an earlier date. This difference is due to changes in concepts of soil series in the application of the soil classification system. Other differences are brought about by a different predominance of soils in map units made up of two or three series. Still other differences may be caused by the range in slope allowed within the map unit of adjoining surveys. In this county or in adjacent counties a map unit may be too small to be delineated.

soil descriptions

Areas dominated by nearly level to moderately sloping, well drained to somewhat poorly drained soils; on uplands

This group of soils makes up about 34 percent of the county. It consists mainly of soils that have a seasonal high water table. In most areas these soils are used for cultivated crops. In some areas they are used for hay, pasture, and woodland. These soils have fair potential for cultivated crops and poor to fair potential for sanitary facilities and building site development.

1. Xenia-Reesville-Fincastle

Nearly level and gently sloping, moderately well drained and somewhat poorly drained silty soils; on uplands

The soils in this map unit are on broad upland till plains. The till plains are made up of ridges consisting of gently sloping side slopes, knolls, and broad flats. Most of these mapped areas are dissected by small streams. The slope range is 0 to 6 percent.

This map unit makes up about 19 percent of the survey area. It is about 39 percent Xenia soils, 29 percent Reesville soils, 15 percent Fincastle soils, and 17 percent soils of minor extent.

Xenia soils generally are on the gently sloping side slopes and knolls. In places, these soils are on small flat areas on knolls. They have a surface layer of dark brown silt loam and a subsoil of dark brown silty clay loam, yellowish brown silty clay loam, and clay loam.

Reesville soils generally are on the broad flats. They have a surface layer of dark grayish brown silt loam and a subsoil of yellowish brown and grayish brown silty clay loam.

Fincastle soils generally are on the broad flats that are adjacent to sloping areas and are dissected by small streams. They have a surface layer of dark grayish brown silt loam, a subsurface layer of grayish brown silt loam, and a subsoil of yellowish brown silty clay loam and brown clay loam.

Of minor extent are the well drained Miami soils on knobs and breaks along drainageways, the very poorly drained Ragsdale soils in depressions, and the

somewhat poorly drained Shoals soils in narrow drainageways.

Most of the acreage of this map unit has been cleared. Some of that acreage has been drained. In the cleared areas, soils are used for cultivated crops, small grain, and forage crops. Corn, soybeans, wheat, and hay are the main crops. The uncleared acreage consists of mixed hardwoods.

The use of the soils for cultivated crops, small grain, and forage crops is limited mainly by slope, wetness, and the hazard of erosion.

The soils in this map unit are suitable for trees. In the sloping areas, white oak, black oak, yellow-poplar, sugar maple, and some hickory are dominant. In the flat areas, white oak, red oak, and yellow-poplar are dominant. In the flat areas, the use of logging equipment is somewhat restricted during the wetter season of the year.

The soils in this unit are poorly suited to sanitary facilities and building site development. Slope and wetness are the main limitations.

The soils in this unit are suited to intensive recreation uses. Slope and wetness are the main limitations to those uses. The soils are well suited to extensive recreation uses.

2. Xenia-Russell

Nearly level to moderately sloping, moderately well drained and well drained silty soils; on uplands

The soils in this map unit are on the upper part of side slopes and the narrow ridgetops and knolls of the upland till plains. This unit is made up of long, narrow to broad, irregular side slopes that are adjacent to the broad upland till plains and of the very steep areas bordering the major streams. Most areas of this map unit are dissected by many small streams. The slope range is 0 to 12 percent.

This map unit makes up about 15 percent of the survey area. It is about 45 percent Xenia soils, 32 percent Russell soils, and 23 percent soils of minor extent (fig. 1).

Xenia soils generally are on the side slopes, narrow ridgetops, and knolls. In places these soils are on small flat areas on the knolls. They have a surface layer of

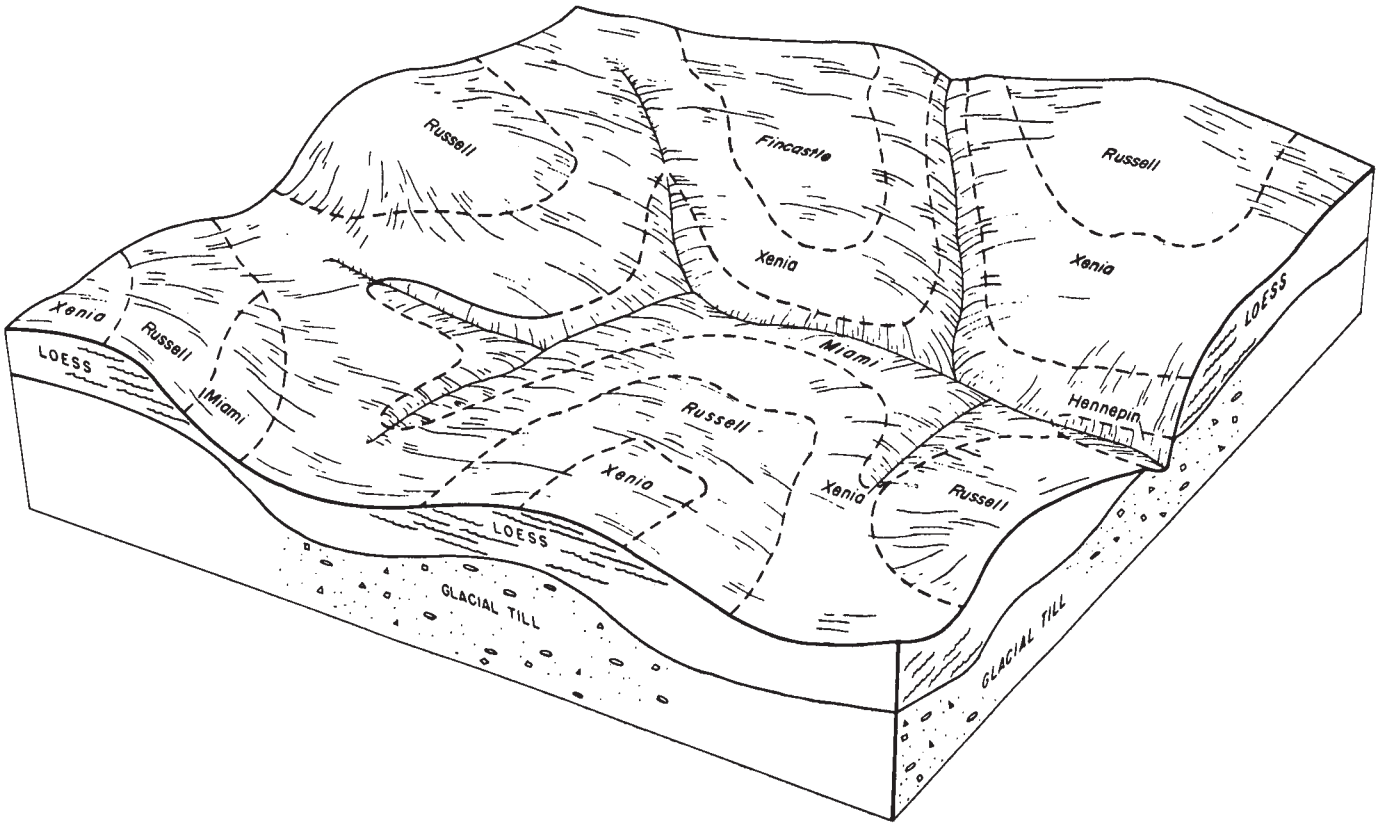

Figure 1.—Typical pattern of soils, topography, and underlying material in the Xenia-Russell map unit.

dark brown silt loam and a subsoil of dark brown silty clay loam, yellowish brown silty clay loam, and clay loam.

Russell soils generally are on the side slopes. They have a surface layer of dark brown silt loam and a subsoil of dark yellowish brown and dark brown silty clay loam and dark yellowish brown and yellowish brown clay loam.

Of minor extent are the well drained Miami soils on knobs and breaks along drainageways, the well drained Hennepin soils on very steep side slopes along drainageways, and the somewhat poorly drained Fincastle soils on broad flats.

Most of the acreage of this map unit has been cleared and used for cultivated crops, small grain, forage crops, and pasture. Corn, soybeans, wheat, and hay are the main crops. Pasture is on the steeper slopes. The uncleared acreage consists of rough, steep areas that are generally in mixed hardwoods.

The use of the soils as cropland, hayland, and pasture is limited by the slope and hazard of erosion. Overgrazing and grazing when the soils are wet, which can accelerate erosion and gullying, are major concerns of pasture management. Providing water for livestock is an additional concern in areas where there are no streams. In some areas, ponds are needed to provide water for livestock.

The soils in this map unit are suitable for trees. White oak, yellow-poplar, sugar maple, and hickory are dominant.

The soils in this unit are suited to sanitary facilities and building site development. Slope and wetness are the main limitations.

The soils in this unit are suited to intensive recreation uses. Slope and wetness are the main limitations to those uses. The soils are well suited to extensive recreation uses.

Areas dominated by nearly level, well drained and somewhat poorly drained soils; on bottom lands

This group of soils makes up about 14 percent of the county. It consists of soils on bottom lands that are subject to flooding. In many areas the soils are used for cultivated crops. In some areas they are used for hay, pasture, or woodland. These soils have fair potential for cultivated crops and poor potential for sanitary facilities and building site development.

3. Chagrin-Shoals

Nearly level, well drained and somewhat poorly drained silty soils; on bottom lands

The soils in this map unit are in nearly level and very slightly depressional areas along the major streams and some minor streams in the county.

This map unit makes up about 12 percent of the survey area. It is about 42 percent Chagrin soils, 34 percent Shoals soils, and 24 percent soils of minor extent.

Chagrin soils generally are adjacent to the streams. They have a surface layer of dark brown silt loam and a subsoil of dark brown and dark yellowish brown loam.

Shoals soils generally are in lower lying, flatter areas away from streams and make up most of the narrow bottom lands adjacent to the minor streams. They have a surface layer of dark grayish brown silt loam. The underlying layers are brown and dark grayish brown, mottled silt loam and grayish brown and yellowish brown, mottled loam.

Of minor extent are the somewhat poorly drained Bartle and Whitaker soils and the well drained Elkinsville, Fox, Martinsville, and Ockley soils on higher rises. Also of minor extent are the well drained Stonelick soils near the streams.

Most of the acreage of this map unit has been cleared and used for cultivated crops, small grain, forage crops, and pasture. Corn, soybeans, and hay are the main crops. Pasture is on narrow bottom lands where it is not feasible to grow row crops. The uncleared acreage consists of rough steep areas and narrow bottom lands that are generally in mixed hardwoods.

The use of the soils for cultivated crops and forage crops is limited by wetness and flooding. Flooding is common in winter and spring.

The soils in this map unit are suited to pasture. Overgrazing and grazing when the soils are wet are major concerns of pasture management. Grazing under wet conditions causes surface compaction and poor tilth.

The soils in this unit are suitable for trees. Yellow-poplar, black walnut, and red oak are in areas of the well drained soils. Yellow-poplar, cottonwood, and sycamore are in areas of the somewhat poorly drained soils.

The soils in this unit are poorly suited to sanitary facilities and building site development. Flooding and wetness are the main limitations.

The soils in this unit are poorly suited to recreation uses. Flooding and wetness are the main limitations.

4. Haymond-Wakeland

Nearly level, well drained and somewhat poorly drained silty soils; on bottom lands

The soils in this map unit are in nearly level to very slightly depressional areas along the major streams and minor streams.

This map unit makes up about 2 percent of the survey area. It is about 29 percent Haymond soils, 27 percent Wakeland soils, and 44 percent soils of minor extent.

Haymond soils generally are adjacent to the streams. They have a surface layer of dark grayish brown silt loam and a subsoil of dark grayish brown and dark brown silt loam.

Wakeland soils generally are in lower lying, flatter areas away from streams. They have a surface layer of dark brown silt loam, which is underlain by grayish brown and dark yellowish brown, mottled silt loam.

Of minor extent are the well drained Chagrin soils near the streams, the poorly drained Birds soils and

somewhat poorly drained Shoals soils away from the streams, and the poorly drained Evansville soils on higher rises.

Most of the acreage of this unit has been cleared and used for cultivated crops, forage crops, and pasture. Corn, soybeans, and hay are the main crops. The uncleared acreage consists of mixed hardwoods.

The use of the soils for cultivated crops and forage crops is limited mainly by wetness and flooding. Flooding is common in winter and spring.

The soils that are used for pasture are suited to raising beef cattle and other livestock. Overgrazing and grazing when the soils are wet are major concerns of pasture management. Grazing under wet conditions causes surface compaction and poor tilth.

The soils in this unit are suitable for trees. The well drained soils support such trees as yellow-poplar, black walnut, and red oak. The somewhat poorly drained soils support such trees as yellow-poplar, cottonwood, and sycamore.

The soils in this unit are poorly suited to sanitary facilities and building site development. Flooding and wetness are the main limitations.

The soils in this unit are poorly suited to recreation uses. Flooding and wetness are the main limitations.

Areas dominated by nearly level, somewhat poorly drained and very poorly drained soils; on uplands and in upland depressions

The soils in this group make up about 11 percent of the county. They have a high water table. Drainage is needed to overcome wetness or ponding. Drainage is installed in most areas. In most areas these soils are used for cultivated crops. In a few areas they are used for hay, pasture, or woodland. These soils have good potential for cultivated crops and poor potential for sanitary facilities and building site development.

5. Reesville-Ragsdale-Fincastle

Nearly level, somewhat poorly drained and very poorly drained silty soils; on uplands and in upland depressions

The soils in this map unit are on broad upland till plains, which are made up of broad swells and slight depressions. Most of these areas are dissected by small streams. The slope range is 0 to 3 percent.

This map unit makes up about 11 percent of the survey area. It is about 43 percent Reesville soils, 29 percent Ragsdale soils, 23 percent Fincastle soils, and 5 percent soils of minor extent.

Reesville soils are on broad flats. They have a surface layer of dark grayish brown silt loam and a subsoil of yellowish brown and grayish brown silty clay loam.

Ragsdale soils are in slightly depressional areas of the flats. They have a surface layer of very dark grayish brown silt loam, a subsurface layer of very dark gray silty clay loam, and a subsoil of grayish brown silty clay loam and yellowish brown silt loam.

Fincastle soils generally are also on the broad flats that are adjacent to sloping areas and are dissected by small streams. They have a surface layer of dark grayish brown silt loam, a subsurface layer of grayish brown silt loam, and a subsoil of yellowish brown silty clay loam and brown clay loam.

Of minor extent are the well drained Miami soils on knobs and breaks along drainageways and the moderately well drained Xenia soils on high rises and in the lower lying areas near drainageways.

Most of the acreage of this map unit has been cleared. Some of that acreage has been drained. This cleared acreage is used for cultivated crops, small grain, and forage crops. Corn, soybeans, wheat, and hay are the main crops. The uncleared acreage consists of mixed hardwoods.

The use of the soils for cultivated crops, small grain, and forage crops is limited by wetness.

The soils in this map unit are suitable for trees. White oak, red oak, and yellow-poplar are dominant. In the flat areas the use of logging equipment is restricted during the wet season.

The soils in this map unit are poorly suited to sanitary facilities and building site development. Wetness is the main limitation.

The soils in this unit are poorly suited to recreation uses. Wetness is the main limitation.

Areas dominated by gently sloping to strongly sloping, moderately well drained and well drained soils; on uplands

This group makes up about 14 percent of the county. It consists mainly of soils that have a fragipan, which restricts the movement of air and water through the soil. The water table is perched at a depth of 2 to 4 feet during the wetter seasons of the year. The gently sloping and moderately sloping soils are used for cultivated crops, hay, or pasture in many areas. The moderately sloping and strongly sloping soils are used as pasture or woodland in most areas. These soils have fair potential for cultivated crops and fair potential for sanitary facilities and building site development.

6. Ava-Cincinnati

Gently sloping to strongly sloping, moderately well drained and well drained silty soils; on uplands

This map unit consists of soils on side slopes, narrow ridgetops, and knolls of the uplands. This unit is made up of side slopes that are adjacent to the broad upland flats and of the very steep areas bordering the major streams. Many areas of this unit are dissected by many small streams. The slope range is 1 to 18 percent.

This map unit makes up about 14 percent of the survey area. It is about 49 percent Ava soils, 27 percent Cincinnati soils, and 24 percent soils of minor extent.

Ava soils generally are on the side slopes. They have a surface layer of dark brown silt loam. The subsoil

consists of brown silt loam, yellowish brown silty clay loam, a yellowish brown silt loam fragipan, and, below the fragipan, light yellowish brown loam.

Cincinnati soils generally are on the higher lying and steeper side slopes. They have a surface layer of yellowish brown silt loam. The subsoil consists of yellowish brown silt loam, brown silty clay loam, a yellowish brown silt loam and clay loam fragipan, and, below the fragipan, yellowish brown clay loam.

Of minor extent are the well drained Alford, Alvin, Grayford, Muren, and Parke soils on gently sloping to moderately steep ridgetops and side slopes along drainageways.

Most of the acreage of this map unit has been cleared and used for cultivated crops, small grain, forage crops, and pasture. Corn, soybeans, wheat, and hay are the main crops. Pasture is on the steeper slopes. The uncleared acreage consists of rough, steep areas that are generally in mixed hardwoods.

The use of the soils as cropland, hayland, and pasture is limited mainly by the slope and hazard of erosion. Overgrazing and grazing when the soils are wet, which can accelerate erosion and gullying, are major concerns of pasture management. Providing water for livestock is an additional concern where there are no streams. In some of these areas, ponds provide water for livestock. The soils are moderately to very slowly permeable, and compaction is generally required for ponds to hold water.

The soils in this map unit are suitable for trees such as white oak, red oak, yellow-poplar, ash, and sugar maple. On the steeper slopes the use of logging equipment is limited. Erosion is a hazard along logging roads and skid trails.

The soils in this unit are poorly suited to sanitary facilities because of wetness and the limited permeability of the fragipan. These soils are suited to building site development. Slope and wetness are the main limitations.

The soils in this unit are suited to recreation uses. Wetness and slope are the main limitations to these uses.

Areas dominated by gently sloping to very steep, well drained soils; on uplands

This group of soils occupies about 10 percent of the county. It consists mainly of well drained soils that dominantly have slope of more than 15 percent. In most areas these soils are used for woodland. In some areas they are used for hay or pasture. In a few of the less sloping areas they are used for cultivated crops. These soils have poor potential for most uses except woodland.

7. Hennepin-Miami-Russell

Gently sloping to very steep, well drained loamy and silty soils; on uplands

The soils in this map unit are on side slopes of the upland till plains. The side slopes are adjacent to areas bordering major streams. Most of this mapped area is dissected by small streams. The slope range is 2 to 50 percent.

This map unit makes up about 10 percent of the survey area. It is about 43 percent Hennepin soils, 27 percent Miami soils, 18 percent Russell soils, and 12 percent soils of minor extent.

Hennepin soils are on steep and very steep, narrow to moderately broad side slopes. They have a surface layer of dark grayish brown loam and a subsoil of dark brown loam.

Miami soils are on the moderately sloping and strongly sloping side slopes. These soils are generally dissected by many small streams. They have a surface layer of dark yellowish brown clay loam and a subsoil of dark yellowish brown and dark brown clay loam.

Russell soils are on the gently sloping to moderately sloping side slopes. They have a surface layer of dark brown silt loam and a subsoil of dark yellowish brown silt loam, dark brown silty clay loam, and dark yellowish brown and yellowish brown clay loam.

Of minor extent are the somewhat poorly drained Shoals soils, which are intermingled with the Hennepin soils.

About 45 percent of the acreage of this map unit has been cleared. In most of the cleared areas on the steeper side slopes, the soils are used for pasture and hay. In the cleared areas on the more gently sloping side slopes, the soils are used for cultivated crops, small grain, and forage crops, for example, corn, soybeans, and wheat. The uncleared acreage consists of rough, steep areas that are generally in mixed hardwoods.

The use of the soils as cropland, hayland, and pasture is limited mainly by the slope and hazard of erosion. Overgrazing and grazing when the soils are wet, which can accelerate erosion and gullying, are major concerns of pasture management. Providing water for livestock is an additional concern in areas where there are no streams. In some of these areas, ponds provide water for livestock.

The soils in this map unit are suitable for trees such as white oak, red oak, yellow-poplar, and sugar maple. On the steeper slopes the use of logging equipment is limited. Erosion is a hazard along logging roads and skid trails.

The soils in this unit are poorly suited to sanitary facilities and building site developments. Slope is the main limitation.

The soils in this unit are suited to recreation uses. Slope is the main limitation to these uses.

Areas dominated by steep and very steep, moderately well drained and well drained soils; on uplands and terraces

This group of soils makes up about 8 percent of the county. It consists mainly of soils that have slope of more than 25 percent. In most areas the soils are used

as pasture. They are generally unsuitable for cultivated crops. These soils have poor potential for most uses except woodland.

8. Hickory-Chetwynd

Steep and very steep, moderately well drained and well drained loamy and silty soils; on uplands and terraces

The soils in this map unit are on upland side slopes and terrace side slopes. Most of the area is dissected by small streams. The slope range is 25 to 70 percent.

This map unit makes up about 8 percent of the survey area. It is about 76 percent Hickory soils, 11 percent Chetwynd soils, and 13 percent soils of minor extent.

Hickory soils are steep and very steep. They are on irregular, narrow to moderately broad side slopes that are adjacent to minor and major streams. They have a surface layer of very dark grayish brown loam and a subsoil of yellowish brown loam and clay loam.

Chetwynd soils are steep and very steep. They are on irregular, narrow to moderately broad side slopes that are adjacent to minor and major streams. They have a surface layer of dark grayish brown silt loam and a subsurface layer of yellowish brown loam. The subsoil is multicolored with layers of loam, clay loam, sandy clay loam, sandy loam, loamy sand, and sand.

Of minor extent are the well drained Gilpin soils on moderately steep side slopes and the well drained Corydon and Weikert soils on steep and very steep side slopes.

About 25 percent of the acreage of this map unit has been cleared. In most of the cleared areas the soils are used for permanent pasture. The soils are poorly suited to cultivated farm crops because of slope. The uncleared acreage consists of rough, steep areas that are generally in mixed hardwoods.

The use of the soils as pasture is limited mainly by slope and hazard of erosion. Overgrazing and grazing when the soils are wet, which can accelerate erosion and gullying, are major concerns of pasture management. Providing water for livestock is an additional concern in areas where there are no streams. In some of these areas the Hickory soils are used for ponds for livestock. The Chetwynd soils are poorly suited to ponds because there is too much sand in the subsoil.

The soils in this map unit are suitable for trees such as white oak, red oak, yellow-poplar, green ash, and hickory. On the steeper slopes, however, the use of logging equipment is limited. Erosion is a hazard along logging roads and skid trails.

The soils are poorly suited to sanitary facilities and building site development. Slope is the main limitation.

The soils are poorly suited to recreation uses. Slope is the main limitation to these uses.

Areas dominated by nearly level to moderately sloping, somewhat poorly drained and moderately well drained soils; on uplands

This group of soils makes up about 9 percent of the county. It consists mainly of soils that have a water table at a depth of 1 to 4 feet. In many areas the soils have been drained and are used for cultivated crops. In some areas they are used for hay, pasture, or woodland. These soils have good potential for cultivated crops and poor potential for sanitary facilites and building site development.

9. Iva-Ava

Nearly level to moderately sloping, somewhat poorly drained and moderately well drained silty soils; on uplands

The soils in this map unit are on upland till plains that consist of broad upland flats, ridges, side slopes, and knolls. Most of these areas are dissected by small streams. The slope range is 0 to 12 percent.

This map unit makes up about 9 percent of the survey area. It is about 63 percent Iva soils, 22 percent Ava soils, and 15 percent soils of minor extent.

Iva soils are on broad flats. They have a surface layer of grayish brown silt loam and a subsoil of light brownish gray and yellowish brown silt loam and light brownish gray silty clay loam.

Ava soils generally are on the side slopes, narrow ridges, and knolls or in small flat areas atop the knolls and ridges. They have a surface layer of dark brown silt loam. The subsoil consists of brown silt loam, yellowish brown silty clay loam, a silt loam fragipan, and light yellowish brown loam below the fragipan.

Of minor extent are the moderately well drained Muren soils on gently sloping to moderately sloping areas on ridges bordering drainageways and the poorly drained Hoosierville soils on broad flats in the southeastern part of the county, bordering Morgan County.

Most of the acreage of this map unit has been cleared, and many of these areas have been drained. The soils are used for cultivated crops, mainly corn, soybeans, wheat, and hay. A few areas are in mixed hardwoods.

The soils are well suited to cultivated crops, small grain, and forage crops. Wetness is the main limitation to cropland use.

The soils in this unit are suitable for trees. White oak, red oak, and yellow-poplar are the dominant trees. The use of logging equipment in the flattest areas may be somewhat limited during wet seasons.

The soils are poorly suited to sanitary facilities and building site development. Wetness and slope are the main limitations.

The soils are suited to recreation uses. Wetness and slope are the main limitations to these uses.

broad land use considerations

Deciding which land should be used for urban development is an important issue in the survey area. Each year a considerable amount of land is being developed for urban uses in Cloverdale, Floyd, Greencastle, Madison, and Washington Townships. About 26,932 acres, or nearly 9 percent of the survey area, is urban or built-up land. The general soil map is most helpful for planning the general outline of urban areas. It cannot be used for the selection of sites for specific urban structures. The data about specific soils in this survey area can be helpful in planning future land use patterns.

Soils unfavorable for urban development are extensive in the survey area. In map units 3 and 4 the soils are on flood plains and flooding is a severe hazard. Extensive drainage is required on the wet soils in map unit 5 and the Iva soils of map unit 9. The Fincastle and Reeseville soils of map unit 1 and the Iva soils of map unit 9 are severely limited for urban development because of wetness. Also the soils in map unit 8 and the Hennepin soils of map unit 7 are severely limited for urban development because of steepness of slope.

In areas of map units 6 and 2, many sites can be developed for urban uses at lower cost than sites in the map units named above, and they are fairly suited to urban development.

The soils in map units 5 and 9 have good potential for farming; however, drainage is required. They have poor potential for nonfarm uses. Wetness is a severe limitation to nonfarm uses of these soils. With proper subsurface and surface drainage, this limitation can be overcome.

Most soils of the county have good or fair potential for woodland use. Commercially valuable trees are least common in map units 5 and 9. Generally they do not grow as rapidly on the wetter soils of map units 5 and 9 as they do on the soils in the other map units.

The soils in map units 1 and 2 have fair to good potential for use as sites for parks and extensive recreation areas. Hardwood forests enhance the beauty of some of these map units. Undrained areas in map units 4, 5, and 9 provide habitat for many important species of wildlife and are good for nature study.

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, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Miami silt loam, 12 to 18 percent slopes, eroded, is one of several phases in the Miami series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Shoals-Hennepin complex, 0 to 50 percent slopes, is an example.

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

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

Table 5 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

AlB—Alford silt loam, 2 to 6 percent slopes. This is a gently sloping, deep, and well drained soil. It is on broad convex ridgetops, long side slopes, and toe slopes of the uplands. Areas of this map unit are generally broad and irregular in shape. They range from 4 to 50 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil to a depth of 80 inches is dark brown, friable silt loam in the upper part; yellowish brown and dark yellowish brown, firm silty clay loam in the middle part; and yellowish brown and dark yellowish brown, friable silt loam in the lower part. In some places the subsoil has more sand.

Included in mapping are a few small slightly depressional areas of moderately well drained Muren soils, small areas of Hickory soils that have slope of more than 6 percent, and soils on steeper slopes around sinkholes. In small severely eroded areas of soils on steeper slopes, the subsoil has been mixed with the surface soil by plowing. In these areas the surface layer is silty clay loam. The Muren soils make up 8 percent of the map unit and the other included soils make up 4 percent.

This soil has very high available water capacity and moderate permeability. The content of organic matter is low in the surface layer. Surface runoff from cultivated areas is medium. In some areas, reaction in the upper 20 inches of the soil is affected by lime dust from nearby limestone quarries and a cement plant.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is well suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are needed to control erosion. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. Crop residue returned to the soil and cover crops also help to control erosion and improve and maintain tilth and the content of organic matter.

The use of this soil for grasses and legumes for hay or pasture also helps to control erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is moderately limited for use as a site for buildings because of shrinking and swelling of the soil. Properly designing foundations and footings to prevent structural damage and backfilling along the foundation walls with coarse material help to overcome this limitation.

The use of this soil as a site for local roads and streets is severely limited by the hazard of frost action in the soil and by the low strength of the soil. Adding more suitable base material helps to overcome these limitations.

This soil is slightly limited for use as septic tank absorption fields.

Because of the hazard of erosion, all disturbed areas should be smoothed and planted to a vegetative cover as soon as possible.

The soil is in capability subclass IIe and woodland suitability subclass 1o.

AlC2—Alford silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping, deep, and well drained soil. It is on side slopes adjacent to drainageways of the uplands. Areas of this map unit are small and long and narrow in shape. They range from 4 to 10 acres in size.

In a typical profile the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 52 inches thick. In the upper part it is dark yellowish brown, friable silt loam; and in the lower part it is dark brown, friable silt loam. The substratum to a depth of 64 inches is yellowish brown silt loam. In a few small areas the soil is severely eroded. The included soil makes up 8 percent of the map unit.

This soil has very high available water capacity and moderate permeability. The content of organic matter is low in the surface layer. Surface runoff from cultivated areas is medium. In some areas, reaction in the upper 20 inches of the soil is affected by lime dust from nearby limestone quarries and a cement plant.

This soil is used mainly for hay and pasture. In some areas it is used for cultivated crops and as woodland.

This soil is suited to corn, soybeans, and small grain. If the soil is cultivated, erosion is a severe hazard. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Crop residue returned to the surface and cover crops help to reduce runoff and control erosion and help to maintain tilth and the content of organic matter.

This soil is well suited to grasses and legumes for hay or pasture. The use of this soil for hay and pasture helps to control erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is moderately limited for use as a site for buildings because of slope and shrinking and swelling of the soil. Grading the site to modify the slope or designing buildings to conform to the natural slope help to overcome the slope limitation. Backfilling along foundation walls and basement walls helps to prevent structural damage caused by shrinking and swelling of the soil.

The use of this soil as a site for local roads and streets is severely limited by the hazard of frost action and low strength. Adding a more suitable base material helps to overcome these limitations.

This soil is moderately limited for use as septic tank absorption fields because of slope. Constructing the filter field on the contour or modifying the slope can partially overcome this limitation.

Because of the hazard of erosion, all disturbed areas should be smoothed and planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

AnC—Alvin sandy loam, 6 to 12 percent slopes. This is a moderately sloping, deep, and well drained soil. It is on outwash plains and terraces. Areas of this map unit are generally narrow and irregular in shape. They range from 4 to 15 acres in size.

In a typical profile the surface layer is dark grayish brown sandy loam in the upper part and dark brown fine sandy loam in the lower part. It is about 10 inches thick. The subsoil is about 31 inches thick. In the upper part it is dark yellowish brown, friable sandy loam; in the middle part it is dark brown, firm sandy clay loam; and in the

lower part it is dark brown, friable sandy loam. The substratum to a depth of 60 inches is dark brown fine sand. The surface layer is loam in a few areas.

Included in mapping are a few small areas of soils that have slope of more than 16 percent. The included soils make up 8 percent of the map unit.

This soil has moderate available water capacity. Permeability is moderate or moderately rapid in the solum and rapid in the underlying material. The content of organic matter is low in the surface layer. Surface runoff from cultivated areas is medium.

This soil is used mainly for cultivated crops. In many areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Crop residue returned to the surface and cover crops help to control erosion and improve and maintain tilth and the content of organic matter.

The use of this soil for grasses and legumes for hay or pasture helps to control erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during dry periods help to keep the pasture and the soil in good condition.

The soil is well suited to trees. Several areas are in hardwoods. Plant competition is moderate. Site preparation, spraying, cutting, or girdling can control unwanted trees and shrubs.

This soil is moderately limited for most kinds of building site development because of the slope. Grading the site to modify the slope or designing buildings to conform to the natural slope helps to overcome this limitation.

This soil is moderately limited for local roads and streets because of the hazard of frost action and the slope. Providing drainage ditches to remove excess water helps to overcome the hazard of frost action. Building roads on the contour helps to overcome the slope limitation.

This soil is suitable for use as septic tank absorption fields.

Because of the hazard of erosion, all exposed areas should be smoothed, shaped, and planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIIe and woodland suitability subclass 2o.

AvB—Ava silt loam, 1 to 4 percent slopes. This is a gently sloping, deep, and moderately well drained soil. It is on side slopes of the uplands. Areas of this map unit are broad to narrow and irregular in shape. They range from 5 to 75 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 52 inches thick. The upper part is yellowish brown, friable silt loam; the next part is mottled yellowish brown and light brownish gray, firm silty clay loam; the next part is a yellowish brown, mottled silt loam fragipan. The lower part to a depth of 70 inches is dark yellowish brown, mottled, friable loam.

Included in mapping are a few small slightly depressional areas of somewhat poorly drained Iva soils and poorly drained Hoosierville soils and small areas of soils that have slope of more than 6 percent. The Iva and Hoosierville soils make up 8 percent of the map unit and the other included soils make up 4 percent.

This soil has moderate available water capacity. Permeability is very slow in the fragipan. The content of organic matter is moderate in the surface layer. Surface runoff is medium. The water table is at a depth of 2 to 4 feet early in spring. In some areas, reaction in the upper 20 inches of the soil is affected by lime dust from nearby limestone quarries and a cement plant.

This soil is used mainly for cultivated crops. In some areas it is used for hay, pasture, and woodland.

This soil is well suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices that help to control erosion are needed. Conservation cropping systems, conservation tillage, terraces, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Crop residue returned to the surface and cover crops help to control erosion and improve and maintain tilth and the content of organic matter. If rainfall is below average or poorly distributed, crops are subject to damage by drought. Early in spring, seedbed preparation is often delayed because of wetness caused by the perched water table above the fragipan.

The use of this soil for grasses and legumes for hay or pasture helps to control erosion.

This soil is poorly suited to alfalfa and other deep-rooted plants because the fragipan restricts the penetration of roots and the movement of water. Overgrazing and grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

The use of this soil as a site for buildings without basements is moderately limited mainly by wetness and shrinking and swelling of the soil. Subsurface drainage is needed to lower the water table. Foundations should be designed to withstand the shrinking and swelling of the soil. Backfilling along the foundation walls helps to reduce the damage caused by the shrinking and swelling.

The use of this soil as a site for local roads and streets is severely limited by the hazard of frost action in

the soil and the low strength of the soil. Adding a more suitable base material helps to overcome these limitations.

This soil is severely limited for use as a site for most types of sanitary facilities because of wetness and slow permeability of the fragipan. Wetness can be partially overcome by lowering the water table. Alternate sites should be considered.

Because of the hazard of erosion, all exposed areas should be smoothed, shaped, and planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIe and woodland suitability subclass 2o.

AwB2—Ava silt loam, 3 to 6 percent slopes, eroded. This is a gently sloping, deep, and moderately well drained soil. It is on narrow ridgetops, side slopes, and toe slopes of the uplands. Areas of this map unit are generally narrow and irregular in shape. They range from 4 to 20 acres in size.

In a typical profile the surface layer is dark brown silt loam about 7 inches thick. The subsoil is about 58 inches thick. The upper part is dark yellowish brown, friable silt loam; the next part is dark yellowish brown, firm silt loam; the next part is yellowish brown, firm silt loam; the next part is a dark yellowish brown silt loam fragipan; and the lower part is yellowish brown to dark yellowish brown, firm silt loam. The substratum to a depth of 70 inches is dark yellowish brown silt loam. In some areas bedrock is at a depth of less than 72 inches. In places the soil formed in a thinner layer of loess, does not have a distinct fragipan, and is underlain by gray clay loam.

Included in mapping are a few small areas of the somewhat poorly drained Iva soils, which make up about 9 percent of the map unit.

This soil has moderate available water capacity. Permeability is very slow in the fragipan. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is medium. The water table is at a depth of 2 to 4 feet early in spring. The reaction in the surface layer in a few areas is influenced by lime dust from nearby limestone quarries and a cement plant.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is well suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are needed to control erosion. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. Crop residue returned to the surface and cover crops also help to control erosion and improve and maintain tilth and the content of organic matter.

This soil is well suited to grasses and legumes for hay and pasture. The use of this soil for hay and pasture helps to control erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. The fragipan, the layer impervious to roots, can limit the growth of some deeper rooting legumes. Selecting the proper legume, maintaining proper stocking rates, and rotating the pasture help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Hardwoods grow in several areas. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

The use of this soil as a site for buildings without basements is moderately limited by wetness and shrinking and swelling of the soil. Subsurface drainage is needed to lower the water table. Foundations should be designed to withstand the shrinking and swelling of the soil. Backfilling along foundation walls helps to reduce the damage caused by the shrinking and swelling. Because of wetness, this soil should not be used as a site for buildings with basements.

The use of this soil as a site for local roads and streets is severely limited by the hazard of frost action and low strength. Properly grading, mixing, and treating with soil additives and strengthening the base with more suitable material help to overcome these limitations.

This soil is severely limited for use as a site for most types of sanitary facilities because of wetness and slow permeability of the fragipan. Wetness can be partially overcome by lowering the water table. Alternate sites should be considered.

Because of the hazard of erosion, all exposed areas should be smoothed, shaped, and planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIe and woodland suitability subclass 2o.

AwC2—Ava silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping, deep, and moderately well drained soil. It is on side slopes adjacent to drainageways of the uplands. Areas of this map unit are generally broad and irregular in shape. They range from 3 to 75 acres in size.

In a typical profile the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 52 inches thick. In the upper part it is brown and yellowish brown, friable and firm silt loam and silty clay loam; in the middle part it is a yellowish brown silt loam fragipan; and in the lower part it is light yellowish brown, friable loam. The substratum to a depth of 80 inches is yellowish brown loam. In places the soil is severely eroded, has slope of more than 12 percent, or is marked by sinkholes. Bedrock is at a depth of less than 72 inches in places. In some areas the soil does not have a distinct fragipan, formed in thinner loess, or has a substratum of gray clay loam.

This Ava soil has moderate available water capacity. Permeability is very slow in the fragipan. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is medium. The water table

is at a depth of 2 to 4 feet early in spring. The reaction in the surface layer in a few areas is influenced by lime dust from nearby limestone quarries and a cement plant.

This soil is used mainly for cultivated crops, hay, and permanent pasture. In some areas it is used as woodland.

This soil is suited to corn, soybeans, and small grain. If the soil is cultivated, erosion is a severe hazard. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Crop residue returned to the surface and cover crops help to reduce runoff and control erosion and to maintain tilth and the content of organic matter.

This soil is well suited to grasses and legumes for hay and pasture. The use of this soil for hay and pasture helps to control erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. The fragipan, the layer impervious to roots, can limit the growth of some deeper rooting legumes. Selecting the proper legume, maintaining proper stocking rates, and rotating the pasture help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Hardwoods grow in many areas. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

The use of this soil as a site for buildings without basements is moderately limited by the slope, wetness, and shrinking and swelling of the soil. Altering the slope, properly designing foundations and footings, and lowering the water table can help to overcome these limitations.

The use of this soil as a site for local roads and streets is severely limited by the hazard of frost action in the soil and by the low strength of the soil. Adding more suitable base material helps to overcome these limitations.

This soil is severely limited for use as septic tank absorption fields because of wetness and the very slow permeability of the fragipan. Alternate sites should be considered.

Because of the hazard of erosion, all exposed areas should be smoothed and planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIIe and woodland suitability subclass 2o.

Ba—Bartle silt loam. This is a nearly level, deep, and somewhat poorly drained soil on low lying terraces. Areas of this map unit are long and narrow and irregular in shape. They range from 4 to 12 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is about 49 inches thick. In the upper part it is pale brown, mottled, friable silt loam; in the middle part it is yellowish brown, mottled, firm silty clay loam; and in the lower part it is a light gray and gray, mottled, firm silt loam and silty clay loam fragipan. To a depth of about 70 inches the substratum is dark yellowish brown sandy loam.

Included in mapping are some poorly drained Birds soils in depressions and small areas of well drained Elkinsville soils that do not have a fragipan and have slope of more than 2 percent. The Elkinsville soils make up 8 percent of the map unit, and the Birds soils make up 4 percent.

This soil has moderate available water capacity and very slow permeability. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is slow or very slow. The water table is at a depth of 1 to 2 feet in winter and spring.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Conservation tillage, crop residue returned to the surface, and winter cover crops help to improve and maintain the content of organic matter and fertility and to improve the tilth of this soil.

If adequately drained, this soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

The use of this soil as a site for dwellings is severely limited by wetness. Lowering the water table by installing an adequate drainage system in combination with storm sewers and foundation drains helps to overcome wetness.

The use of this soil for local roads and streets is severely limited by the hazard of frost action. Lowering the water table, grading, and installing road ditches can help to overcome that limitation. The base material for roads may need to be strengthened with more suitable material if it is to support vehicular traffic.

This soil is severely limited for use as septic tank absorption fields because of wetness and the very slow permeability. Alternate sites should be considered for this use.

This soil is in capability subclass IIw and woodland suitability subclass 3o.

Bd—Birds silt loam. This is a nearly level, deep, and poorly drained soil. It is on bottom lands along broad and narrow streams, narrow draws, and toe slopes. It is frequently flooded for brief periods in spring and fall. Areas of this map unit are generally long, narrow, and irregular in shape. They range from 5 to 40 acres in size.

In a typical profile the surface layer is grayish brown silt loam about 10 inches thick. The underlying material to a depth of 28 inches is gray, mottled, friable silt loam. From 28 to 60 inches the underlying material is light brownish gray, mottled, firm silty clay loam. In some areas there are loamy horizons in the underlying material.

Included in mapping are a few small higher lying areas of the well drained Chagrin soils, which make up 10 percent of the map unit.

This soil has high available water capacity and moderately slow permeability. The content of organic matter in the surface layer is low. Surface runoff from cultivated areas is very slow. The water table is at a depth of 1 foot or less in winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is well suited to corn, soybeans, and grasses and legumes if adequately protected from flooding. Wetness is also a limitation that affects the use of this soil as cropland. If levees and subsurface and surface drains are installed and maintained, a cropping system that includes mostly row crops can be used. Conservation tillage, winter cover crops, and crop residue returned to the surface help to maintain and improve the content of organic matter and to maintain good tilth.

This soil is well suited to grasses and legumes for forage. If this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking, pasture rotation, adding lime and fertilizer, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. It is severely limited for woodland use, however, because of equipment limitation and plant competition. It is moderately limited because of seedling mortality. Harvesting and logging are delayed until the soil is dry or frozen. Some replanting of seedlings may be necessary. Site preparation, spraying, cutting, or girdling can control unwanted trees and shrubs.

This soil is severely limited for use as a site for buildings and local roads and streets and as septic tank absorption fields because of wetness and flooding. It is generally not suited to these uses.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

Ch—Chagrin silt loam. This is a nearly level, deep, and well drained soil on bottom lands. It is frequently flooded. Areas of this map unit are long and wide and irregular in shape. They range from 5 to 250 acres in size.

In a typical profile the surface layer is dark brown silt loam 10 inches thick. The subsoil is dark brown and dark yellowish brown, friable loam about 42 inches thick. The underlying material to a depth of 60 inches is dark brown, stratified sandy loam and sand.

Included in mapping are small areas of well drained Stonelick soils that are on slightly higher rises nearer the streams and are sandier throughout. Also included are small depressional areas of somewhat poorly drained Shoals soils that are farther from the streams. The Stonelick soils make up 7 percent of the map unit and the Shoals soils make up 5 percent.

This soil has high available water capacity and moderate permeability. The content of organic matter is moderate in the surface layer. Surface runoff is slow. The water table is at a depth of 4 to 6 feet in winter and early in spring.

This soil is used intensively for cultivated crops. In a few areas it is used for small grain, hay, and pasture.

This soil is well suited to corn and soybeans if adequately protected from flooding. Conservation practices are needed if the soil is cultivated. If levees and adequate diversion terraces are maintained, a conservation cropping system that includes mostly row crops can be used. Conservation tillage, winter cover crops, and crop residue returned to the surface help to maintain and improve the content of organic matter and to maintain good tilth (fig. 2).

This soil is well suited to grasses and legumes for forage. If this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees; however, only a few areas are used as woodland. This soil is moderately limited for woodland use because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for use as a site for buildings and as septic tank absorption fields because of flooding. It is generally not suited to these uses. Local roads and streets are subject to damage from floodwaters.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

CkG—Chetwynd silt loam, 25 to 50 percent slopes. This is a steep or very steep, well drained soil on side slopes of terraces. Areas of this map unit are long and narrow. They range from 8 to 70 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 3 inches thick. The subsurface layer is yellowish brown loam about 5 inches thick. The subsoil is 70 inches thick. In the upper part it is dark brown and reddish brown, friable and firm loam and clay

Figure 2.—Use of crop residue on Chagrin silt loam.

loam; in the middle part it is yellowish brown and yellowish red, firm sandy clay loam and sandy loam; and in the lower part it is yellowish red stratified sandy loam and loamy sand. The underlying material is yellowish brown stratified sand and loamy sand. In places the slope is less than 25 percent or the subsoil has more sand.

Included in mapping are severely eroded areas, which make up about 8 percent of the map unit.

This soil has moderate available water capacity and moderate permeability. The content of organic matter is moderate. Surface runoff is very rapid.

This soil is used as woodland. It is not suited to cultivated crops and pasture because of the steepness of slope and the severe hazard of erosion.

This soil is suited to trees. Because of the steepness of the slope, however, some harvesting machinery cannot be used and erosion is a severe hazard if the soil is disturbed. Seedlings survive and grow well if competing vegetation is controlled. Site preparation, spraying, and girdling can control unwanted trees and shrubs.

This soil is severely limited for use as a site for buildings and local roads and streets and for use as septic tank absorption fields because of the slope. It is generally not suited to these uses.

This soil is in subclass VIIe and woodland suitability subclass 1r.

CnC2—Cincinnati silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, and well drained soil is on side slopes of the uplands. Areas of this map unit range from 3 to 35 acres in size.

In a typical profile the surface layer is yellowish brown silt loam about 11 inches thick. The subsoil to a depth of 80 inches consists of yellowish brown, friable silt loam in the upper part; brown, firm silty clay loam in the next part; a fragipan of yellowish brown, firm silt loam and

clay loam in the next part; and yellowish brown, firm clay loam in the lower part. In places, loamy glacial till is at a depth of 42 to 60 inches, bedrock is at a depth of less than 72 inches, or the soil does not have a distinct fragipan and is underlain by gray clay loam.

The soil has moderate available water capacity. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. The content of organic matter is low in the surface layer because of erosion. Surface runoff from cultivated areas is medium. The water table is at a depth of 4 feet in winter and early in spring. Reaction in the surface layer is influenced by lime dust from nearby limestone quarries and a cement plant.

This soil is used mainly for hay and pasture. In some areas it is used for cultivated crops and as woodland.

This soil is suited to corn, soybeans, and small grain. If the soil is cultivated, erosion is a very severe hazard. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, or grade stabilization structures help to prevent excessive soil loss by reducing runoff. Crop residue returned to the surface and cover crops also help to reduce runoff and control erosion and to maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. The use of this soil for hay and pasture helps to control erosion. Overgrazing and grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. The fragipan, the layer impervious to roots, can limit the growth of some deeper rooting legumes. Selecting the proper legume, maintaining proper stocking rates, and rotating the pasture help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Hardwoods grow in many areas. This soil is severely limited for woodland use, however, because seedling mortality and the hazard of windthrow are severe. Some replanting of seedlings may be needed. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

The use of this soil as a site for buildings without basements is moderately limited by the slope. Grading the site helps to overcome this limitation. Wetness limits the use of this soil for buildings with basements.

The use of this soil for local roads and streets is severely limited by low strength and the hazard of frost action. Properly grading and mixing the soil and treating it with additives help to overcome these limitations.

This soil is severely limited for use as septic tank absorption fields because of the slow permeability of the fragipan. Enlarging the absorption fields on the contour helps to overcome this limitation.

Because of the hazard of erosion, all exposed areas should be smooth and planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIIe and woodland suitability subclass 2d.

CnD2—Cincinnati silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, and well drained soil is on side slopes between ridgetops and drainageways of the uplands. Areas of this map unit are generally narrow and irregular in shape. They range from 3 to 12 acres in size.

In a typical profile the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 44 inches thick. In the upper part it is dark yellowish brown, firm silty clay loam; in the middle part it is a yellowish brown silty clay loam fragipan; and in the lower part it is yellowish brown, firm clay loam. The underlying material to a depth of 60 inches is yellowish brown, firm loam. In a few places the soil is severely eroded and has a silty clay loam surface layer. In many places, glacial loam till is at a depth of 42 to 60 inches or bedrock is at a depth of less than 72 inches. In places, the soil does not have a distinct fragipan and is underlain by gray clay loam.

This soil has moderate available water capacity. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. The content of organic matter in the surface layer is low, and surface runoff is rapid. The water table is at a depth of 4 feet in winter and early in spring. The reaction in the surface layer is influenced in a few areas by lime dust from limestone quarries and a cement plant.

This soil is used mainly for hay and pasture. A few areas are used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain because erosion is a severe hazard. Most row crops are grown so that stands of grasses and legumes can be reestablished. Conservation tillage, diversions, grassed waterways, and crop residue returned to the surface help to reduce runoff and control erosion. A crop rotation that includes mostly grasses and legumes for hay and pasture is most effective in reducing runoff and controlling erosion.

This soil is well suited to grasses and legumes for hay and pasture. If the soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. The fragipan, the layer impervious to roots, can limit the growth of some deeper rooting legumes. Selecting the proper legume, proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Some areas are in woodland. The erosion hazard and equipment limitations are moderate for this strongly sloping soil. Logging roads should be constructed on the contour. Windthrow is a moderate hazard. Seedling mortality is moderate and some replanting of seedlings may be necessary. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, or girdling.

The use of this soil as a site for buildings is severely limited by the slope. Grading the site to modify the slope or designing buildings to conform to the natural slope help to overcome this limitation.

The use of this soil for local roads and streets is severely limited by low strength, frost action, and slope. Adding more suitable base material helps to overcome the frost action and low strength limitations.

This soil is severely limited for use as septic tank absorption fields because of slope and the slow permeability of the fragipan. Alternate sites should be selected.

This soil is in capability subclass IVe and woodland suitability subclass 2d.

CoG—Corydon silt loam, 25 to 50 percent slopes. This steep to very steep, well drained soil is on side slopes of the uplands. It is shallow over limestone bedrock. Areas of this map unit are long, narrow, and irregular in shape. They range from 3 to 36 acres in size.

In a typical profile the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is reddish brown silty clay loam about 7 inches thick. Limestone bedrock is at a depth of 13 inches. In a few areas, the slope is less than 25 percent.

Figure 3.—Landscape of Corydon silt loam, 25 to 50 percent slopes that has been cleared of trees, sowed to a vegetative cover, and used for pasture.

Included in mapping are small areas of exposed bedrock and areas where the soil is severely eroded. These inclusions make up 8 percent of the map unit.

This soil has low available water capacity and moderately slow permeability. The content of organic matter is moderate. Surface runoff is very rapid.

This soil is used mainly as woodland and pasture (fig. 3). It is not suited to corn, soybeans, small grain, or forage crops because of the steepness of slope and a severe hazard of erosion.

This soil is suited to trees. It is moderately limited for woodland use, however, because of the windthrow hazard. It is severely limited for this use because of the erosion hazard, equipment limitation, and seedling mortality. The steepness of slope limits the use of some machinery. Logging roads should be built on the contour. Some replanting of seedlings may be necessary.

This soil is severely limited for use as a site for buildings and local roads and streets and for use as septic tank absorption fields because of the steepness of slope and the shallowness over bedrock. It is generally not suited to these uses.

This soil is in capability subclass VIIe and woodland suitability subclass 3d.

EIB—Elkinsville silt loam, 2 to 6 percent slopes. This gently sloping, deep, and well drained soil is on terraces. It is subject to rare flooding. Areas of this map unit are long and narrow and irregular in shape. They range from 4 to 12 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is dark brown silt loam about 4 inches thick. The subsoil is dark yellowish brown, firm silty clay loam about 46 inches thick. The substratum to a depth of 70 inches is yellowish brown, stratified silt loam, sandy loam, silty clay loam, and clay loam. In a few areas, slope is more than 6 percent.

Included in mapping are a few small depressional areas of the somewhat poorly drained Bartle soils, which make up about 6 percent of the map unit.

This soil has high available water capacity and moderate permeability. The content of organic matter is low in the surface layer. Surface runoff from cultivated areas is medium.

This soil is used mainly for cultivated crops. In a few areas it is used for hay and pasture or as woodland.

This soil is well suited to corn, soybeans, and small grain. To control erosion and surface runoff, however, minimum tillage, terraces and diversions, grassed waterways, and grade stabilization structures are needed. Crop residue returned to the surface and winter cover crops help to improve and maintain the content of organic matter and the fertility and to improve tilth.

This soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Some areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for use as a site for buildings and as septic tank absorption fields because of flooding. It is generally not suited to these uses.

The use of this soil as a site for local roads and streets is severely limited by the hazard of frost action and low strength. Adding more suitable base material helps to overcome these limitations.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

Ev—Evansville silt loam. This is a nearly level, deep, and poorly drained soil. It is on broad swales of the lake plains. It rarely is flooded but is subject to ponding. Areas of this map unit are generally broad and irregular in shape. They range from about 3 to 70 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is gray, mottled, friable silt loam and firm silty clay loam about 38 inches thick. The substratum to a depth of 60 inches is gray, mottled silty clay loam.

Included in mapping are small areas of a very poorly drained soil that is in narrow drainageways and has a dark surface layer. Also included are a few small areas of somewhat poorly drained Iva and Reesville soils on knolls. The Iva and Reesville soils make up 10 percent of the map unit, and the other included soil makes up 2 percent.

This soil has high available water capacity and moderate permeability. The content of organic matter is moderate in the surface layer. Surface runoff is slow. The water table is at or near the surface in winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is used for grasses and legumes for forage. In a few areas it is used as woodland.

This soil is suited to corn, soybeans, and small grain. Adequate drainage has been installed in most areas. Conservation tillage and the use of crop residue and winter cover crops help to maintain the content of organic matter and the fertility of the soil and to improve tilth.

If adequately drained, this soil is suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. A few areas are in hardwoods. The use of this soil as woodland, however,

is severely limited because of plant competition and equipment limitations and is moderately limited because of seedling mortality and hazard of windthrow. Harvesting and logging operations have to be delayed until the soil is dry or frozen. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for use as a site for buildings because of flooding and ponding. It generally is not suited to this use.

The use of this soil for local roads and streets is severely limited because of wetness, frost action, and low strength. The base material needs to be strengthened with more suitable material. Ditches help to remove excess water and reduce the hazard of frost action. Fill is often needed to elevate the roadway.

Ponding, the main limitation to the use of this soil as septic tank absorption fields, is so difficult to overcome that a soil on a higher lying position, above the flood plain, should be considered for this use.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

FdA—Fincastle silt loam, 1 to 3 percent slopes. This nearly level, deep soil is somewhat poorly drained. It is in large flat upland areas and small island-like areas that are surrounded by dark depressional soils. Areas of this map unit are large and broad. They range from 8 to 120 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 10 inches thick. The subsurface layer is grayish brown silt loam about 4 inches thick. The subsoil is about 30 inches thick. In the upper part it is yellowish brown, mottled, firm silty clay loam, and in the lower part it is brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is brown clay loam.

Included in mapping are a few small areas of very poorly drained Ragsdale soils in depressions and some small areas of severely eroded soils on knolls. The Ragsdale soils make up 8 percent of the map unit, and the other included soils make up 4 percent.

This soil has high available water capacity. Permeability is moderately slow in the subsoil and slow to moderate in the underlying till. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is slow. The water table is at a depth of 1 to 3 feet in winter and early in spring.

This soil is used mainly for cultivated crops. In a few areas it is used for hay and pasture or for woodland.

If adequately drained, this soil is suited to corn, soybeans, and small grain. Conservation tillage, crop residue, and winter cover crops help to maintain the content of organic matter and the fertility and to improve tilth.

If adequately drained, this soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture in good condition.

This soil is suited to trees. A few areas are in hardwoods. Plant competition is a moderate limitation to woodland use on this soil. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, and girdling.

The use of this soil as a site for buildings is severely limited by wetness. An adequate drainage system is needed to lower the water table.

The use of this soil as a site for local roads and streets is severely limited by the hazard of frost action and low strength. Mixing the soil with soil additives and reinforcing the base with more suitable material help to overcome these limitations.

This soil is severely limited for use as septic tank absorption fields because of wetness and slow permeability. Alternate sites should be considered.

This soil is in capability subclass IIw and woodland suitability subclass 3o.

FoB2—Fox loam, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on terraces. It is moderately deep over coarse sand and gravelly coarse sand. Areas of this map unit are generally irregular in shape. They range from 3 to 20 acres in size.

In a typical profile the surface layer is dark brown loam about 7 inches thick. The subsoil is about 31 inches thick. In the upper part it is dark yellowish brown, friable loam; in the middle part it is dark brown, firm clay loam; and in the lower part it is dark brown, firm sandy clay loam. The substratum to a depth of 60 inches is dark brown, stratified coarse sand and gravelly coarse sand. A few small areas have slope of more than 6 percent.

Included in mapping are a few small areas of soils that are high in content of gravel. These soils are on escarpments. They make up about 5 percent of the map unit.

This soil has moderate available water capacity. Permeability is moderate in the subsoil and rapid in the substratum. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is medium.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is well suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are needed to help control erosion and surface runoff. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. The use of crop residue and cover crops also helps to control erosion and improve and maintain tilth and the content of organic matter. Droughtiness is a hazard during dry seasons.

The use of this soil for grasses and legumes for hay or pasture helps to control erosion. Overgrazing or grazing

when the soil is wet, however, causes excessive runoff and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. Plant competition is a slight limitation to woodland use. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

The use of this soil as a site for buildings without basements is moderately limited by shrinking and swelling of the soil. Properly designing foundation walls to prevent structural damage and backfilling along the walls with coarse material help to overcome this limitation. This soil is slightly limited for use as a site for buildings with basements.

This soil is severely limited for use as a site for local roads and streets because of low strength and the hazard of frost action. Adding more suitable base material helps to overcome these limitations.

This soil is severely limited for use as septic tank absorption fields because of its poor filtering capacity. Pollution of ground water may occur.

Because of the hazard of erosion, areas disturbed by construction should be planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIe and woodland suitability subclass 2o.

FxC3—Fox clay loam, 6 to 15 percent slopes, severely eroded. This moderately sloping, well drained soil is on terraces. It is moderately deep over coarse sand and gravel. Areas of this map unit are generally small and irregular in shape. They range from 3 to 20 acres in size.

In a typical profile the surface layer is dark brown clay loam about 7 inches thick. The subsoil is dark brown firm clay loam about 19 inches thick. The substratum to a depth of 60 inches is yellowish brown, loose, stratified coarse sand and gravelly coarse sand. In places along gullies the slope is more than 15 percent.

Included in mapping are small areas of soils that are high in content of gravel, are on escarpments, and make up about 5 percent of the map unit.

This soil has moderate available water capacity. Permeability is moderate in the subsoil and rapid in the substratum. The content of organic matter is low in the surface layer. Surface runoff from cultivated areas is medium.

In many areas this soil is used for hay or pasture. In some areas it is farmed. In a few areas it is used as woodland.

This soil is poorly suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are needed to control surface runoff and erosion. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. The use of crop residue and cover crops also helps to control erosion and improve and maintain tilth and the content of organic matter.

The use of this soil for grasses and legumes for hay or pasture helps to control erosion. Overgrazing or grazing when the soil is too dry causes excessive runoff and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

The use of this soil as a site for buildings without basements is moderately limited by the slope and shrinking and swelling of the soil. Grading the site or designing buildings to conform to the natural slope help to overcome the slope limitation. Backfilling along foundation walls with coarse material helps overcome the shrink-swell limitation. Because of the slope, this soil is moderately limited for dwellings with basements.

This soil is severely limited for use as a site for local roads and streets because of slope and shrinking and swelling. Building the road on the contour and adding more suitable base material help to overcome these limitations.

This soil is severely limited for use as septic tank absorption fields because of its poor filtering capacity. Constructing the field on the contour helps to overcome this limitation.

Because of the hazard of erosion, areas disturbed by construction should be planted to a vegetative cover as soon as possible.

This soil is in capability subclass IVe and woodland suitability subclass 2o.

GnE—Gilpin silt loam, 15 to 25 percent slopes. This strongly sloping and moderately steep, well drained soil is on side slopes of uplands. It is moderately deep over shale or sandstone. Areas of this map unit are generally long, narrow, and irregularly shaped. They range from 15 to 80 acres in size.

In a typical profile the surface layer is dark brown silt loam about 3 inches thick. The subsurface layer is dark yellowish brown loam about 5 inches thick. The subsoil is yellowish brown, friable loam about 24 inches thick. It is underlain by sandstone bedrock. In places the slope is less than 15 percent or greater than 25 percent.

Included in mapping are small areas of exposed bedrock, which make up about 8 percent of the map unit.

This soil has low available water capacity and moderate permeability. The content of organic matter is moderate in the surface layer. Surface runoff is rapid.

This soil is used mainly as woodland. In a few small areas it is used as pasture.

This soil is suited to grasses or legumes for hay or pasture. The use of this soil for hay and pasture helps to control erosion. Proper stocking and pasture rotation are necessary to maintain a good stand of grass. Timely deferment of grazing and restricting grazing during dry periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Site preparation, spraying, or girdling can control unwanted trees and shrubs. The erosion hazard and equipment limitations are moderate. Because of the slope, erosion is a hazard in disturbed areas and the use of some machinery is restricted.

This soil is severely limited for use as a site for buildings and local roads and streets and as septic tank absorption fields because of the moderately steep slopes and depth to rock. It is generally not suited to these engineering uses.

This soil is in capability subclass VIe and woodland suitability subclass 2r.

GrC2—Grayford silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping, deep, and well drained soil. It is on broad ridgetops, long side slopes, and toe slopes of the uplands. Areas of this map unit range from 5 to 50 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 72 inches thick. In the upper part it is yellowish brown, firm silty clay loam; in the middle part it is dark brown, firm loam; and in the lower part it is reddish brown and dark reddish brown, very firm clay. Limestone bedrock underlies the subsoil.

Included in mapping are a few small areas of well drained Alford soils that have a thicker loess capping. These included soils make up about 6 percent of the map unit.

This soil has high available water capacity and moderate permeability. The content of organic matter is low in the surface layer. Surface runoff from cultivated areas is medium. Reaction in the surface layer varies widely as a result of local liming practices.

This soil is used mainly for cultivated crops. In some areas it is used for pasture and woodland.

This soil is suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are needed to control surface runoff and erosion. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. Crop residue returned to the surface and cover crops also help to control erosion and improve or maintain tilth.

The use of this soil for grasses and legumes for hay or pasture helps to control erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and a few areas are in hardwoods. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is moderately limited for use as a site for buildings because of slope and shrinking and swelling of the soil. Designing buildings to conform to the natural slope and designing foundations and footings to withstand the shrinking and swelling help to overcome these limitations.

The use of this soil as a site for local roads and streets is severely limited by the hazard of frost action and the low strength. Adding more suitable base material helps to overcome these limitations.

This soil is severely limited for use as septic tank absorption fields because of the slope and the permeability. Enlarging the fields and building them on the contour help to overcome these limitations.

Because of the hazard of erosion, all disturbed areas should be smoothed and planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

GrD2—Grayford silt loam, 12 to 18 percent slopes, eroded. This is a strongly sloping, deep, and well drained soil. It is on broad side slopes and toe slopes of the uplands. Areas of this map unit are generally broad and irregular in shape. They are dominantly about 10 acres in size, but range from 5 to 30 acres.

In a typical profile the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil is about 43 inches thick. In the upper part it is dark yellowish brown, firm silty clay loam, and in the lower part it is reddish brown, very firm clay. Limestone bedrock is at a depth of 54 inches. In some places are similar soils formed in more than 40 inches of loess.

Included in mapping are a few small areas of moderately well drained Ava soils on more gentle slopes, a few small areas of well drained Cincinnati soils, and some severely eroded soils on steeper slopes around sinkholes. The included soils make up about 12 percent of the map unit.

The soil has high available water capacity and moderate permeability. The content of organic matter is low in the surface layer. Surface runoff from cultivated areas is rapid. Reaction in the surface layer varies widely as a result of local liming practices.

This soil is used mainly for cultivated crops. In many areas it is used for hay or pasture. In some areas it is used as woodland.

This soil is poorly suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are

needed to control surface runoff and erosion. Crop rotation, conservation tillage, diversions, and grass waterways help to prevent excessive soil loss. The use of crop residue and cover crops also helps to control erosion and improve and maintain tilth and the content of organic matter.

The use of this soil for grasses and legumes for hay or pasture helps to control erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during dry periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees and several areas are in hardwoods. Plant competition is moderate. Site preparation, spraying, cutting, or girdling can control unwanted trees and shrubs. Because of the slope, erosion is a moderate limitation in disturbed areas and the use of some types of machinery is restricted.

The use of this soil as a site for buildings is severely limited because of the slope. Grading the site to modify the slope or designing buildings to conform to the natural slope helps to overcome this limitation.

This soil is severely limited for use as a site for local roads and streets because of the hazard of frost action, the slope, and the low strength. Installing drainage ditches, building roads on the contour, and adding more suitable base material help to overcome these limitations.

This soil also is severely limited for use as septic tank absorption fields, which are difficult to construct on the slope.

This soil is in capability subclass IVe and woodland suitability subclass 1o.

GrE2—Grayford silt loam, 18 to 25 percent slopes, eroded. This moderately steep, well drained soil is on narrow side slopes and toe slopes of the uplands. Areas of this map unit are generally narrow and irregular in shape. They range from 5 to 15 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark brown silt loam about 6 inches thick. The subsoil is about 40 inches thick. In the upper part it is reddish brown, firm silty clay loam; in the next part it is reddish brown, firm clay loam; in the next part it is yellowish brown, firm silty clay; and in the lower part it is dark brown, firm silty clay. Limestone bedrock is below a depth of 49 inches. In places there are similar soils that formed in deeper deposits of loess.

Included in mapping are a few small areas of well drained Cincinnati soils, which are less sloping and make up about 8 percent of the map unit.

The soil has high available water capacity and moderate permeability. The content of organic matter is low in the surface layer. Surface runoff from cultivated areas is rapid.

In many areas this soil is used for hay, pasture, or woodland. In a few areas it is used for cultivated crops.

The soil is generally not suited to corn, soybeans, and small grain.

The use of this soil for grasses and legumes for hay or pasture helps to control erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during dry periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Many areas are in hardwoods. This soil is moderately limited for woodland use, however, because of the hazard of erosion and the limitations to the use of equipment. Harvesting is delayed until the soil is dry. Logging trails should be placed on the contour. Site preparation, spraying, cutting, or girdling can control unwanted trees and shrubs.

This soil is severely limited for use as a site for all buildings and local roads and streets and as septic tank absorption fields because of the slope. It generally is not suited to these uses.

This soil is in capability subclass VIe and woodland suitability subclass 1r.

Hb—Haymond silt loam. This is a nearly level, deep, and well drained soil on bottom lands. It is frequently flooded. Areas of this map unit are long and narrow and irregular in shape. They range from 5 to 30 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam 7 inches thick. The subsoil is dark grayish brown and dark brown, friable silt loam about 40 inches thick. From 47 to 60 inches the underlying material is dark yellowish brown silt loam and sandy loam.

Included in mapping are small areas of somewhat poorly drained Wakeland soils and a few areas of the well drained Chagrin soils, which have more sand in the solum. The included soils make up 12 percent of the map unit.

This soil has high available water capacity and moderate permeability. The content of organic matter in the surface layer is moderate. Surface runoff from cultivated areas is slow.

This soil is intensively used for corn and soybeans. In a few areas it is used for small grain, hay and pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain if adequately protected from flooding. Conservation practices are needed if the soil is cultivated. If levees and adequate diversion terraces are maintained, a conservation cropping system that includes mostly row crops can be used. Conservation tillage, winter cover crops, and returning crop residue to the surface help to maintain and improve the content of organic matter and to maintain good tilth.

This soil is well suited to grasses and legumes for forage. If this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture in good condition.

This soil is well suited to trees, but it is used as woodland in only a few areas. This soil is moderately limited for woodland use because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for use as a site for buildings and local roads and streets and as septic tank absorption fields because of flooding. It generally is not suited to these uses.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

HeG—Hennepin loam, 25 to 50 percent slopes. This steep and very steep, deep, and well drained soil is on side slopes of the uplands. Areas of this map unit are long, narrow, and irregularly shaped. They range from 5 to 50 acres in size.

In a typical profile the surface layer is dark grayish brown loam about 4 inches thick. The subsoil is dark brown, friable loam about 11 inches thick. The substratum to a depth of about 60 inches is brown, mottled loam. In a few areas, the subsoil is clay loam.

Included in mapping are a few small areas of Miami soils on slope of less than 25 percent, small areas of exposed rock, areas that are severely eroded, and areas of soils that have a high content of gravel. The inclusions make up about 12 percent of the map unit.

This soil is moderately permeable in the solum and moderately slowly permeable in the underlying till. The available water capacity is moderate. The content of organic matter in the surface layer is low. Surface runoff is very rapid.

This soil is used as woodland. It is not suited to row crops, small grain, or forage crops because the slope is very steep and the hazard of erosion is severe.

This soil is well suited to trees. Slopes are too steep for the operation of some machinery, however, and erosion is a hazard if the soils are disturbed. Seedlings survive and grow well if competing vegetation is controlled. Site preparation, cutting, spraying, and girdling can control unwanted trees and shrubs.

This soil is severely limited for use as a site for buildings and local roads and streets and as septic tank absorption fields because of the steep slopes. It is generally not suited to these uses.

This soil is in capability subclass VIIe and woodland suitability subclass 1r.

HoG—Hickory loam, 25 to 70 percent slopes. This steep or very steep, deep, and moderately well drained and well drained soil is on side slopes of the uplands. Areas of this map unit are generally broad and irregular in shape. They range from 5 to 175 acres in size.

In a typical profile the surface layer is very dark grayish brown loam about 3 inches thick. The subsoil is about 49 inches thick. In the upper part it is yellowish brown, friable loam, and in the lower part it is yellowish brown, firm clay loam. The substratum to a depth of 60 inches is yellowish brown loam. In a few areas, carbonates occur at a shallower depth.

Included in mapping are small areas of well drained Hickory soils on slopes of less than 25 percent, small areas of soils where rock is exposed, gravelly areas, and severely eroded areas. The included soils make up about 12 percent of the map unit.

This soil is moderately permeable. Available water capacity is high. The content of organic matter is low. Surface runoff is very rapid.

This soil is used as woodland. It is not suited to row crops, small grain, or forage crops because the slope is very steep and the hazard of erosion is severe.

This soil is well suited to trees. Slopes are too steep for the operation of some machinery, however, and erosion is a hazard if the soils are disturbed. Logging roads should be placed on the contour. Seedlings survive and grow well if competing vegetation is controlled. Site preparation, cutting, spraying, and girdling can control unwanted trees and shrubs.

This soil is severely limited for use as a site for buildings, local roads and streets, and sanitary facilities because of the slope. It is not generally suited to these uses.

This soil is in capability subclass VIIe and woodland suitability subclass 1r.

Hv—Hoosierville silt loam. This is a nearly level, deep, and poorly drained soil on broad flats of the uplands. Areas of this map unit are generally broad and irregular in shape. They range from about 4 to 40 acres in size.

In a typical profile the surface layer is grayish brown silt loam about 8 inches thick. The subsoil is about 52 inches thick. In the upper part it is light brownish gray, mottled, friable silt loam; in the middle part it is gray, mottled, firm silty clay loam; and in the lower part it is gray, mottled, friable silt loam. The substratum to a depth of 70 inches is yellowish brown, mottled, friable silt loam.

Included in mapping are small areas of somewhat poorly drained Iva soils on slightly higher lying rises. The Iva soils make up 10 percent of the map unit.

This soil has a high available water capacity and is slowly permeable. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is slow. The water table is at or near the surface in winter and early in spring.

In most places this soil is drained and used for cultivated crops. In some places it is used for grasses and legumes for forage. In a few places it is used as woodland.

If adequately drained, this soil is suited to corn, soybeans, and small grain. Wetness is the main limitation to cropland use. Excess water can be removed by surface and subsurface drains or by pumping. Conservation tillage, crop residue returned to the

surface, and winter cover crops help to maintain the content of organic matter and fertility and to improve tilth.

If adequately drained, this soil is suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture in good condition.

This soil is well suited to water tolerant trees. A few areas are in hardwoods. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for use as a site for most buildings because of wetness. An adequate drainage system helps to overcome this limitation.

The use of this soil as a site for local roads and streets is severely limited by wetness, the hazard of frost action, and low strength. Elevating the roadbed with more suitable base material helps to overcome these limitations.

This soil is severely limited for use as septic tank absorption fields because of wetness. Enlarging the filter field and lowering the water table help to overcome this limitation.

This soil is in capability subclass IIIw and woodland suitability subclass 3w.

IvA—Iva silt loam, 0 to 2 percent slopes. This nearly level, deep, and somewhat poorly drained soil is on broad ridgetops of the uplands. Areas of this map unit are generally broad and irregular in shape. They range from about 8 to 300 acres in size.

In a typical profile the surface layer is grayish brown silt loam about 8 inches thick. The subsoil is about 52 inches thick. In the upper part it is light brownish gray, mottled, friable silt loam; in the next part it is yellowish brown, mottled, firm silt loam; in the next part it is light brownish gray, mottled, firm silty clay loam; and in the lower part it is light gray, mottled, friable silt loam. The substratum to a depth of 80 inches is dark yellowish brown silt loam. In a few areas, silty clay loam sediments are below a depth of 4 feet.

Included in mapping are a few small gently sloping areas of moderately well drained Muren soils on higher lying rises and areas of poorly drained Hoosierville soils in small depressions. The Muren soils make up 8 percent of the map unit and the other included soils make up 4 percent.

This soil has a high available water capacity. Permeability is slow. The content of organic matter is low in the surface layer. Surface runoff from cultivated areas is slow. The water table is at a depth of 1 to 3 feet in winter and early in spring.

In most places this soil is drained and used for cultivated crops (fig. 4). In some places it is used for grasses and legumes for forage. In a few places it is used as woodland.

If adequately drained, this soil is suited to corn, soybeans, and small grain. Conservation tillage, crop residue returned to the surface, and winter cover crops help to maintain the content of organic matter and fertility and to improve soil tilth.

If adequately drained, this soil is suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture in good condition.

This soil is well suited to water tolerant trees. A few areas are in hardwoods. Wetness, which delays planting and harvesting operations, and plant competition are moderate limitations to woodland use.

This soil is severely limited for use as a site for buildings. Surface and subsurface drains are needed to help lower the water table.

This soil is severely limited for use as a site for local roads and streets because of the hazard of frost action and low strength. Adding more suitable base material helps to overcome these limitations.

This soil is severely limited for use as septic tank absorption fields because of wetness and the slow permeability. Enlarged absorption fields in drained areas generally function poorly. Alternate sites should be considered.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

McA—Martinsville loam, 0 to 2 percent slopes. This nearly level, deep, and well drained soil is on outwash plains and terraces. Areas of this map unit range from 3 to 20 acres in size.

In a typical profile the surface layer is dark grayish brown loam about 8 inches thick. The subsurface layer is dark brown, friable loam about 4 inches thick. The subsoil is about 24 inches thick. In the upper part it is dark yellowish brown, firm loam, and in the lower part it is dark brown, firm clay loam. The substratum to a depth of 60 inches is brown sandy loam. In places this soil has 15 to 20 inches of loess on the surface.

Included in mapping are a few areas of somewhat poorly drained Whitaker soils and very poorly drained Rensselaer soils. The included soils make up about 12 percent of the map unit.

This soil has moderate available water capacity. Permeability is moderate. The content of organic matter in the surface layer is moderate. Runoff from cultivated areas is slow.

This soil is used mainly for corn, soybeans, and small grain. In some areas it is used for pasture, hay, or woodland.

This soil is suited to corn, soybeans, and small grain. Crop rotation and conservation tillage help prevent excessive soil loss. Crop residue returned to the surface

Figure 4.—Lateral tile trench cut in Iva silt loam, 0 to 2 percent slopes.

and cover crops also help to control erosion and improve and maintain tilth and the content of organic matter. Seepy areas in some of the drainageways and swales need subsurface drains.

Growing grasses and legumes for hay or pasture is effective in controlling water erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, and timely deferment of grazing help keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in woodland. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is moderately limited for use as a site for buildings because of its shrink-swell potential. Designing foundations to withstand the shrinking and swelling of the soil and backfilling along basement and foundation walls with coarse material help to overcome this limitation.

This soil is moderately limited for use as a site for local roads and streets because of the hazard of frost action and the low strength. Adding more suitable base material helps to overcome these limitations.

This soil is slightly limited for use as septic tank absorption fields.

This soil is in capability class I and woodland suitability subclass 1o.

McB—Martinsville loam, 2 to 6 percent slopes. This gently sloping, deep, and well drained soil is on outwash plains and on terraces. Areas of this map unit range from 3 to 20 acres in size.

In a typical profile the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 62

inches thick. In the upper part it is dark yellowish brown, friable loam; in the middle part it is dark brown, firm loam and sandy loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of 80 inches is yellowish brown fine sand.

Included in mapping are a few areas of soils that have a thick loess capping. The included soils make up about 6 percent of the map unit.

This soil has moderate available water capacity and moderate permeability. The content of organic matter in the surface layer is moderate. Surface runoff is medium.

This soil is used mainly for cultivated crops. In some areas it is used for pasture, hay, or woodland.

This soil is suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are needed to control erosion. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, or grade stabilization structures help to control erosion. Crop residue returned to the surface and cover crops also help to control erosion and improve and maintain tilth and the content of organic matter. Seepy areas in some of the drainageways and swales need subsurface drains.

Growing grasses and legumes for hay or pasture is effective in controlling water erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, and timely grazing help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in the woodland. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is moderately limited for use as a site for buildings because of its shrink-swell potential. Designing foundations to withstand shrinking and swelling of the soil and backfilling along basement and foundation walls with coarse material help to overcome this limitation.

This soil is moderately limited for use as a site for local roads and streets because of the hazard of frost action and low strength. Adding more suitable base material helps to overcome these limitations.

This soil is slightly limited for use as septic tank absorption fields.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

MeD2—Miami silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, and well drained soil is on long, narrow side slopes and ridges of the uplands. Areas of this map unit are irregular in shape. They range from 3 to 15 acres in size.

In a typical profile the surface layer is dark brown silt loam about 6 inches thick. The subsoil is about 25 inches thick. In the upper part it is light brown, firm loam, and in the lower part it is dark yellowish brown, firm clay loam. The substratum to a depth of 60 inches is light brown loam.

Included in mapping are a few small areas of well drained Hennepin soils on steeper slopes. The included soils make up about 8 percent of the map unit.

This soil has high available water capacity. Permeability is moderate in the solum and moderately slow in the substratum. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is rapid.

This soil is used mainly for pasture. In a few areas it is used as woodland.

This soil is poorly suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are needed to control surface runoff and erosion. Crop rotation, conservation tillage, diversions, and grassed waterways help to control erosion. Crop residue returned to the surface and cover crops also help to control erosion and improve and maintain tilth and the content of organic matter.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture in good condition.

The soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for use as a site for buildings and local roads and streets because of slope. Grading the building or road site to modify the slope or designing buildings to conform to the natural slope help to overcome this limitation.

This soil is severely limited for use as a site for septic tank absorption fields because of slope and permeability. Building the absorption field on the contour and enlarging the size of the field help to overcome these limitations.

Because of the hazard of erosion, areas disturbed by construction should be planted to a vegetative cover as soon as possible.

This soil is in capability subclass IVe and woodland suitability subclass 1o.

MgC3—Miami clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, and well drained soil is on ridgetops and side slopes of the uplands. Areas of this map unit are narrow to moderately wide and irregular in shape. They range from 3 to 30 acres in size.

In a typical profile the surface layer is dark yellowish brown clay loam about 4 inches thick. The subsoil is about 28 inches thick. In the upper part it is dark yellowish brown, firm clay loam; and in the lower part it is dark brown, firm clay loam. The substratum to a depth

of about 60 inches is yellowish brown, firm loam. In some places the subsoil is thinner.

Included in mapping are a few small areas of well drained Hennepin soils on steeper slopes and soils along deep gullies that have exposed underlying material. The included soils make up about 12 percent of the map unit.

This soil has moderate available water capacity. Permeability is moderate in the solum and moderately slow in the substratum. The content of organic matter is low in the surface layer. Runoff from cultivated areas is medium.

This soil is used mainly for hay or pasture. In a few areas it is used as woodland and for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are needed to control surface runoff and erosion. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, and grade stabilization structures help to control erosion. Crop residue returned to the surface and cover crops also help to control erosion and improve and maintain tilth and the content of organic matter.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is moderately limited for use as a site for buildings because of the slope and shrinking and swelling of the soil. Grading the site to modify the slope or designing buildings to conform to the natural slope, designing foundations and basement walls to withstand the shrinking and swelling of the soil, and backfilling along foundations and basement walls with coarser material help to overcome these limitations.

The use of this soil for local roads and streets is moderately limited by the slope, the hazard of frost action, and the low strength. Adding more suitable base material helps to overcome the hazard of frost action and the low strength.

This soil is severely limited for use as septic tank absorption fields because of permeability. Enlarging the absorption field helps to overcome this limitation. In a poorly designed system, the effluent may surface as a result of lateral seepage on the top of the till.

Because of the hazard of erosion, disturbed areas should be planted to a vegetative cover as soon as possible.

This soil is in capability subclass IVe and woodland suitability subclass 1o.

MgD3—Miami clay loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, and well drained soil is on long narrow side slopes and ridges of the uplands. Areas of this map unit are small and irregular in shape. They range from 3 to 11 acres in size.

In a typical profile the surface layer is dark yellowish brown clay loam about 8 inches thick. The subsoil is yellowish brown, firm clay loam about 18 inches thick. The substratum to a depth of 60 inches is yellowish brown, firm loam. In some areas the subsoil is thinner.

Included in mapping are a few small areas of well drained Hennepin soils on steeper slopes. Along a few deep gullies underlying material is exposed. The included soils make up about 12 percent of the map unit.

This soil has moderate available water capacity. Permeability is moderate in the solum and moderately slow in the substratum. The content of organic matter is low in the surface layer. Surface runoff from cultivated areas is rapid.

This soil is used mainly for pasture. In a few small areas it is used for corn, soybeans, and small grain. In some areas it is used as woodland.

This soil is generally not suited to corn, soybeans, and small grain. Most row crops are grown so that stands of grasses and legumes can be reestablished.

The use of this soil for grasses and legumes for hay or pasture is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes excessive runoff and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. A few areas are in hardwoods. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for use as a site for buildings and local roads and streets because of the slope. Grading the building or road site to modify the slope or designing buildings to conform to the natural slope help to overcome this limitation.

This soil is severely limited for use as septic tank absorption fields because of permeability and slope. Enlarging the filter field and placing it in the less sloping areas should be considered.

Because of the hazard of erosion, disturbed areas should be planted to a vegetative cover as soon as possible.

This soil is in capability subclass VIe and woodland suitability subclass 1o.

MuB—Muren silt loam, 1 to 4 percent slopes. This is a nearly level, gently sloping, deep, and moderately well drained soil. It is on ridgetops and along side slopes of the uplands. Areas of this map unit are broad and irregular in shape. They range from 4 to 30 acres in size.

In a typical profile the surface layer is dark brown silt loam about 8 inches thick. The subsurface layer is dark

yellowish brown silt loam about 4 inches thick. The subsoil is about 48 inches thick. In the upper part it is yellowish brown, firm silty clay loam, and in the lower part it is yellowish brown, mottled, firm silty clay loam. The substratum to a depth of 70 inches is yellowish brown, mottled silt loam. In places the slope is more than 4 percent.

Included in mapping are a few small depressional areas of the poorly drained Hoosierville and somewhat poorly drained Iva soils. The included soils make up 8 percent of the map unit.

The soil has high available water capacity and moderately slow permeability. The content of organic matter in the surface layer is moderate. Surface runoff from cultivated areas is medium. The water table is at a depth of 3 to 6 feet in winter and early in spring. In some areas, lime dust from local limestone quarries and a cement plant has affected reaction in the upper 20 inches of some Muren soils.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture or as woodland.

This soil is well suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are needed to control surface runoff and erosion. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, and grade stabilization structures help prevent excessive soil loss. Crop residue returned to the surface and cover crops also help to control erosion and improve and maintain tilth and the content of organic matter.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good conditon.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled. Site preparation, spraying, cutting, or girdling can control unwanted trees and shrubs.

The use of this soil as a site for dwellings without basements is moderately limited by the shrinking and swelling of the soil. Backfilling along basement and foundation walls with a coarser material helps to overcome this limitation. Wetness is an additional limitation for dwellings with basements.

The use of this soil as a site for local roads and streets is severely limited by the hazard of frost action and the low strength. Adding a more suitable base material helps to overcome these limitations.

This soil is severely limited for use as septic tank absorption fields because of wetness and moderately slow permeability of the soil. Lowering the water table and enlarging the filter field can improve the functioning of the absorption field.

Because of the hazard of erosion, all disturbed areas of this soil should be smoothed and planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

OcA—Ockley silt loam, 0 to 2 percent slopes. This nearly level, deep, and well drained soil is on moderately wide terraces. Areas of this map unit are generally long and narrow or irregularly shaped. They range from 5 to 20 acres in size.

In a typical profile the surface layer is dark brown silt loam about 10 inches thick. The subsurface layer is strong brown silty clay loam about 8 inches thick. The subsoil is about 40 inches thick. In the upper part it is dark brown and dark yellowish brown, firm silty clay loam, and in the lower part it is dark yellowish brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown coarse sand and gravelly coarse sand. In places the solum is thinner or the surface layer is sand.

Included in mapping are small areas of well drained Chagrin and Stonelick soils along streams. The included soils make up about 5 percent of the map unit.

This soil has high available water capacity and moderate permeability. The content of organic matter in the surface layer is moderate. Surface runoff from cultivated areas is slow.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is well suited to corn, soybeans, and small grain. Conservation tillage, crop residue returned to the surface, and winter cover crops help improve and maintain the content of organic matter and fertility and improve the tilth of this soil.

This soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use because of plant competition. Seedlings survive and grow well if competing vegetation is controlled. Site preparation, spraying, cutting, or girdling can control unwanted trees and shrubs.

The use of this soil as a site for buildings is moderately limited by the shrinking and swelling of the soil. Backfilling along basement and foundation walls helps to overcome this limitation. Wetness is an additional limitation for dwellings with basements.

The use of this soil as a site for local roads and streets is severely limited by the low strength. Adding more suitable base material helps to overcome this limitation.

This soil is slightly limited for use as a site for septic tank absorption fields. Pollution of ground water should be considered.

This soil is in capability class I and woodland suitability subclass 1o.

OcB2—Ockley silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, and well drained soil is on moderately wide terraces. Areas of this map unit are generally long and narrow or irregularly shaped. They range from 4 to 25 acres in size.

In a typical profile the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 44 inches thick. In the upper part it is dark yellowish brown and dark brown, firm silty clay loam; in the middle part it is dark yellowish brown, firm clay loam; and in the lower part it is dark brown, firm gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown coarse sand and gravelly coarse sand. In some areas the solum is thinner or the surface is sandy or gravelly.

This soil has high available water capacity and moderate permeability. The content of organic matter in the surface layer is moderate. Surface runoff from cultivated areas is medium.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is well suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are needed to control erosion. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. Crop residue returned to the surface and cover crops help to control erosion and to maintain tilth and the content of organic matter.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled. Site preparation, spraying, cutting, or girdling can control unwanted trees and shrubs.

This soil is moderately limited for use as a site for buildings because of the shrinking and swelling of the soil. Backfilling along basement and foundation walls with coarse material helps to overcome this limitation.

This soil is moderately limited for use as a site for local roads and streets because of the low strength. Adding more suitable base material helps to overcome this limitation.

This soil is slightly limited for use as septic tank absorption fields. Seepage of effluent into ground water may become a problem in some areas.

Because of the hazard of erosion, all exposed areas should be smoothed and planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

PeB2—Parke silt loam, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on outwash plains. Areas of this map unit are generally long and narrow in shape. They range from 10 to 90 acres in size.

In a typical profile the surface layer is dark brown silt loam about 8 inches thick. The subsoil to a depth of 80 inches is dark brown, friable and firm silt loam and silty clay loam in the upper part; reddish brown, firm loam in the middle part; and yellowish red, friable sandy loam in the lower part. In places the subsoil is mixed with the surface layer by plowing and is silty clay loam.

This soil has high available water capacity and moderate permeability. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is medium. In some parts of the county the reaction of the surface layer is influenced by lime dust carried by wind from local limestone quarries and the cement plant.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is well suited to corn, soybeans, and small grain. If the soil is cultivated, conservation practices are needed to control surface runoff and erosion. Crop rotation, conservation tillage, terraces and diversions, contour farming, grassed waterways, and grade stabilization structures help to control erosion. Crop residue returned to the surface and cover crops also help to control erosion and improve and maintain tilth and the content of organic matter.

The use of this soil for grasses and legumes for hay or pasture is also affected in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled. Site preparation, spraying, cutting, or girdling can control unwanted trees and shrubs.

This soil is moderately limited for use as a site for buildings without basements because of shrinking and swelling of the soil. Designing foundations and footings to withstand the shrinking and swelling and backfilling along foundations with coarse material help to overcome this limitation.

This soil is severely limited for use as local roads and streets because of the hazard of frost action and the low

strength. Adding more suitable base material helps to overcome these limitations.

This soil is slightly limited for use as septic tank absorption fields.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

PeC2—Parke silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping, deep, and well drained soil. It is on narrow side slopes and toe slopes of the uplands. Areas of this map unit are generally long and narrow. They range from 4 to 20 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is dark brown silt loam about 3 inches thick. The subsoil is about 70 inches thick. In the upper part it is dark yellowish brown, friable silt loam; in the middle part it is yellowish brown, friable loam; and in the lower part it is dark reddish brown, friable sandy clay loam. The underlying material to a depth of 80 inches is dark yellowish brown fine sandy loam. In places this soil has a thinner solum or is severely eroded.

This soil has high available water capacity and moderate permeability. The content of organic matter is moderate in the surface soil. Surface runoff is medium.

This soil is used mainly for hay or pasture and as woodland. In some areas it is used for cultivated crops.

This soil is suited to corn, soybeans, and small grain. Soil erosion is a severe limitation. If the soil is cultivated, conservation practices that help control erosion and surface runoff are needed. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, and grade stabilization structures help to control erosion. Crop residue returned to the surface and cover crops also help to control erosion and to maintain tilth and the content of organic matter.

The use of this soil for grasses and legumes for hay and pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use because of plant competition. Seedlings survive and grow well if competing vegetation is controlled. Site preparation, spraying, cutting, or girdling can control unwanted trees and shrubs.

This soil is moderately limited for use as a site for buildings without basements because of the slope and shrinking and swelling of the soil. Backfilling along foundations with a coarse material can partly overcome the shrinking and swelling. Slope is the only limitation to the use of this soil as a site for houses with basements.

This soil is severely limited for use as a site for local roads and streets because of the hazard of frost action and the low strength. Adding more suitable base material helps to overcome these limitations.

This soil is moderately limited for use as septic tank absorption fields because of slope. Installing the absorption field on the contour helps to overcome this limitation.

Because of the hazard of erosion, all exposed areas should be smoothed and planted to a vegetative cover.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

Po—Pits, quarries. This miscellaneous area consists of open excavations from which soil and underlying limestone or sandstone have been removed. The remaining exposed limestone or sandstone supports few or no plants. This area ranges from 3 to 90 acres in size.

Included in mapping are a few small areas of water. Along Big Walnut Creek two gravel pits are included.

This miscellaneous area is commonly adjacent to upland soils such as Ava, Cincinnati, Corydon, Gilpin, Grayford, Iva, Russell, Weikert, and Xenia soils.

Ra—Ragsdale silt loam. This is a nearly level, deep, and very poorly drained soil. It is in slightly depressional areas of the uplands (fig. 5). It is frequently ponded by runoff from adjacent higher lying areas. Areas of this map unit are generally irregular in shape. They range from 2 to 65 acres in size.

In a typical profile the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is very dark gray silty clay loam about 8 inches thick. The subsoil to a depth of 80 inches is grayish brown, mottled, firm silty clay loam in the upper part and yellowish brown, mottled, friable silt loam in the lower part.

Included in mapping are a few small areas of somewhat poorly drained Fincastle and Reesville soils and some wetter soils in deep depressions. The Fincastle and Reesville soils make up 8 percent of the map unit and the other included soils make up 4 percent.

This soil has high available water capacity and slow permeability. The content of organic matter is high in the surface layer. Surface runoff is ponded or very slow. The water table is at or above the surface in winter and early in spring.

In most areas this soil is drained and used for cultivated crops and grasses and legumes for forage.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main limitation to cropland use. The use of open ditches, tile drains, or surface drains or pumping, or a combination of these practices, can help remove excess water. If drained and properly managed, this soil is suited to intensive row cropping. Conservation tillage and crop residue returned to the surface help improve and maintain the tilth and the content of organic matter of the soil.

This soil is well suited to grasses and legumes for hay or pasture. If adequately drained, this soil can support

Figure 5.—Typical landscape of Ragsdale silt loam, in the foreground, and Reesville silt loam.

high yields of forage or pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of the plant cover. Proper stocking, rotational grazing, timely deferment of grazing, and restricting grazing during wet periods help to reduce surface compaction and to maintain good tilth and plant densities.

This soil is well suited to water tolerant trees and shrubs. It is severely limited for woodland use, however, because of the equipment limitation, seedling mortality, and the hazard of windthrow. Wetness limits the use of harvesting and planting machinery. Some replanting of seedlings is generally needed.

This soil is severely limited for use as a site for buildings because of ponding. Artificial drainage can help to overcome this limitation.

The use of this soil as a site for local roads and streets is severely limited by the hazard of frost action, ponding, and low strength. Elevating the roadbed helps to overcome the ponding limitation. Adding more suitable base material helps to overcome the frost action and low strength limitations.

This soil is severely limited for use as septic tank absorption fields because of ponding and slow permeability. Sanitary facilities should be connected to commercial sewers and treatment facilities, or alternate sites should be selected.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

ReA—Reesville silt loam, 0 to 2 percent slopes. This nearly level, deep, and somewhat poorly drained soil is on large and small upland flats. Areas of this map unit are generally broad and irregular in shape. They range from 3 to 45 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 24 inches thick. In the upper part it is yellowish brown, mottled, firm silty clay loam; in the middle part it is grayish brown, mottled, firm silty clay loam; and in the lower part it is yellowish brown, mottled, firm silty clay

loam. Below this, to a depth of 60 inches, is yellowish brown, mottled silt loam and loam. In places the lower part of the subsoil formed in loamy glacial till.

Included in mapping are a few small areas of very poorly drained Ragsdale soils in depressions and along drainageways. These soils make up about 8 percent of the map unit.

This soil has high available water capacity and moderately slow permeability. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is slow. The water table is 1.0 to 2.5 feet below the surface in winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is used for grasses and legumes for forage. In a few areas it is used as woodland.

If adequately drained, this soil is suited to corn, soybeans, and small grain. Conservation tillage, crop residue returned to the surface, and winter cover crops help to maintain the content of organic matter and fertility and to improve soil tilth.

If adequately drained, this soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture in good condition.

This soil is suited to hardwood trees. It is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled. Site preparation, spraying, cutting, and girdling can control unwanted trees and shrubs.

This soil is severely limited for use as a site for buildings and as septic tank absorption fields because of wetness. Artificial drainage is necessary.

This soil is severely limited for use as a site for local roads and streets because of the hazard of frost action and the low strength. Replacing the soil with more suitable base material helps to overcome these limitations.

This soil is in capability subclass IIw and woodland suitability subclass 2o.

Rn—Rensselaer silt loam. This is a nearly level, deep, and very poorly drained soil. It is in slight depressions on terraces. It is frequently ponded by runoff from adjacent higher lying areas. Areas of this map unit are small and are irregularly shaped. They range from 3 to 30 acres in size.

In a typical profile the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is black silty clay loam about 10 inches thick. The subsoil is about 27 inches thick. In the upper part it is dark gray and gray, mottled, firm clay loam, and in the lower part it is dark gray, mottled, friable loam. The substratum to a depth of 78 inches is grayish brown, mottled fine sand and gray fine sand. In places the substratum contains a high percentage of gravel or of silty sediments.

Included in mapping are small areas of somewhat poorly drained Whitaker soils in higher lying areas. These included soils make up about 4 percent of the map unit.

This soil has high available water capacity. Permeability is slow. The content of organic matter in the surface layer is high. Surface runoff from cultivated areas is very slow or ponded. The water table is at or above the surface in winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is used as woodland.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main limitation to the use of this soil as cropland. The use of open ditches, tile drains, or surface drains or pumping, or a combination of these practices, can help to remove excess water. If drained and properly managed, this soil is suited to intensive row cropping. Conservation tillage and crop residue returned to the surface help improve and maintain the tilth and the content of organic matter of the soil.

If adequately drained, this soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing and restricting grazing during wet periods help to keep the pasture in good condition.

This soil is well suited to water tolerant trees. A few areas are in hardwoods. This soil is severely limited for woodland use, however, because of the equipment limitation, seedling mortality, and the hazard of windthrow. Harvesting of trees and planting of seedlings are often delayed by wetness. Some replanting of seedlings may be necessary. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for use as a site for buildings because of ponding. Artificial drainage can help to overcome this limitation. The use of this soil as a site for local roads and streets is severely limited by the hazard of frost action, ponding, and low strength. Elevating the roadbed helps to overcome the ponding limitation. Adding more suitable base material helps to overcome the frost action and low strength limitations.

This soil is severely limited for use as septic tank absorption fields because of ponding and slow permeability. Sanitary facilities should be connected to commercial sewers and treatment facilities, or an alternate site should be selected.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

RuB—Russell silt loam, 2 to 6 percent slopes. This is a gently sloping, deep, and well drained soil. It is on broad ridgetops, long side slopes, and toe slopes of the uplands. Areas of this map unit are broad and irregular in shape. They range from 3 to 50 acres in size.

In a typical profile the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 45

inches thick. In the upper part it is dark yellowish brown, friable silt loam and dark brown, firm silty clay loam, and in the lower part it is dark yellowish brown and yellowish brown, firm clay loam. The substratum to a depth of 60 inches is yellowish brown loam.

Included in mapping are a few small slightly depressional areas of somewhat poorly drained Fincastle and Reesville soils. Also included are small areas of soils that are severely eroded and a few areas with sinkholes. The Fincastle and Reesville soils make up 8 percent of the map unit and the other included soils make up 4 percent.

This soil has high available water capacity. Permeability is moderate. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is medium.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main limitation to the use of this soil as cropland. If the soil is cultivated, conservation practices are needed to control surface runoff and erosion. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Crop residue returned to the surface and cover crops also help to control erosion and improve and maintain tilth and the content of organic matter.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is moderately limited for use as a site for buildings because of its shrink-swell potential. Designing foundations, footings, and basement walls to withstand the shrinking and swelling and backfilling with coarse materials help to overcome this limitation.

This soil is severely limited for use as a site for local roads and streets because of the hazard of frost action and the low strength. Replacing the soil with more suitable base material helps to overcome these limitations.

This soil is moderately limited for use as septic tank absorption fields because of the slope and permeability. Enlarging the filter field and installing it on the contour help to overcome these limitations.

Because of the hazard of erosion, all disturbed areas should be smoothed and planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

RuC—Russell silt loam, 6 to 12 percent slopes. This moderately sloping, deep, well drained soil is on side slopes adjacent to drainageways of the uplands. Areas of this map unit are long and narrow in shape. They range from 3 to 30 acres in size.

In a typical profile the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsoil is about 38 inches thick. In the upper part it is dark yellowish brown, friable silt loam, and in the lower part it is yellowish brown, firm silty clay loam and clay loam. The substratum to a depth of 60 inches is yellowish brown, mottled loam.

Included in mapping are a few small areas of severely eroded soils that make up about 8 percent of the map unit.

This soil has high available water capacity and moderate permeability. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is medium.

This soil is used mainly for cultivated crops. Some areas are used for hay and pasture or as woodland.

This soil is suited to corn, soybeans, and small grains. If the soil is cultivated, the hazard of erosion is severe and conservation practices that help control surface runoff and erosion are needed. Crop rotations, conservation tillage, terraces and diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Returning crop residue to the surface and the use of cover crops help to reduce runoff and control erosion and to maintain tilth and the content of organic matter.

This soil is well suited to grasses and legumes for hay or pasture. The use of this soil for hay and pasture helps to control erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is moderately limited for use as a site for buildings because of the slope and shrinking and swelling of the soil. Reinforcing foundations and footings and backfilling basement walls with coarse material help to overcome these limitations.

This soil is severely limited for use as a site for local roads and streets because of the hazard of frost action and the low strength. Adding more suitable base material helps to overcome these limitations.

This soil is moderately limited for use as septic tank absorption fields because of permeability and slope.

Enlarging the absorption field and constructing it on the contour help to overcome these limitations.

Because of the hazard of erosion, all exposed areas should be smoothed, shaped, and planted to a vegetative cover as soon as possible.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

Sh—Shoals silt loam. This is a nearly level, deep, somewhat poorly drained soil. It is on bottom lands along broad and narrow streams, narrow draws, and toe slopes. It is frequently flooded for brief periods. Areas of this map unit are generally long and irregular in shape. They range from 5 to 100 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 8 inches thick. The underlying material to a depth of 50 inches is brown and dark grayish brown, mottled, friable silt loam in the upper part and grayish brown, mottled, firm loam and clay loam in the lower part. From 50 to 60 inches the underlying material is mottled grayish brown and yellowish brown loam.

Included in mapping are a few small areas of very poorly drained soils in depressions and a few small areas of well drained Stonelick soils. These included soils make up about 12 percent of the map unit.

This soil has high available water capacity and moderate permeability. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is very slow. The water table is at a depth of 1 to 3 feet in winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is well suited to corn, soybeans, small grain, and grasses and legumes if adequately protected from flooding. Wetness is also a limitation to the use of this soil as cropland. If levees, drainage ditches, subsurface drains, and grade stabilization structures (fig. 6) are maintained, a cropping system that includes mostly row crops can be used. Conservation tillage, winter cover crops, and crop residue returned to the surface help to maintain and improve the content of organic matter and maintain good tilth.

This soil is well suited to grasses and legumes for forage. If this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to water-tolerant trees. It is severely limited for woodland uses, however, because of plant competition. Site preparation, spraying, cutting, or girdling can control unwanted trees and shrubs.

This soil is severely limited for use as a site for buildings and local roads and streets and as septic tank absorption fields because of wetness and flooding. It is generally not suited to these uses.

This soil is in capability subclass IIw and woodland suitability subclass 2o.

Sm—Shoals-Hennepin complex, 0 to 50 percent slopes. This complex consists of somewhat poorly drained, nearly level Shoals soils on narrow flood plains and sloping to very steep Hennepin soils on adjacent side slopes of uplands. The Shoals soils are frequently flooded. Areas of this complex are 20 to 75 acres and are 60 percent Shoals soils and Hennepin soils. Individual areas of the Shoals and Hennepin soils are so small that it is not practical to map them separately.

In a typical profile of the Shoals soils the surface layer is dark grayish brown silt loam about 8 inches thick. The underlying material to a depth of 60 inches is brown and grayish brown, mottled, friable silt loam in the upper part and mottled grayish brown and yellowish brown clay loam in the lower part.

In a typical profile of the Hennepin soils the surface layer is dark grayish brown loam about 4 inches thick. The subsoil is dark brown, friable loam about 11 inches thick. The substratum to a depth of about 60 inches is brown loam.

Included in mapping are small areas of the well drained Chagrin and Stonelick soils. Included on the side slopes are small areas of moderately sloping and strongly sloping, well drained Miami soils. The included soils make up about 10 percent of the complex.

The available water capacity is high in the Shoals soils and moderate in the Hennepin soils. In the Shoals soils permeability is moderate, and in the Hennepin soils it is moderate in the subsoil and moderately slow and slow in the substratum. The content of organic matter is moderate in the Shoals soils and low in the Hennepin soil. Surface runoff is very slow for the Shoals soils and rapid or very rapid for the Hennepin soil. The water table in the Shoals soil is at a depth of 1 to 3 feet in winter and early in spring.

In most areas the soils are used for timber. In a few areas they are used as pasture. In areas of the steeper soils, woodland use helps to control runoff and erosion.

The soils in this complex are well suited to timber production. In areas of Hennepin soils, however, slopes are too steep for the operation of some harvesting machinery and erosion is a hazard if the soils are disturbed. Logging trails and roads should be placed on the contour. Control of competing vegetation by site preparation, spraying, cutting, or girdling is needed to insure the establishment of seedlings.

These soils are generally not suited to use as sites for buildings and local roads and streets because of the slope or flooding. They are severely limited for use as septic tank absorption fields because of the slope, flooding, or high water table.

Figure 6.—A grade stabilization structure below a grass waterway in an area of Shoals silt loam.

The Shoals soils are in capability subclass IIw and woodland suitability subclass 2o. The Hennepin soils are in capability subclass VIIe and woodland suitability subclass 1r.

Sw—Stonelick sandy loam. This is a nearly level, deep, and well drained soil on bottom lands. It is frequently flooded. Areas of this map unit range from 5 to 75 acres.

In a typical profile the surface layer is dark brown sandy loam about 10 inches thick. The underlying material to a depth of 60 inches is dark brown loamy fine sand in the upper part, dark brown fine sandy loam in the middle part, and dark brown, stratified sand and loamy sand in the lower part.

Included in mapping are small areas of well drained Chagrin soils on slightly lower positions and small areas of the somewhat poorly drained Shoals soils that are on lower lying areas away from streams. The Chagrin soils make up 8 percent of the map unit and the Shoals soils make up 4 percent.

This soil has moderate available water capacity and moderately rapid permeability. The content of organic matter in the surface layer is low. Surface runoff is slow.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

If adequately protected from flooding, this soil is well suited to corn, soybeans, and small grain. If levees and adequate diversion terraces are built and maintained, a cropping system that includes mostly row crops can be used. Conservation tillage, winter cover crops, and crop residue returned to the surface help to maintain and improve the content of organic matter and to maintain good tilth.

This soil is well suited to grasses and legumes for forage. If this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is dry. Grazing under dry conditions causes the plants to die out. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are used as woodland. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, and girdling.

This soil is severely limited for use as a site for buildings, local roads and streets, and septic tank absorption fields because of flooding. It is generally not suited to these uses.

This soil is in capability subclass IIIw and woodland suitability subclass 2o.

Ud—Udorthents, loamy. This is nearly level to moderately sloping, deep, and well drained or moderately well drained soil. It is in disturbed areas of the uplands and terraces, which surround highway interchanges, shopping centers, and factories. In places, deep cuts have been made in the original surface. The soil material from those cuts has been used to fill in lower lying areas and thereby provide a smoother, more level surface. In other places, the soil material has been removed and used to provide fill for highway grades, overpasses, and exit ramps. Areas of this unit are 3 to 30 acres in size.

Typically the fill is a mixture of surface soil, subsoil, and substratum. Texture is silt loam, loam, and clay loam that may contain some gravel, shale, or stone. In a typical area where a deep cut has been made, the material is mainly loam or clay loam glacial till.

Included in mapping are small areas of short steep slopes, areas of sand and gravel, and areas where bedrock outcrops. Highways also cover much of some areas. Also included, near urban areas, are some manmade dumps consisting of rubble, tree tops, etc., which are eventually covered with soil material.

This soil has moderate available water capacity and moderate to slow permeability. The content of organic matter in the surface material is very low.

This soil is used mainly for permanent grass or low growing shrubs because access to most areas is limited. In many areas it is surrounded by heavily traveled highways. Special management practices are needed for areas of this soil.

If this soil material is used for crops, an intensified fertility program with special emphasis on incorporation of organic residue or manure is needed. Conservation practices are needed to control erosion in the gently sloping and moderately sloping areas. Drainage may be needed in the nearly level areas. Exposed areas should be revegetated as soon as possible after construction. Diversions, box inlet structures, grade stabilization structures, and grassed waterways can be used to control erosion.

Onsite investigation is needed if this soil is used for building site development. For example, depth to the water table and its relation to frost action potential should be considered. Engineering test data should be collected. The soil properties significant to design of a structure vary from one place to another within a mapped area of this soil. If this soil is used as a building site, removal of vegetation should be held to a minimum, and protective plant cover should be established as quickly as possible so that erosion can be held to a minimum. Nearly level areas may need drainage.

The limitations of this soil for sanitary facilities are variable, and onsite investigation is needed. Attention should be given to wetness and permeability in nearly level areas and to slope and permeability in gently sloping and moderately sloping areas.

This map unit is not assigned to a capability subclass or woodland suitability subclass.

Wa—Wakeland silt loam. This is a nearly level, deep, and somewhat poorly drained soil. It is on bottom lands along broad and narrow streams, narrow drainageways, and toe slopes. It is frequently flooded for brief periods. Areas of this map unit are generally long and irregular in shape. They are dominantly about 25 acres in size, but range from 4 to 60 acres.

In a typical profile the surface layer is dark brown silt loam 10 inches thick. The underlying material to a depth of about 60 inches is grayish brown, mottled silt loam in the upper part and dark yellowish brown, mottled silt loam in the lower part.

Included in mapping are a few small areas of well drained Chagrin and Haymond soils. These soils make up 12 percent of the map unit.

This soil has high available water capacity. Permeability is moderate. The content of organic matter is moderate. Surface runoff from cultivated areas is very slow. The water table is at a depth of 1 to 3 feet in winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

If adequately protected from flooding, this soil is well suited to corn, soybeans, small grain, and grasses and legumes. If levees, drainage ditches, and subsurface drains are built and maintained, a cropping system that includes mostly row crops can be used. Conservation tillage, winter cover crops, and crop residue returned to the surface help to maintain and improve the content of organic matter and to maintain good tilth.

This soil is well suited to grasses and legumes for forage. If this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting

grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. It is moderately limited for woodland use, however, because of equipment limitations and plant competition. Site preparation, spraying, cutting, or girdling can control unwanted trees and shrubs.

This soil is severely limited for use as a site for buildings and local roads and streets, and as septic tank absorption fields because of wetness and flooding. It is generally not suited to these uses.

This soil is in capability subclass IIw and woodland suitability subclass 2o.

WeG—Weikert silt loam, 25 to 70 percent slopes. This very steep, well drained soil is on side slopes of the uplands. It is shallow over sandstone bedrock. Areas of this map unit are long, narrow, and irregular in shape. They range from 4 to 50 acres in size.

In a typical profile the surface layer is dark brown silt loam about 2 inches thick. The subsoil is pale brown and yellowish brown, friable channery and very channery loam about 14 inches thick. Yellowish brown fractured sandstone is at a depth of 16 inches.

Included in mapping are small areas of well drained Hennepin soils on slopes of less than 25 percent, areas where bedrock is exposed, and areas of severely eroded soils. These inclusions make up 10 percent of the map unit.

This soil has low available water capacity. Permeability is moderately rapid. The content of organic matter is moderate. Surface runoff is very rapid.

This soil is used as woodland. It is not suited to cultivated crops because slopes are very steep and the hazard of erosion is severe.

This soil is suited to trees. Erosion is a moderate concern if areas are disturbed. Slopes are too steep for the operation of some harvesting machinery. Seedling mortality is severe and some replanting of seedlings is necessary.

This soil is severely limited for use as a site for buildings and local roads and streets and for use as septic tank absorption fields because of the very steep slopes and shallowness to bedrock. It generally is not suited to these uses.

This soil is in capability subclass VIIe and woodland suitability subclass 4d.

Wh—Whitaker silt loam. This is a nearly level, deep, and somewhat poorly drained soil on broad terraces. Areas of this map unit are long and wide and irregular in shape. They range from 3 to 40 acres in size.

In a typical profile the surface layer is dark brown silt loam about 10 inches thick. The subsoil is about 36 inches thick. In the upper part it is light brownish gray, mottled silty clay loam, and in the lower part it is yellowish brown, mottled firm loam. The substratum to a depth of about 60 inches is brown and yellowish brown, mottled, firm sandy loam and fine sand. In places there is a loess mantle 15 to 25 inches thick.

Included in mapping are a few areas of well drained Martinsville soils in higher lying areas and small areas of very poorly drained Rensselaer soils along narrow drainageways. The included soils make up 8 percent of the map unit.

This soil has high available water capacity. Permeability is moderate. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is slow. The water table is 1 to 3 feet below the surface during winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main limitation to the use of this soil as cropland. Open ditches, subsurface drains, or surface drains can remove excess water. If drained and properly managed, this soil is suited to intensive row cropping. Conservation tillage, crop residue returned to the surface, and winter cover crops help to improve and maintain the content of organic matter and fertility and to improve soil tilth.

If adequately drained, this soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for use as a site for buildings because of wetness. An adequate drainage system in combination with foundation drains is needed to help lower the water table. Houses should be constructed without basements.

This soil is severely limited for use as a site for local roads and streets because of the low strength and the hazard of frost action. Adding more suitable base material helps to overcome these limitations.

This soil is severely limited for use as septic tank absorption fields. Adequate drainage is necessary for the absorption field to function properly.

This soil is in capability subclass IIw and woodland suitability subclass 3o.

XeA—Xenia silt loam, 0 to 2 percent slopes. This nearly level, deep, and moderately well drained soil is on uplands. Areas of this map unit are narrow and irregular in shape. They range from 2 to 30 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is

about 41 inches thick. In the upper part it is dark yellowish brown, friable silt loam; in the middle part it is dark yellowish brown, mottled, firm silty clay loam and clay loam; and in the lower part it is brown, mottled, firm clay loam. The substratum to a depth of 60 inches is brown, mottled, calcareous loam. In some pedons the subsoil is thinner.

Included in mapping are a few small areas of well drained Russell soils on higher knolls and a few small areas of somewhat poorly drained Fincastle and Reesville soils. The Russell soils make up 5 percent of the map unit and the Fincastle and Reesville soils make up 7 percent.

This soil has high available water capacity. Permeability is moderately slow. The content of organic matter in the surface layer is moderate. Surface runoff from cultivated areas is slow. The water table is at a depth of 2 to 6 feet in winter and early in spring.

This soil is used mainly for cultivated crops. In many areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is well suited to corn, soybeans, and small grain. Crop residue returned to the surface, conservation tillage, and cover crops help to improve the content of organic matter of this soil.

This soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when this soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

The use of this soil as a site for houses without basements is moderately limited by wetness and shrinking and swelling of the soil. Foundation drains are needed to remove excess water. The foundations should be reinforced and placed on coarse material to help prevent structural damage caused by shrinking and swelling of the soil. This soil should not be used as a site for houses with basements.

This soil is severely limited for use as a site for local roads and streets because of the low strength of the soil and the hazard of frost action in the soil. The base material should be replaced with a more suitable material that is capable of supporting vehicular traffic. Road ditches help to remove excess water and help reduce the hazard of frost action.

This soil also is severely limited for use as septic tank absorption fields because of the moderately slow permeability and wetness. Enlarged septic tank absorption fields and good drainage help to overcome these limitations.

This soil is in capability class I and woodland suitability subclass 1o.

XeB2—Xenia silt loam, 2 to 6 percent slopes, eroded. This gently sloping, moderately well drained soil is on broad ridgetops of the uplands. Areas of this map unit are generally broad and irregular in shape. They range from 8 to 250 acres in size.

In a typical profile the surface layer is dark brown silt loam about 10 inches thick. The subsoil is about 40 inches thick. In the upper part it is dark brown, firm silty clay loam and in the lower part it is yellowish brown, mottled, firm silty clay loam and clay loam. The substratum to a depth of 60 inches is yellowish brown, mottled loam. In some places the subsoil is thinner.

Included in mapping are a few slightly depressional areas of somewhat poorly drained Reesville soils and very poorly drained Ragsdale soils. The Reesville and Ragsdale soils make up about 8 percent of the map unit. Somewhat poorly drained Fincastle soils, in flat and gently sloping areas, make up about 4 percent of the map unit.

This soil has high available water capacity. Permeability is moderately slow. The content of organic matter is moderate in the surface layer. Surface runoff from cultivated areas is medium. The water table is 2 to 6 feet below the surface during winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is used for hay or pasture. In a few areas it is used as woodland.

This soil is well suited to corn, soybeans, and small grain. Soil erosion is the main limitation to the use of this soil as cropland. If the soil is cultivated, surface runoff and erosion control are needed. Crop rotation, conservation tillage, terraces and diversions, grassed waterways, and grade stabilization structures help to control erosion. Crop residue returned to the surface and cover crops also help to control erosion and improve and maintain the tilth and the content of organic matter of this soil (fig. 7).

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricting grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in hardwoods. This soil is moderately limited for woodland use, however, because of plant competition. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

The use of this soil as a site for houses without basements is moderately limited because of wetness and shrinking and swelling of the soil. Foundation drains are needed to remove excess water. The foundations should be reinforced and placed on coarse material to help prevent structural damage caused by shrinking and

Figure 7.—Use of crop residue on Xenia silt loam, 2 to 6 percent slopes, eroded.

swelling of the soil. This soil should not be used as a site for houses with basements.

This soil is severely limited for use as a site for local roads and streets because of the low strength of the soil and the hazard of frost action in the soil. The base material should be replaced with material that is capable of supporting vehicular traffic. Road ditches help remove excess water and help reduce the hazard of frost action.

This soil is severely limited for use as septic tank absorption fields because of the slow permeability and wetness. Enlarged absorption fields and good drainage help to overcome these limitations.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

prime farmland

Prime farmland, as defined by the U.S. Department of Agriculture, is that land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high crop yields if acceptable farming methods are used. Prime farmland produces the highest yields with minimal inputs of energy and money and farming it results in the least damage to the environment. Prime farmland is of major importance in satisfying the nation's short- and long-range needs for food and fiber. The supply of high quality farmland is limited and should be used with wisdom and foresight.

Prime farmland is either currently used for producing food or fiber or is available for this use. Urban or built-up land or water areas are not included. Urban and built-up land includes any unit of land of 10 acres or more in size that is used for residences, industrial sites, commercial sites, construction sites, institutional sites, railroad yards, small parks, cemeteries, airports, golf courses, sanitary landfills, sewage treatment plants, water-control structures and spillways, shooting ranges, and so forth.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. It has favorable temperature and growing season and acceptable reaction. It has few or no rocks and is permeable to water and air. Prime farmland is not excessively erodible or saturated with water for long periods or frequently flooded during the growing season. Slope ranges mainly from 0 to 6 percent.

About 165,000 acres, or nearly 53 percent of Putnam County, meets the soil requirements for prime farmland. Areas are scattered throughout the county. Nearly all of this prime farmland is used for corn and soybeans.

Some parts of the county have been losing prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and difficult to cultivate, and generally less productive.

Soil map units that make up prime farmland in Putnam County are listed in this section. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 5. The location is shown on the detailed soil maps at the back of this publication. Some map units are considered prime farmland only in areas that are adequately drained. The soil qualities that affect use and management are described in the section "Detailed soil map units."

The map units that meet the soil requirements for prime farmland are:

AlB—Alford silt loam, 2 to 6 percent slopes
AvB—Ava silt loam, 1 to 4 percent slopes
AwB2—Ava silt loam, 3 to 6 percent slopes, eroded
Ba—Bartle silt loam (where drained)
ElB—Elkinsville silt loam, 2 to 6 percent slopes
Ev—Evansville silt loam (where drained)
FdA—Fincastle silt loam, 1 to 3 percent slopes
FoB2—Fox loam, 2 to 6 percent slopes, eroded
Hv—Hoosierville silt loam (where drained)
IvA—Iva silt loam, 0 to 2 percent slopes (where drained)
McA—Martinsville loam, 0 to 2 percent slopes
McB—Martinsville loam, 2 to 6 percent slopes
MuB—Muren silt loam, 1 to 4 percent slopes
OcA—Ockley silt loam, 0 to 2 percent slopes
OcB2—Ockley silt loam, 2 to 6 percent slopes, eroded
PeB2—Parke silt loam, 2 to 6 percent slopes, eroded
Ra—Ragsdale silt loam (where drained)
ReA—Reesville silt loam, 0 to 2 percent slopes (where drained)
Rn—Rensselaer silt loam (where drained)
RuB—Russell silt loam, 2 to 6 percent slopes
Wh—Whitaker silt loam (where drained)
XeA—Xenia silt loam, 0 to 2 percent slopes
XeB2—Xenia silt loam, 2 to 6 percent slopes, eroded

use and management of the soils

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

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

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

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

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

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

crops and pasture

George Murphey, 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.

According to the Conservation Needs Inventory (*3*) approximately 190,500 acres in the survey area was used for crops and pasture in 1967. Of this total, 99,000 acres was used for row crops; 12,500 acres for small grain; 36,000 acres for rotation hay and pasture; and 43,000 acres for permanent pasture. The major row crops are corn and soybeans. The major small grain crops are oats and wheat.

Acreage in crops increased in the period 1973 to 1976. The potential of the soils in Putnam County for increased production of food is good. If the latest crop production technology is applied to all cropland in the county, food production can be increased significantly. This soil survey can facilitate the application of such technology.

Poor internal soil drainage is the major conservation problem on approximately 52 percent of the acreage used for crops and pasture in Putnam County. Bartle, Birds, Evansville, Fincastle, Hoosierville, Iva, Ragsdale, Reesville, Rensselaer, Shoals, Wakeland, and Whitaker soils require surface and subsurface drainage for maximum crop production. Commonly, crop yields can be increased by 50 percent if the soil is drained.

Soil erosion is the major conservation problem on approximately 42 percent of the cropland and pastureland in Putnam County. Soil erosion is a hazard if the slope is more than 2 percent. Alford, Ava, Cincinnati, Grayford, Martinsville, Miami, Russell, and Xenia soils commonly have slope of more than 2 percent.

Loss of the surface layer through erosion results in permanent damage to the soil, which in turn reduces yields of cropland and pastureland. This is especially true on soils that have a clayey subsoil. Fox, Martinsville, Miami, Ockley, and Russell soils have a clayey subsoil and slope of more than 2 percent.

Most cropland in Putnam County can be protected from wind and water erosion by using a conservation tillage system. Any form of noninversion tillage that retains protective amounts of residue mulch on the surface throughout the year is called *conservation tillage*.

No-tillage, strip tillage, and stubble mulching are examples. In addition to protecting the soil from erosion, conservation tillage maintains or improves soil structure, reduces compaction and tillage pans, and improves soil aeration, infiltration, and tilth.

On sloping cropland erosion can be reduced by the use of terraces, diversions, grass waterways, and erosion control structures. Chisel plowing, contouring, and crop rotation also reduce erosion. On slopes of more than 12 percent permanent hay or pasture are more practical for erosion control.

Flooding is a hazard on approximately 12 percent of the cropland and pastureland in Putnam County. Soils subject to frequent flooding include Birds, Chagrin, Haymond, Shoals, Stonelick, and Wakeland.

Major flooding problems cannot be solved by an individual landowner, but require community action. A Public Law 566 Watershed Project has been implemented in the Little Walnut Creek Watershed, which has greatly reduced the hazard of flooding in this area.

Individual landowners can reduce crop damage resulting from minor flooding by constructing open ditches, diversions, and surface drains.

Low pH is also a management problem. Most of the Putnam County soils have a solum that is naturally acid. The soils on flood plains, for example, Birds, Chagrin, Haymond, Shoals, and Wakeland soils range from strongly acid to neutral or mildly alkaline.

All upland soils have a solum that is naturally acid. They need applications of ground limestone to raise the pH level for good growth of alfalfa, red clover, soybeans, and other crops that grow best on near neutral soils. Available phosphorus and potash levels are naturally low in most of these soils. On all soils, additions of lime and fertilizer should be based on soil tests, the nutrient requirements of the crop grown, and the desired crop yields.

Fragipans are another management problem in areas of Ava, Bartle, and Cincinnati soils. A fragipan impedes the movement of water and air and restricts root penetration, thereby reducing crop and pasture yields during periods of limited rainfall. It can cause a perched water table during rainy periods, commonly in winter and spring. Because of this perched water table, frost heave, which can damage the roots of plants such as alfalfa, is a hazard.

The most suitable field crops for this area are corn, soybeans, wheat, and oats. Grain sorghum, sudangrass, barley, and rye are also suitable but commonly are not grown. Fescue and red clover can be grown for seed, but this is not a common practice.

Technical assistance in planning, designing, and installing conservation practices can be obtained from the Putnam County Soil and Water Conservation District or the Putnam County Cooperative Extension Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 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 yields are based mainly on the experience and records of farmers and conservationists. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

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

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

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

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 grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

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

Class I soils have slight limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

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 (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *w*, indicates excessive water in or on the soil; *d*, restricted root depth; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: w, d, and r.

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

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

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

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

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

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

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

windbreaks and environmental plantings

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, hold snow on the fields, and provide food and cover for wildlife.

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

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

recreation

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include 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, shorebirds, rails, kingfishers, 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 need to be considered in planning, in site selection, and in design.

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

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

building site development

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

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

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

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

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope,

stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 13 shows the degree and the 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 effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

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

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

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

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

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

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

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

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

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over

bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

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

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

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

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

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

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

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

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

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

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

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

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

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

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

water management

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

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

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

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

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

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

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances, such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, 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 (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6.

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 oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are

given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

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 and water in swamps and marshes are not considered flooding.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

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 is 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, artesian, 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. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. 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 specified as either soft or hard. If the rock is soft or fractured, excavations generally 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 excavations.

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 most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*5*). 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. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is 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 Udalf (*Ud*, meaning humid, 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 Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*4*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*5*). 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."

Alford series

The Alford series consists of deep, well drained, moderately permeable soils on loess covered uplands. These soils formed in silty loess. The slope range is 2 to 12 percent.

Alford soils are similar to Parke soils and are commonly adjacent to Hickory soils on the landscape. Parke soils have thinner loess capping than Alford soils and a lower B horizon that developed in outwash material. Hickory soils are on steeper side slopes and have little or no loess capping and a lower B horizon that developed in glacial till.

Typical pedon of Alford silt loam, 2 to 6 percent slopes, in a cultivated field, 200 feet north and 100 feet

east of the southwest corner of sec. 36, T. 14 N., R. 5 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, brown (10YR 5/3) dry; weak medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.
B1—9 to 15 inches; dark brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; many fine roots; slightly acid; clear wavy boundary.
B21t—15 to 27 inches; yellowish brown (10YR 5/4) silty clay loam; weak medium subangular blocky structure; firm; many fine roots; many fine pores; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.
B22t—27 to 34 inches; dark yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; many fine roots; common fine pores; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds and few light brownish gray (10YR 5/2) silt coatings on faces of peds; medium acid; clear smooth boundary.
B23t—34 to 49 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common fine roots; common fine pores; discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; gradual wavy boundary.
B31—49 to 58 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable; few fine roots; few fine pores; medium acid; gradual wavy boundary.
B32—58 to 80 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable; medium acid.

The solum is more than 80 inches thick. The loess is more than 60 inches thick.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. It is medium acid or slightly acid in unlimed areas.

The A2 horizon, if present, has hue of 10YR, value of 4, and chroma of 3 or 4. It is silt loam.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6.

It is strongly acid or medium acid.

Alvin series

The Alvin series consists of deep, well drained soils on outwash plains and terraces. These soils are moderately or moderately rapidly permeable in the solum and rapidly permeable in the underlying material. They formed in eolian or water deposited sandy material of mixed minerology. The slope range is 6 to 12 percent. These soils have a lower base saturation than is defined in the range for the series. This difference, however, does not alter the use or behavior of the soils.

Alvin soils are commonly adjacent to Alford and Parke soils on the landscape. Alford soils formed in 5 to 7 feet of loess and Parke soils in 20 to 40 inches of loess over outwash.

Typical pedon of Alvin sandy loam, 6 to 12 percent slopes, in a pasture, 2,000 feet north and l,800 feet west of the southeast corner of sec. 11, T. l3 N., R. 5 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.
A2—6 to 10 inches; dark brown (10YR 4/3) fine sandy loam; moderate fine granular structure; friable; many fine roots; medium acid; clear smooth boundary.
B1—10 to 18 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; many fine roots; medium acid; clear smooth boundary.
B21t—18 to 30 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; common fine roots; many continuous dark brown (7.5YR 4/4) clay films on faces of most peds; strongly acid; gradual wavy boundary.
B22t—30 to 41 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; few discontinuous dark brown (7.5YR 4/4) clay films on faces of some peds; strongly acid; gradual wavy boundary.
C—41 to 60 inches; dark brown (7.5YR 4/4) fine sand; single grain; loose; medium acid.

The solum is 41 to 60 inches thick.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is slightly acid or neutral.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4. It is sandy clay loam or sandy loam in the upper part and fine sandy loam and sandy loam in the lower part. Reaction ranges from strongly acid to slightly acid.

The C horizon is fine sand or sand. Reaction is medium acid in the upper part of the horizon and neutral in the lower part.

Ava series

The Ava series consists of deep, moderately well drained soils on loess-covered uplands. These soils have a fragipan that is very slowly permeable. They formed in loess, glacial drift, and residuum of limestone and sandstone bedrock. The slope range is 1 to 12 percent.

Ava soils are similar to Alford and Parke soils and are commonly adjacent to Hickory soils on the landscape. Unlike the Ava soils, Alford, Parke, and Hickory soils do not have a fragipan. Parke soils formed in loess and outwash. Hickory soils are on steeper side slopes.

Typical pedon of Ava silt loam, 6 to 12 percent slopes, eroded, in a pasture, 100 feet south and 200 feet west of the northeast corner of sec. 31, T. 13 N., R. 4 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; slightly acid; clear wavy boundary.
Blt—8 to 12 inches; brown (10YR 5/3) silt loam; weak medium subangular blocky structure; friable; many fine roots; many fine pores; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.
B2t—12 to 22 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; many continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.
Bx1—22 to 32 inches; yellowish brown (10YR 5/4) silt loam; coarse prismatic structure; firm; few fine roots in faces of prisms; common fine pores in faces of prisms; continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; many light brownish gray (10YR 6/2) silt coatings on faces of prisms; very strongly acid; clear wavy boundary.
Bx2—32 to 50 inches; yellowish brown (10YR 5/6) silt loam; very coarse prismatic structure; firm; continuous dark brown (7.5YR 4/4) clay films on faces of peds; many gray (10YR 6/1) silt coatings on faces of prisms; very strongly acid; clear wavy boundary.
IIB3—50 to 60 inches; light yellowish brown (10YR 6/4) loam; weak fine subangular blocky structure; friable; 2 percent sandstone fragments; strongly acid; clear wavy boundary.
IIC—60 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; 3 percent sandstone fragments; strongly acid.

The solum is 48 to 80 inches thick. The loess capping is 42 to 65 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The A2 horizon, if present, has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is generally strongly acid to slightly acid in unlimed areas.

The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam, silt loam, or loam. It ranges from very strongly acid to medium acid.

The Bx horizon has a color range similar to that of the B2t horizon. It is silty clay loam or silt loam.

The C horizon is loam or clay loam. It is strongly acid or medium acid.

In map unit AvB the depth to gray mottles is slightly less than the minimum depth defined in the range for the Ava series. This difference, however, does not alter the use and behavior of the soil.

Bartle series

The Bartle series consists of deep, somewhat poorly drained, very slowly permeable soils that are on low-lying terraces. These soils formed in strongly acid material of mixed origin from Illinoian drift and are underlain by residuum of shale and sandstone. The slope range is 0 to 2 percent.

Bartle soils are commonly adjacent to Elkinsville and Chagrin soils on the landscape. Unlike Bartle soils, Elkinsville soils do not have mottles in the upper part of the solum, do not have a fragipan, and are on gently sloping terraces. Chagrin soils are free of mottles, formed in neutral loamy alluvium, and are on bottom lands.

Typical pedon of Bartle silt loam, in a cultivated field, 2,500 feet south and 2,100 feet east of the northwest corner of sec. 3, T. 14 N., R. 5 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.
B1—10 to 18 inches; pale brown (10YR 6/3) silt loam; common medium distinct strong brown (7.5YR 5/4) and pinkish gray (7.5YR 7/2) mottles; weak subangular blocky structure; friable; many fine roots; many fine pores; neutral; clear smooth boundary.
B2t—18 to 28 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct yellowish brown (10YR 5/8) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin discontinuous brown (10YR 5/3) clay films on faces of some peds; thick continuous gray (10YR 6/1) silt coatings on faces of most peds; strongly acid; clear smooth boundary.
Bxlg—28 to 42 inches; light gray (10YR 7/2) silt loam; common medium distinct yellowish brown (10YR 5/8), light brownish gray (10YR 6/2), and pale brown (10YR 6/3) mottles; moderate coarse prismatic structure; firm; brittle; many very dark brown (10YR 2/2) manganese oxide concretions; common fine roots; common fine pores; strongly acid; clear smooth boundary.
Bx2g—42 to 59 inches; gray (10YR 6/1) silty clay loam; common medium distinct strong brown (7.5YR 5/4) mottles; moderate very coarse prismatic structure; firm; many very dark brown (10YR 2/2) manganese oxide concretions; few fine roots; few fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of some peds; strongly acid; gradual smooth boundary.
IIC—59 to 70 inches; dark yellowish brown (10YR 4/4) sandy loam; massive; friable; very strongly acid.

The solum is 42 to 60 inches thick.

The Ap horizon has a hue of 10YR, value of 4 or 5, and chroma of 2. It is slightly acid or neutral.

The A2 horizon, if present, has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. Mottles are few to many. Reaction is slightly acid or neutral.

The B2t horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 4. It has common or many distinct mottles. It ranges from silt loam to silty clay loam.

The Bx horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. It is mottled.

The IIC horizon is sandy loam, silt loam, or silty clay loam. It commonly is very strongly acid or strongly acid, but in some pedons it is medium acid.

Birds series

The Birds series consists of deep, poorly drained, moderately slowly permeable soils. These soils formed in silty acid alluvium on bottom lands. The slope range is 0 to 2 percent.

Birds soils are adjacent to Hickory soils on the landscape. Hickory soils are on nearby steep to very steep uplands, have an argillic horizon, and formed in till.

Typical pedon of Birds silt loam, in a cultivated field, 1,050 feet north and 1,800 feet west of the southeast corner of sec. 34, T. 14 N., R. 5 W.

Ap—0 to 10 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak fine granular structure; friable; many roots; neutral; clear smooth boundary.

C1g—10 to 28 inches; gray (10YR 6/1) silt loam; common medium distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium granular structure; friable; many fine roots; medium acid; gradual smooth boundary.

C2g—28 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; firm; few fine roots; strongly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. It is slightly acid or neutral.

The C horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 1 or 2 with mottles of higher chroma. Reaction is strongly acid or medium acid.

Chagrin series

The Chagrin series consists of deep, well drained, and moderately permeable soils. These soils formed in alluvial deposits on bottom lands. The slope range is 0 to 2 percent.

Chagrin soils are similar to Haymond and Stonelick soils and are commonly adjacent to Shoals soils on the landscape. Haymond soils have more silt in the solum than the Chagrin soils. Stonelick soils have coarser textures. Shoals soils are mottled throughout the solum and are farther away from the streams.

Typical pedon of Chagrin silt loam, in a cultivated field, 2,500 feet north and 2,500 feet west of the southeast corner of sec. 34, T. 15 N., R. 5 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21—10 to 29 inches; dark brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; many fine roots; many fine pores; neutral; clear smooth boundary.

B22—29 to 43 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; common fine roots; common fine pores; neutral; clear smooth boundary.

B23—43 to 52 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; few fine roots; few fine pores; mildly alkaline; clear smooth boundary.

C—52 to 60 inches; dark brown (10YR 4/3) stratified sandy loam and sand; single grain; loose; slight effervescence; moderately alkaline.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam or loam.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or loam.

The C horizon is stratified silt loam, loam, sandy loam, or sand.

Chetwynd series

The Chetwynd series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in highly weathered outwash and are underlain by sand and loamy sand. The slope range is 25 to 50 percent.

Chetwynd soils are similar to Hickory soils and are commonly adjacent to Alford and Parke soils on the landscape. Unlike the Chetwynd soils, Hickory soils formed in loamy glacial till and are on steep to very steep side slopes of the uplands. Alford and Parke soils have more silt and less sand in the solum.

Typical pedon of Chetwynd silt loam, 25 to 50 percent slopes, in a wooded area, 2,210 feet west and 1,980 feet north of the southeast corner of sec. 25, T. 13 N., R. 5 W.

A1—0 to 3 inches; dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; many fine pores; neutral; abrupt wavy boundary.

A2—3 to 8 inches; yellowish brown (10YR 5/4) loam; moderate medium granular structure; friable; many fine roots; many fine pores; slightly acid; clear wavy boundary.

B1—8 to 12 inches; dark brown (7.5YR 4/4) loam; weak fine subangular blocky structure; friable; many fine roots; many fine pores; very strongly acid; clear wavy boundary.

B21t—12 to 25 inches; reddish brown (5YR 4/4) clay loam; moderate medium subangular blocky

structure; firm; many fine roots; many fine pores; thick continuous reddish brown (5YR 4/3) clay films on faces of peds; 10 percent fine gravel; very strongly acid; gradual wavy boundary.

B22t—25 to 40 inches; yellowish brown (5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous reddish brown (5YR 4/4) clay films on faces of peds; 5 percent fine gravel; very strongly acid; gradual wavy boundary.

B23t—40 to 48 inches; yellowish red (5YR 4/6) sandy loam; weak medium and coarse subangular blocky structure; firm; common fine roots; common fine pores; thin continuous reddish brown (5YR 4/4) clay films on faces of peds; 4 percent fine gravel; very strongly acid; gradual wavy boundary.

B24t—48 to 70 inches; yellowish red (5YR 4/6) stratified sandy loam and loamy sand; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous reddish brown (5YR 4/4) clay films on faces of peds; strongly acid; 6 percent fine gravel; strongly acid; gradual wavy boundary.

B3—70 to 78 inches; strong brown (7.5YR 5/6) stratified loamy sand and sand; weak medium subangular blocky structure; very friable; very strongly acid; gradual wavy boundary.

IIC—78 to 80 inches; yellowish brown (10YR 5/4) stratified sand and loamy sand; single grain; loose; strongly acid.

The solum thickness and depth to carbonates are 66 to more than 80 inches.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. It is loam or silt loam.

The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B2t horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 4 to 6.

The content of sand is more than 20 percent. Reaction ranges from very strongly acid to medium acid.

The IIC horizon is stratified sand, loamy sand, and their gravelly analogs.

Cincinnati series

The Cincinnati series consists of deep, well drained soils on loess-covered uplands. These soils have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in and below the fragipan. These soils formed in loess, glacial drift, and residuum of limestone and sandstone. The slope range is 6 to 18 percent.

Cincinnati soils are similar to the Alford and Parke soils and are commonly adjacent to Hickory soils on the landscape. Unlike the Cincinnati soils, Alford, Parke, and Hickory soils do not have a fragipan. Alford soils formed in loess. Parke soils formed in loess and outwash. Hickory soils are on steeper side slopes and formed mainly in glacial till.

Typical pedon of Cincinnati silt loam, 6 to 12 percent slopes, eroded, in a pasture, 20 feet south and 2,100 feet west of the northeast corner of sec. 4, T. 12 N., R. 4 W.

Ap—0 to 11 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; weak fine granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

B21t—11 to 18 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

B22t—18 to 29 inches; brown (10YR 5/3) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bx1—29 to 38 inches; yellowish brown (10YR 5/6) silt loam; coarse prismatic structure; firm; few fine roots in faces of prisms; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of some peds; many gray (10YR 6/1) silt coatings on faces of prisms; medium acid; clear wavy boundary.

IIBx2—38 to 54 inches; yellowish brown (10YR 5/6) clay loam; very coarse prismatic structure; firm; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; many light brownish gray (10YR 6/2) and light gray (10YR 7/1) silt coatings on faces of prisms; medium acid; clear wavy boundary.

IIB23t—54 to 72 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

IIB24t—72 to 80 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; many medium distinct light brownish gray (10YR 6/2) mottles; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; many medium black (10YR 2/1) manganese oxide concretions; 2 percent sandstone fragments; slightly acid.

The loess capping commonly is 24 to 40 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The A2 horizon, if present, has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is strongly acid to slightly acid in unlimed areas.

The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It ranges from very strongly acid to medium acid. The Bx and IIBx horizons are similar in color to the B2t horizon and are clay loam, silty clay loam, or silt loam.

Some pedons have a IIC horizon, which is loam or clay loam and ranges from strongly acid to slightly acid.

Corydon series

The Corydon series consists of shallow, well drained, moderately slowly permeable soils on uplands. These soils formed in residuum of limestone. The slope range is 25 to 50 percent.

Corydon soils are commonly adjacent to Alford and Grayford soils on the landscape. Alford soils are deep, formed in silty loess, and are on gently sloping to moderately sloping areas of the upland ridgetops. Grayford soils are deep, formed in 20 to 40 inches of silty loess and the underlying glacial till, and are on gently sloping to strongly sloping areas of the uplands.

Typical pedon of Corydon silt loam, 25 to 50 percent slopes, in a wooded area, 2,000 feet south and 2,500 feet west of the northeast corner of sec. 3, T. 14 N., R. 5 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam brown (10YR 4/3 crushed), grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many fine roots; neutral; clear smooth boundary.

B2t—6 to 13 inches; reddish brown (5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; neutral; abrupt irregular boundary.

R—13 inches; limestone bedrock that has cracks filled with B2t horizon material, weathering soil material, and fine roots.

The solum is 10 to 20 inches thick.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The B2t horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 5, and chroma of 3 or 4. It is slightly acid or neutral.

Elkinsville series

The Elkinsville series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in strongly acid material from glacial drift and residuum of shale and sandstone. The slope range is 2 to 6 percent.

Elkinsville soils are commonly adjacent to Bartle and Chagrin soils on the landscape. Bartle soils have mottles in all B horizons, have a fragipan, and are on nearly level low-lying terraces. Chagrin soils are free of mottles, formed in neutral loamy alluvium, and are on bottom lands.

Typical pedon of Elkinsville silt loam, 2 to 6 percent slopes, in a cultivated field, 2,000 feet south and 2,000 feet west of the northeast corner of sec. 3, T. 14 N., R. 5 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A2—9 to 13 inches; dark brown (10YR 4/3) silt loam; weak medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

B21t—13 to 24 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; few thin discontinuous pale brown (10YR 6/3) silt coatings on faces of peds; slightly acid; clear smooth boundary.

B22t—24 to 37 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium angular blocky structure; firm; common fine roots; common fine pores; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual smooth boundary.

B23t—37 to 59 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; common fine pores; thick continuous pale brown (10YR 6/3) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

C—59 to 68 inches; yellowish brown (10YR 5/4) stratified silt loam and silty clay loam; weak medium subangular blocky structure; firm; few fine roots; few fine pores; thick continuous pale brown (10YR 6/3) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

IIC—68 to 70 inches; yellowish brown (10YR 5/4) stratified sandy loam and clay loam; massive; loose; very strongly acid.

The solum is 42 to 72 inches thick.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3.

The A2 horizon has hue of 10YR, value of 4, and chroma of 3 or 4.

The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam in the upper part and silty clay loam or loam in the lower part. Reaction in the lower B2t horizon is strongly acid to neutral.

The C horizon ranges from very strongly acid to medium acid.

Evansville series

The Evansville series consists of deep, poorly drained, moderately permeable soils on terraces and lake plains. These soils formed in alluvium and lacustrine sediments. The slope range is 0 to 2 percent.

Evansville soils are commonly adjacent to Reesville and Wakeland soils on the landscape. Reesville soils have an argillic horizon and are on higher lying rises than the Evansville soils. Wakeland soils do not have a B horizon, contain less clay, and are on bottom lands.

Typical pedon of Evansville silt loam, in a cultivated field, 2,600 feet north and 1,500 feet west of the southeast corner of sec. 30, T. 15 N., R. 5 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

B1g—10 to 21 inches; gray (10YR 5/1) silt loam; few fine distinct dark brown (7.5YR 4/4) mottles; weak medium granular structure; friable; many fine roots; common fine pores; neutral; clear smooth boundary.

B2g—21 to 34 inches; gray (10YR 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; few fine pores; neutral; clear smooth boundary.

B3g—34 to 48 inches; gray (10YR 5/1) silty clay loam; many medium distinct dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; firm; few fine roots; few fine pores; neutral; clear smooth boundary.

C1g—48 to 60 inches; gray (10YR 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; neutral; clear smooth boundary.

The solum is 48 to 54 inches thick and is neutral throughout.

The Bg horizon has hue of 10YR, value of 5, and chroma of 1 or 2. It is distinctly mottled.

The Cg horizon has color and texture similar to the Bg horizon.

Fincastle series

The Fincastle series consists of deep, somewhat poorly drained soils on loess covered uplands. These soils formed in loess and underlying loamy glacial till. They are moderately slowly permeable in the solum and slowly to moderately permeable in the underlying till. The slope range is 1 to 3 percent.

Fincastle soils are similar to Reesville soils and are commonly adjacent to Ragsdale and Xenia soils on the landscape. Unlike the Fincastle soils, Reesville soils formed entirely in loess and have a thinner solum. Ragsdale soils have a mollic epipedon and have mottles in the lower part of the surface layer and in the subsoil. Xenia soils have mottles in the middle part of the B2t horizon.

Typical pedon of Fincastle silt loam, 1 to 3 percent slopes, in a cultivated field, 1,500 feet north and 1,500 feet east of the southwest corner of sec. 1, T. 16 N., R. 4 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A2—10 to 14 inches; grayish brown (10YR 5/2) silt loam; moderate medium granular structure; friable; many fine roots; many fine pores; few very dark grayish brown (10YR 3/2) organic stains on faces of peds; neutral; clear wavy boundary.

B2t—14 to 28 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark brown (10YR 4/3) clay films on faces of peds; medium acid; gradual wavy boundary.

IIB3t—28 to 44 inches; brown (10YR 5/3) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; neutral; gradual wavy boundary.

IIC—44 to 60 inches; brown (10YR 5/3) clay loam; massive; firm; strong effervescence; moderately alkaline.

The solum is 36 to 48 inches thick. The loess capping is 24 to 35 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. It is generally slightly acid or neutral.

The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2.

The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is mottled. It is strongly acid or medium acid, but in some pedons it is only slightly acid or neutral in the lower part. Texture is silty clay loam or clay loam.

The IIC horizon is clay loam or loam. It ranges from neutral to moderately alkaline.

Fox series

The Fox series consists of well drained soils that are moderately deep over sand and gravel. These soils are on terraces. They formed in loamy glacial outwash over stratified coarse sand and gravelly coarse sand. They are moderately permeable in the solum and rapidly permeable in the substratum. The slope range is 2 to 12 percent.

Fox soils are similar to Ockley soils and are commonly adjacent to Chagrin and Stonelick soils on the landscape. Ockley soils have a thicker B horizon than the Fox soils. Chagrin and Stonelick soils formed in alluvium and have little or no gravel in the solum.

Typical pedon of Fox loam, 2 to 6 percent slopes, eroded, in a cultivated field, 700 feet north and 400 feet east of the southwest corner of sec. 31, T. 15 N., R. 3 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak fine granular structure;

friable; many fine roots; neutral; abrupt smooth boundary.
B1—7 to 11 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; many fine roots; many fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; neutral; clear wavy boundary.
B21t—11 to 19 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; thin discontinuous dark reddish brown (5YR 3/3) clay films on faces of peds; 10 percent fine gravel; neutral; gradual wavy boundary.
B22t—19 to 26 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; many fine pores; thin discontinuous dark reddish brown (5YR 3/3) clay films on faces of peds; 5 percent fine gravel; slightly acid; clear wavy boundary.
B23t—26 to 38 inches; dark brown (10YR 4/3) sandy clay loam; weak fine subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark reddish brown (5YR 3/3) clay films on faces of peds; 5 percent fine gravel; slightly acid; abrupt irregular boundary.
IIC—38 to 60 inches; dark brown (10YR 4/3) stratified coarse sand and gravelly coarse sand; single grain; loose; 15 percent gravel; strong effervescence; moderately alkaline.

The solum is 26 to 40 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam, sandy loam, or clay loam. It is slightly acid or neutral.

The A2 horizon, if present, has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam, sandy loam, or clay loam. It is slightly acid or neutral.

The B2t horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 or 4, and chroma of 3 or 4. It is loam, clay loam, or sandy clay loam or the gravelly analogs of these textures.

The IIC horizon is mildly alkaline or moderately alkaline. In some pedons, tongues of a B3t horizon extend several inches into the IIC horizon.

Gilpin series

The Gilpin series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in residuum of shale or sandstone. The slope range is 15 to 25 percent.

Gilpin soils are similar to Weikert soils and are commonly adjacent to Hickory and Chetwynd soils on the landscape. Weikert soils are shallow and have more coarse fragments than Gilpin soils. Hickory and Chetwynd soils have a thicker solum and formed in glacial till and outwash.

Typical pedon of Gilpin silt loam, 15 to 25 percent slopes, in a wooded area, 2,500 feet south and 1,250 feet east of the northwest corner of sec. 12, R. 5 W., T. 12 N.

A1—0 to 3 inches; dark brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; strongly acid; abrupt smooth boundary.
A2—3 to 8 inches; dark yellowish brown (10YR 4/4) loam; weak fine granular structure; friable; 5 percent sandstone fragments; strongly acid; abrupt smooth boundary.
B21t—8 to 14 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; friable; few thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; 10 percent sandstone fragments; very strongly acid; clear wavy boundary.
B22t—14 to 32 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; few thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; 10 percent sandstone fragments; very strongly acid; clear wavy boundary.
R—32 inches; dark yellowish brown (10YR 5/6) fractured sandstone bedrock.

The solum is 26 to 36 inches thick. Rippable bedrock is at a depth of 28 to 40 inches. Reaction is very strongly acid or strongly acid.

The A horizon has hue of 10YR, value of 3 to 5, 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 loam, shaly loam, silty clay loam, or shaly silty clay loam.

The C horizon, if present, has hue of 10YR, value of 4 or 5, and chroma 4 to 8. Texture is shaly, very shaly, channery, or very channery loam.

Grayford series

The Grayford series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess, glacial till, and residuum of limestone. The slope range is 6 to 25 percent.

Grayford soils are similar to Alford soils and are commonly adjacent to Ava and Cincinnati soils on the landscape. Alford soils formed in more than 60 inches of loess. Ava and Cincinnati soils have a fragipan. Ava soils have gray mottles in the argillic horizon.

Typical pedon of Grayford silt loam, 6 to 12 percent slopes, eroded, in a cultivated field, 2,500 feet south and 950 feet west of the northeast corner of sec. 14, T. 12 N., R. 3 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21t—8 to 12 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; neutral; clear smooth boundary.
B22t—12 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; slightly acid; clear smooth boundary.
IIB23t—24 to 51 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin continuous reddish brown (5YR 4/4) clay films on faces of peds; few black (10YR 2/1) iron and manganese oxide concretions; medium acid; clear smooth boundary.
IIIB24t—51 to 60 inches; reddish brown (5YR 4/4) clay; moderate coarse subangular blocky structure; very firm; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; few black (10YR 2/1) manganese oxide concretions; 4 percent fine gravel; medium acid; clear smooth boundary.
IIIB25t—60 to 80 inches; dark reddish brown (5YR 3/4) clay; moderate coarse subangular blocky structure; very firm; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.
R—80 inches; limestone bedrock.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6.

The IIB2t horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam or silty clay loam. It is strongly acid or medium acid.

The IIIBt horizon has hue of 5YR or 7.5YR, value of 4, and chroma of 4. It is silty clay or clay. It is strongly acid or medium acid.

The Grayford soils in map units GrD2 and GrE2 do not have the loamy component in the solum as required for the Grayford series. They are also shallower to clayey textures than soils of the Grayford series. These differences do not alter the use and behavior of the soil.

Haymond series

The Haymond series consists of deep, well drained, moderately permeable soils. These soils formed in silty alluvial deposits on bottom lands. The slope range is 0 to 2 percent.

Haymond soils are similar to Chagrin soils and are commonly adjacent to Wakeland soils on the landscape. Chagrin soils contain more sand in the solum than the Haymond soils. Wakeland soils have more mottles in all the C horizons.

Typical pedon of Haymond silt loam, in a cultivated field, 1,980 feet north and 80 feet east of the southwest corner of sec. 16, T. 12 N., R. 5 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; mildly alkaline; many fine pores; abrupt smooth boundary.
B21—7 to 17 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium subangular blocky structure; friable; common fine roots; common fine pores; neutral; gradual wavy boundary.
B22—17 to 47 inches; dark brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; common fine roots; common fine pores; neutral; gradual wavy boundary.
C1—47 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; structureless with bedding planes evident; friable; common fine roots; common fine pores; neutral; gradual wavy boundary.
C2—60 to 70 inches; dark yellowish brown (10YR 4/4) sandy loam; massive; friable; few fine roots; few fine pores; neutral.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B horizon contains strata of silt loam, loam, or sandy loam. The 10- to 40-inch control section is, on the average, between 12 and 18 percent clay and less than 15 percent fine and coarser sand.

Hennepin series

The Hennepin series consists of deep and well drained soils. These soils formed in loamy glacial till on uplands. They are moderately permeable in the solum and moderately slowly permeable in the underlying till. The slope range is 25 to 50 percent.

Hennepin soils are adjacent to Miami and Russell soils on the landscape. Miami and Russell soils have a thicker solum than the Hennepin soils, have an argillic horizon, and are on ridgetops.

Typical pedon of Hennepin loam, 25 to 50 percent slopes, in a wooded area, 2,500 feet north and 1,500 feet east of the southwest corner of sec. 35, T. 14 N., R. 4 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, light gray (10YR 7/2) dry; weak medium granular structure; friable; many fine roots; neutral; gradual wavy boundary.
B2—4 to 15 inches; dark brown (10YR 4/3) loam; moderate medium granular structure; friable; 3 percent fine gravel; common fine roots; neutral; gradual wavy boundary.
C—15 to 60 inches; brown (10YR 5/3) loam; common medium distinct brownish yellow (10YR 6/8) mottles; massive; friable; 6 percent gravel; slight effervescence; moderately alkaline.

The solum is 12 to 20 inches thick. Coarse fragments, dominantly gravel, make up 1 to 4 percent of the solum.

The A1 horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. It is loam or silt loam and is slightly acid or neutral.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is slightly acid to moderately alkaline.

The C horizon is loam or clay loam and is mildly alkaline or moderately alkaline.

Hickory series

The Hickory series consists of deep, moderately well drained and well drained, moderately permeable soils on uplands. These soils formed in material weathered from glacial till. The slope range is 25 to 70 percent.

Hickory soils are similar to Cincinnati soils and are adjacent to Iva and Shoals soils on the landscape. Cincinnati soils have a thick loess cap and have a fragipan. Iva soils formed in deep loess and are somewhat poorly drained. Shoals soils formed in loamy alluvium and are somewhat poorly drained.

Typical pedon of Hickory loam, 25 to 70 percent slopes, in a wooded area, 2,500 feet north and 1,700 feet west of the southeast corner of sec. 12, T. 14 N., R. 5 W.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B1—3 to 10 inches; yellowish brown (10YR 5/4) loam; weak fine granular structure; friable; many fine roots; many fine pores; medium acid; clear smooth boundary.

B21t—10 to 16 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; many fine roots; common fine pores; thin patchy discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

B22t—16 to 26 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; less than 1 percent fine gravel; medium acid; clear smooth boundary.

B23t—26 to 32 inches; yellowish brown (10YR 5/4) clay loam; moderate fine subangular blocky structure; firm; few fine roots; few fine pores; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of some peds; black (10YR 2/1) organic stains on faces of peds; strongly acid; gradual smooth boundary.

B3t—32 to 52 inches; yellowish brown (10YR 5/4) clay loam; moderate coarse subangular blocky structure; firm; very few fine pores; few patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; 1 percent fine gravel; medium acid; abrupt smooth boundary.

C—52 to 60 inches; yellowish brown (10YR 5/4) loam; few medium distinct yellowish brown (10YR 5/8) mottles; massive; firm; 1 percent fine gravel; slight effervescence; mildly alkaline.

The solum is 40 to 56 inches thick.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2. The A2 horizon, if present, has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. The A horizon is dominantly loam, but the range includes silt loam where the loess layer is less than 18 inches thick. The A horizon ranges from neutral to medium acid.

The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6.

The B3t horizon is clay loam or loam.

The C horizon is clay loam or loam.

Hoosierville series

The Hoosierville series consists of deep, poorly drained, slowly permeable soils on loess covered uplands. The slope range is from 0 to 2 percent.

Hoosierville soils are similar to Iva soils and are commonly adjacent to them on the landscape. Iva soils are on smaller flats and ridgetops and are better drained.

Typical pedon of Hoosierville silt loam, in a cultivated field, 2,600 feet west and 1,050 feet north of the southeast corner of sec. 29, T. 13 N., R. 3 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/1) dry; moderate medium granular structure; friable; many fine roots; many fine pores; neutral; clear smooth boundary.

B1g—8 to 13 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; many fine roots; many fine pores; strongly acid; clear smooth boundary.

B21tg—13 to 31 inches; gray (10YR 6/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; patchy gray (10YR 6/1) clay films on faces of peds; light brownish gray (10YR 6/2) silt coatings; medium acid; clear smooth boundary.

B22tg—31 to 40 inches; gray (10YR 5/1) silty clay loam; moderate medium distinct brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; patchy gray (10YR 6/1) clay films on faces of peds; light gray (10YR 7/2) silt coatings; slightly acid; clear smooth boundary.

B3g—40 to 60 inches; gray (10YR 6/1) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; few fine pores; patchy gray (10YR 6/1) clay films on faces of peds; light gray (10YR

7/2) silt coatings; slightly acid; clear smooth boundary.
C—60 to 70 inches; yellowish brown (10YR 5/4) silt loam; few fine faint grayish brown (10YR 5/2) mottles; massive; friable; slightly acid.

The solum is 46 to 70 inches thick. The loess commonly is 57 to 83 inches thick.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Reaction is neutral or mildly alkaline. The B2tg horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 1 or 2. It is medium acid or strongly acid in the upper part and less acid in the lower part.

The C horizon ranges from medium acid to neutral.

Iva series

The Iva series consists of deep, somewhat poorly drained, slowly permeable soils on loess covered uplands. These soils formed in loess. The slope range is 0 to 2 percent.

Iva soils are commonly adjacent to Alford and Parke soils on the landscape. Alford soils are on steeper slopes than the Iva soils and are free of mottles. Parke soils also are on steeper slopes and are free of mottles. The lower part of the B horizon in Parke soils formed in outwash material.

Typical pedon of Iva silt loam, 0 to 2 percent slopes, in a cultivated field, 2,200 feet west and 2,500 feet north of the southeast corner of sec. 12, T. 13 N., R. 5 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/1) dry; moderate medium granular structure; friable; many fine roots; many fine pores; neutral; abrupt smooth boundary.
B1—8 to 13 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium granular structure; friable; many fine roots; many fine pores; few black (10YR 2/1) iron and manganese oxide concretions; strongly acid; clear wavy boundary.
B21t—13 to 32 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; continuous gray (10YR 6/1) clay films on faces of peds; light gray (10YR 7/2) silt coatings; few black (10YR 2/1) iron and manganese oxide concretions; strongly acid; irregular wavy boundary.
B22t—32 to 44 inches; light brownish gray (10YR 6/2) silty clay loam; moderate medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; discontinuous gray (10YR 6/1) clay films on faces of peds; light gray (10YR 7/2) silt coatings; many black (10YR 2/1) iron and manganese oxide concretions; strongly acid; irregular wavy boundary.
B3—44 to 60 inches; light gray (10YR 7/2) silt loam; moderate medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; few fine roots; few fine pores; patchy gray (10YR 6/1) clay films on faces of peds; many black (10YR 2/1) iron and manganese oxide concretions; medium acid; irregular wavy boundary.
C—60 to 80 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium distinct light gray (10YR 7/2) and yellowish brown (10YR 5/6) mottles; massive; friable; few black (10YR 2/1) iron and manganese oxide concretions; slightly acid.

The solum is 42 to 60 inches thick. The loess capping is more than 60 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. The A2 horizon, if present, has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is silt loam.

The B2t horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 6 and is mottled. It is medium acid or strongly acid.

The C horizon is strongly acid to slightly acid.

Martinsville series

The Martinsville series consists of deep, well drained, moderately permeable soils on outwash plains and terraces. These soils formed in a thin mantle of loess over loamy and sandy material. The slope range is 0 to 6 percent. These soils have a lower content of clay and a thicker solum than defined in the range for the series. These differences do not alter the use or behavior of the soils.

Martinsville soils are commonly adjacent to Chagrin and Whitaker soils on the landscape. Chagrin soils formed in alluvium. Whitaker soils are mottled in all B horizons.

Typical pedon of Martinsville loam, 2 to 6 percent slopes, in a cultivated field, 2,144 feet south and 80 feet west of the northeast corner of sec. 10, T. 12 N., R. 3 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.
B1t—8 to 13 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; many fine roots; many fine pores; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; slightly acid; clear wavy boundary.
B21t—13 to 28 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

B22t—28 to 55 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; light gray (10YR 7/1) silt streaks; very dark gray (10YR 3/1) organic stains; medium acid; clear wavy boundary.
B3—55 to 70 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; friable; few fine roots; common fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; light gray (10YR 7/1) silt streaks; medium acid; clear smooth boundary.
C—70 to 80 inches; yellowish brown (10YR 5/6) fine sand; single grain; light gray (10YR 7/1) sand streaks; medium acid.

The solum is 36 to 72 inches thick.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is commonly loam or silt loam and strongly acid to neutral.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, clay loam, sandy loam, or sandy clay loam. It is medium acid or strongly acid.

The B3 horizon has colors similar to those of the B2 horizon. It is often stratified. Texture includes sandy loam or sandy clay loam. Reaction ranges from medium acid to mildly alkaline.

The C horizon is commonly stratified. Texture includes sand, fine sand, or sandy loam.

Miami series

The Miami series consists of deep, well drained soils on uplands. These soils are moderately permeable in the solum and moderately slowly permeable in the underlying material. They formed in a thin layer of loess and the underlying loamy glacial till. The slope range is 6 to 18 percent.

Miami soils are similar to Alford and Russell soils and are commonly adjacent to Xenia soils on the landscape. Alford and Russell soils have more silt and less sand in the solum than the Miami soils. Xenia soils are mottled in the middle part of the B2 horizon and have a thicker solum.

Typical pedon of Miami clay loam, 6 to 12 percent slopes, severely eroded, in a pasture, 2,150 feet east and 40 feet north of the southwest corner of sec. 35, T. 14 N., R. 4 W.

Ap—0 to 4 inches; dark yellowish brown (10YR 4/4) clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; many fine roots; many fine pores; neutral; abrupt smooth boundary.
B21t—4 to 11 inches; dark yellowish brown (10YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; many fine roots; many fine pores; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; neutral; clear wavy boundary.
B22t—11 to 22 inches; dark brown (10YR 4/3) clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; neutral; clear wavy boundary.
B23t—22 to 32 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of most peds; few reddish brown (5YR 4/8) iron aggregates; neutral; clear wavy boundary.
C—32 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; few glacial pebbles 5 to 20 millimeters in diameter; few yellowish red (5YR 4/8) iron aggregates; slight effervescence; mildly alkaline.

The solum is 24 to 42 inches thick. Depth to carbonates generally coincides with thickness of the solum.

The Ap horizon is clay loam or silt loam. It has hue of 10YR, value of 4, and chroma of 2 to 4.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or loam. It ranges from strongly acid to neutral.

The C horizon is loam or clay loam. It is mildly alkaline or moderately alkaline. Carbonates are present.

Muren series

The Muren series consists of deep, moderately well drained, moderately slowly permeable soils that formed in loess on uplands. The slopes range is 1 to 4 percent.

Muren soils are similar to the Ava soils and are commonly adjacent to Hickory soils on the landscape. Ava soils have a fragipan. Hickory soils have little or no loess capping and are on steep to very steep slopes along drainageways.

Typical pedon of Muren silt loam, 1 to 4 percent slopes, in a cultivated field, 2,500 feet south and 1,000 feet west of the northeast corner of sec. 30, T. 14 N., R. 5 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; many fine roots; slightly acid; clear wavy boundary.
A2—8 to 12 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium granular structure; friable; many fine roots; medium acid; clear smooth boundary.
B21t—12 to 20 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine subangular blocky structure; firm; many fine roots; many fine pores; thin discontinuous dark yellowish brown (10YR 4/4) clay

films on faces of peds; strongly acid; clear smooth boundary.

B22t—20 to 32 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

B23t—32 to 60 inches; yellowish brown (10YR 5/6) silty clay loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

C—60 to 70 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; few fine roots; few fine pores; medium acid.

The solum is 48 to 56 inches thick. The loess capping is 56 to 80 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is medium acid to neutral, depending on local liming practices.

The B2t horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is mottled in the lower part. It is silty clay loam or silt loam. It ranges from medium acid to very strongly acid.

The C horizon ranges from strongly acid to slightly acid.

Ockley series

The Ockley series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in a thin layer of loess and the underlying loamy glacial outwash. The slope range is 0 to 6 percent.

Ockley soils are similar to Fox soils and are commonly adjacent to Chagrin and Stonelick soils on the landscape. Fox soils have a thinner solum than the Ockley soils. Chagrin and Stonelick soils formed in loamy alluvial deposits and do not have an argillic horizon.

Typical pedon of Ockley silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 1,500 feet north and 50 feet west of the southeast corner of sec. 10, T. 14 N., R. 5 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21t—8 to 16 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; slightly acid; clear smooth boundary.

B22t—16 to 20 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

IIB23t—20 to 32 inches; dark yellowish brown (10YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; common fine roots; common fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; 5 percent fine gravel; strongly acid; clear wavy boundary.

IIB24t—32 to 41 inches; dark brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on gravel and as bridging of gravel; 25 percent gravel; medium acid; gradual wavy boundary.

IIB3t—41 to 52 inches; dark brown (7.5YR 4/4) gravelly clay loam; weak medium subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous clay films on gravel and as bridging of gravel; 25 percent gravel; slightly acid; gradual wavy boundary.

IIIC—52 to 60 inches; yellowish brown (10YR 5/4) coarse sand and gravelly coarse sand; weakly stratified; single grain; loose; 30 percent gravel; strong effervescence; moderately alkaline.

The solum is 48 to 60 inches thick. The loess is dominantly less than 20 inches thick.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is slightly acid or neutral.

The B2t horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 3 or 4. It is strongly acid to slightly acid.

The IIB2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4.

The IIIC horizon is mildly alkaline or moderately alkaline.

Parke series

The Parke series consists of deep, well drained, moderately permeable soils on outwash plains. These soils formed in loess and the underlying loamy and sandy outwash. The slope range is 2 to 12 percent.

Parke soils are similar to the Alford and Chetwynd soils and are commonly adjacent to these soils. Alford soils have a less acid solum than the Parke soils, and they formed only in loess. Chetwynd soils have more sand and less silt in the solum and are on steep and very steep side slopes.

Typical pedon of Parke silt loam, 2 to 6 percent slopes, eroded, in a pasture, 2,500 feet south and 1,400 feet east of the northwest corner of sec. 35, T. 13 N., R. 5 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; weak medium granular

structure; many fine roots; friable; slightly acid; abrupt smooth boundary.
B21t—8 to 18 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; many fine roots; many fine pores; friable; thin patchy very dark brown (10YR 3/2) clay films on faces of peds; strongly acid; clear wavy boundary.
B22t—18 to 30 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; common fine roots; common fine pores; firm; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.
IIB23t—30 to 45 inches; reddish brown (5YR 4/4) loam; weak medium subangular blocky structure; common fine roots; common fine pores; firm; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.
IIB3—45 to 80 inches; yellowish red (5YR 4/6) sandy loam; weak coarse subangular blocky structure; friable; strongly acid.

The solum is 48 to 84 inches thick. The loess capping is 20 to 40 inches thick.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The A2 horizon, if present, has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 or 6. It is silt loam or silty clay loam. The lower part of the B2t horizon in some pedons contains a small amount of sand and some fine gravel.

The IIB2t horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam, loam, or sandy loam. It is strongly acid in the upper part to slightly acid in the lower part.

Ragsdale series

The Ragsdale series consists of deep, very poorly drained, slowly permeable soils in upland depressions. These soils formed in loess. The slope range is 0 to 2 percent.

Ragsdale soils are adjacent to Reesville and Xenia soils on the landscape. Unlike Ragsdale soils, Reesville and Xenia soils do not have a mollic epipedon. Xenia soils have mottles in the middle part of the B horizon. The lower part of the B horizon of those soils formed in till.

Typical pedon of Ragsdale silt loam, in a cultivated field, 2,000 feet south and 30 feet west of the northeast corner of sec. 2, T. 15 N., R. 4 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.
A12—9 to 17 inches; very dark gray (10YR 3/1) silty clay loam; common fine distinct (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; many fine roots; neutral; gradual irregular boundary.
B21tg—17 to 31 inches; grayish brown (10YR 5/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin dark gray (10YR 4/1) clay films; few very dark gray (10YR 3/1) iron and manganese oxide concretions; neutral; gradual irregular boundary.
B22tg—31 to 50 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; neutral; clear wavy boundary.
B3—50 to 80 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct dark gray (10YR 4/1) and yellowish brown (10YR 5/6) splotches and streaks; massive; friable; neutral.

The solum is 45 to 72 inches thick. The loess capping is more than 60 inches thick.

The Ap and A12 horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A12 horizon may be mottled in the lower part. It is slightly acid or neutral.

The B2t horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 1 to 4. It is distinctly mottled. It is silty clay loam or silt loam and is slightly acid or neutral.

The B3 horizon ranges from silty clay loam to loam and is neutral or mildly alkaline.

Reesville series

The Reesville series consists of deep, somewhat poorly drained soils on loess covered till plains. Permeability is moderately slow. The slope range is 0 to 2 percent.

Reesville soils are similar to Fincastle and Iva soils and are commonly adjacent to Ragsdale and Xenia soils on the landscape. Unlike the Reesville soils, Fincastle soils have a lower B horizon that formed in weathered glacial till. Iva soils are more acid and are leached of carbonates to a greater depth. Ragsdale soils have a mollic epipedon and are in more depressional areas. Xenia soils have mottles in the middle part of the B horizon.

Typical pedon of Reesville silt loam, 0 to 2 percent slopes, in a cultivated field, 1,100 feet south and 1,500 feet east of the northwest corner of sec. 1, T. 16 N., R. 3 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.
B21t—9 to 16 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown

(10YR 5/2) mottles; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; thin continuous grayish brown (2.5Y 5/2) clay films on faces of peds; common medium distinct pale brown (10YR 6/3) silt coatings on faces of peds; slightly acid; gradual smooth boundary.

B22t—16 to 22 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous grayish brown (2.5Y 5/2) clay films on faces of peds; many black (10YR 2/1) iron and manganese oxide concretions; neutral; clear wavy boundary.

B23t—22 to 33 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few fine roots; few fine pores; thin continuous dark brown (10YR 4/3) clay films on faces of peds; neutral; clear wavy boundary.

C1—33 to 45 inches; yellowish brown (10YR 5/6) silt loam; many medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; friable; slight effervescence; mildly alkaline; clear wavy boundary.

C2—45 to 55 inches; yellowish brown (10YR 5/6) silt loam; few medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; slight effervescence; mildly alkaline; clear wavy boundary.

IIC3—55 to 60 inches; yellowish brown (10YR 5/6) loam; many medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; strong effervescence; moderately alkaline.

The solum is 33 to 45 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 and is slightly acid or neutral.

The A2 horizon, if present, has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is mottled.

The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is mottled. It is silt loam or silty clay loam. The B3 horizon, if present, is neutral or mildly alkaline.

The C and IIC horizons are neutral to moderately alkaline.

Rensselaer series

The Rensselaer series consists of deep, very poorly drained, slowly permeable soils on terraces. These soils formed in loamy and sandy lake-laid material. The slope range is 0 to 2 percent.

Rensselaer soils are similar to Ragsdale soils and are commonly adjacent to Martinsville and Whitaker soils on the landscape. Ragsdale soils have a solum formed in loess. Martinsville soils do not have a mollic epipedon and are not mottled. Whitaker soils do not have a mollic epipedon and commonly have a bright colored B horizon with gray mottles.

Typical profile of Rensselaer silt loam, in a cultivated field, 50 feet north and 1,200 feet west of the southeast corner of sec. 36, T. 16 N., R. 3 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

A12—8 to 18 inches; black (10YR 2/1) silty clay loam; moderate medium subangular blocky structure; firm; many fine roots; neutral; clear smooth boundary.

B21tg—18 to 28 inches; dark gray (10YR 4/1) clay loam; common medium distinct brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; few thin discontinuous very dark gray (10YR 3/1) clay films on faces of peds; neutral; gradual smooth boundary.

B22tg—28 to 36 inches; gray (10YR 5/1) clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; few thin discontinuous very dark gray (10YR 3/1) clay films on faces of peds; neutral; gradual wavy boundary.

B3g—36 to 45 inches; dark gray (10YR 4/1) loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; few fine pores; neutral; clear wavy boundary.

IIC1—45 to 60 inches; grayish brown (10YR 5/2) fine sand; many medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; mildly alkaline; clear wavy boundary.

IIC2g—60 to 78 inches; gray (10YR 6/1) fine sand; single grain; loose; slight effervescence; mildly alkaline.

The solum is 45 to 50 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silt loam, silty clay loam, or clay loam.

The B2t horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 or 2. It is mottled. It is silty clay loam or clay loam that is, on the average, 24 to 28 percent clay.

In some pedons, the IIC horizon is stratified clay loam, silt loam, fine sand, or loam.

Russell series

The Russell series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying till. The slope range is 2 to 12 percent.

Russell soils are similar to Miami soils and are commonly adjacent to Fincastle and Xenia soils on the landscape. Miami soils have a thinner solum than the

Russell soils. Fincastle soils have mottles in all B horizons. Xenia soils have mottles in the middle part of the B horizon.

Typical pedon of Russell silt loam, 2 to 6 percent slopes, in a cultivated field, 2,600 feet north and 2,000 feet west of the southeast corner of sec. 1, T. 14 N., R. 4 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many fine roots; many fine pores; neutral; clear wavy boundary.
B1t—8 to 13 inches; dark yellowish brown (10YR 4/4) silt loam; weak subangular blocky structure; friable; many fine roots; many fine pores; neutral; clear wavy boundary.
B21t—13 to 28 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; continuous brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.
IIB22t—28 to 39 inches; dark yellowish brown (10YR 4/4) clay loam; moderate coarse blocky structure; firm; common fine roots; common fine pores; continuous brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.
IIB3t—39 to 53 inches; yellowish brown (10YR 5/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; strongly acid; clear wavy boundary.
IIC—53 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to effervescent soil material are 36 to 67 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is slightly acid or neutral. If an A2 horizon is present, it has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It ranges from medium acid to neutral.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam. It is very strongly acid to medium acid.

The IIB2t horizon is similar in color to the B2t horizon. It is very strongly acid to slightly acid. It is as much as 5 percent fine gravel.

The IIC horizon is loam or clay loam and is mildly alkaline or moderately alkaline.

Shoals series

The Shoals series consists of deep, somewhat poorly drained, moderately permeable soils. These soils formed in silty and loamy alluvial deposits on bottom lands. The slope range is 0 to 2 percent.

Shoals soils are similar to Wakeland soils and are commonly adjacent to Chagrin and Hennepin soils on the landscape. Wakeland soils have more silt and less sand than Shoals soils within a depth of 40 inches. Chagrin soils are free of mottles. Hennepin soils are on steep and very steep side slopes above Shoals soils and are not mottled.

Typical pedon of Shoals silt loam, in a cultivated field, 2,300 feet north and 220 feet west of the southeast corner of sec. 2, T. 14 N., R. 5 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.
C1—8 to 15 inches; brown (10YR 5/3) silt loam; common medium distinct light grayish brown (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common fine roots; neutral; clear smooth boundary.
C2—15 to 25 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct gray (10YR 6/1) and yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; friable; few fine roots; few very dark gray (10YR 3/1) iron and manganese oxide concretions; neutral; gradual smooth boundary.
C3—25 to 38 inches; grayish brown (10YR 5/2) loam; common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; common dark gray (10YR 3/1) iron and manganese oxide concretions; neutral; gradual smooth boundary.
C4—38 to 50 inches; grayish brown (10YR 5/2) loam; common medium distinct yellowish brown (10YR 5/4) mottles; massive; firm; neutral; gradual smooth boundary.
C5—50 to 60 inches; mottled yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) loam; massive; firm; neutral.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. It commonly is silt loam or loam.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4 and is distinctly mottled. It is dominantly silt loam or loam, but the range includes sandy loam, silty clay loam, or clay loam. Reaction ranges from neutral to moderately alkaline.

Stonelick series

The Stonelick series consists of deep, well drained soils that formed in loamy and sandy alluvial deposits on bottom lands. Permeability is moderately rapid. The slope range is 0 to 2 percent.

Stonelick soils are similar to Chagrin and Haymond soils and are commonly adjacent to Shoals soils on the landscape. Chagrin soils have less sand and more clay than Stonelick soils to a depth of 40 inches. Haymond soils have more silt and more clay to a depth of 40 inches. Shoals soils have mottles in all C horizons.

Typical pedon of Stonelick sandy loam, in a cultivated field, 1,000 feet south and 1,200 feet west of the northeast corner of sec. 17, T. 14 N., R. 4 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) sandy loam, light yellowish brown (10YR 5/3) dry; weak fine granular structure; friable; many fine roots; slight effervescence; mildly alkaline; clear smooth boundary.
C1—10 to 16 inches; dark brown (10YR 4/3) loamy fine sand; single grain; very loose; many fine roots; slight effervescence; mildly alkaline; clear smooth boundary.
C2—16 to 45 inches; dark brown (10YR 4/3) fine sandy loam; single grain; loose; common fine roots; slight effervescence; mildly alkaline; clear smooth boundary.
C3—45 to 60 inches; dark brown (10YR 4/3) stratified sand and loamy sand; single grain; loose; 11 percent gravel; slight effervescence; mildly alkaline.

The weighted average of gravel through the texture control section ranges from 0 to 20 percent.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is loam, silt loam, or sandy loam. It is neutral or mildly alkaline.

The C horizon has hue of 10YR and 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is fine sandy loam, loam, loamy fine sand, fine sand, or sand. It is stratified in the lower part. It is neutral to moderately alkaline.

Wakeland series

The Wakeland series consists of deep, somewhat poorly drained, moderately permeable soils. These soils formed in silty alluvium on bottom lands. The slope range is 0 to 2 percent.

Wakeland soils are similar to Shoals soils and are commonly adjacent to Chagrin and Haymond soils on the landscape. Shoals and Chagrin soils have more sand than Wakeland soils. Chagrin and Haymond soils are free of mottles.

Typical pedon of Wakeland silt loam, in a cultivated field, 1,340 feet east and 30 feet south of the northwest corner of sec. 3, T. 12 N., R. 3 E.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; neutral; abrupt smooth boundary.
C1g—10 to 21 inches; grayish brown (10YR 5/2) silt loam; common fine distinct brown (10YR 5/3) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; thin continuous light gray (10YR 7/2) coatings on faces of peds; neutral; clear smooth boundary.
C2g—21 to 30 inches; grayish brown (10YR 5/2) silt loam; common medium distinct yellowish brown (10YR 5/6) and dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; neutral; clear smooth boundary.
C3—30 to 60 inches; brown (10YR 5/3) and dark yellowish brown (10YR 4/4) silt loam; common medium distinct light brownish gray (10YR 6/2) and dark yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; neutral.

Wakeland soils are medium acid to neutral throughout.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4, and it has few to many faint to prominent mottles. It is silt loam or loam. In some pedons, the C horizon below a depth of 40 inches may have thin layers of loam to very fine sand.

Weikert series

The Weikert series consists of shallow, well drained moderately rapidly permeable soils on steep and very steep upland side slopes. These soils formed in residuum of sandstone. The slope range is 25 to 70 percent.

Weikert soils are commonly adjacent to Hennepin and Hickory soils on the landscape. Hennepin and Hickory soils formed in glacial till on steep and very steep side slopes. Hickory soils have an argillic horizon.

Typical pedon of Weikert silt loam, 25 to 70 percent slopes, in a wooded area, 1,500 feet north and 1,000 feet west of the southeast corner of sec. 5, T. 4 N., R. 5 W.

Ap—0 to 2 inches; dark brown (10YR 4/3) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine roots; 1 percent sandstone fragments; medium acid; clear smooth boundary.
B21—2 to 7 inches; pale brown (10YR 5/3) channery loam; weak fine granular structure; friable; many fine roots; 40 percent sandstone fragments; medium acid; gradual wavy boundary.
B22—7 to 16 inches; yellowish brown (10YR 5/4) very channery loam; weak fine granular structure; friable; many fine roots; 60 percent sandstone fragments; strongly acid; clear wavy boundary.
R—16 to 20 inches; yellowish brown (10YR 5/8) fractured sandstone.

The solum is 10 to 20 inches thick. Bedrock is at a depth of 11 to 20 inches.

The A1 horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is channery silt loam, silt loam, or loam. Reaction is medium acid or slightly acid.

The B2 horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6 and is channery loam, very channery loam, or channery sandy loam. Reaction is strongly acid or medium acid.

Whitaker series

The Whitaker series consists of deep, somewhat poorly drained, moderately permeable soils. These soils formed in stratified silty, loamy, and sandy outwash on terraces. The slope range is 0 to 2 percent.

Whitaker soils are adjacent to Martinsville and Rensselaer soils. Martinsville soils do not have mottles in the B horizon. Rensselaer soils have a mollic epipedon and formed in calcareous loamy and sandy outwash material. Martinsville and Rensselaer soils are in higher lying areas than Whitaker soils.

Typical pedon of Whitaker silt loam, in a cultivated field, 1,150 feet north and 1,150 feet west of the southeast corner of sec. 36, T. 13 N., R. 3 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21t—10 to 18 inches; light brownish gray (10YR 6/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; thin dark grayish brown (10YR 4/2) clay films; neutral; clear smooth boundary.

IIB22t—18 to 32 inches; yellowish brown (10YR 5/6) loam; common medium distinct light brownish gray (10YR 4/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; few dark grayish brown (10YR 4/2) clay films; medium acid; clear smooth boundary.

IIB3t—32 to 46 inches; yellowish brown (10YR 5/6) loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; black (10YR 2/1) iron and manganese oxide concretions; medium acid; clear wavy boundary.

IIC1—46 to 56 inches; brown and yellowish brown (10YR 5/4) sandy loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; firm; few fine roots; black (10YR 2/1) iron and manganese oxide concretions; slightly acid; clear wavy boundary.

IIC2—56 to 60 inches; yellowish brown (10YR 5/4) fine sand; common fine distinct light brownish gray (10YR 6/2) mottles; massive; firm; few roots; neutral.

The solum is 40 to 50 inches thick.

The Ap horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 3. The A horizon is loam or silt loam and is slightly acid or neutral.

The Bt and IIBt horizons have hue of 10YR, value of 4 to 6, and chroma of 2 to 6 and are mottled. They are clay loam, loam, or silty clay loam and are medium acid to neutral.

The IIC horizon is stratified. Texture includes silt loam, loam, sandy loam, or fine sand. Reaction ranges from slightly acid to moderately alkaline.

Xenia series

The Xenia series consists of deep, moderately well drained, moderately slowly permeable soils. These soils formed in loess and the underlying loamy glacial till. The slope range is 0 to 6 percent.

Xenia soils are similar to Muren soils and are commonly adjacent to Fincastle and Russell soils on the landscape. Muren soils formed in loess and have less sand in the lower part of the B horizon than Xenia soils. Fincastle soils have mottles in all B horizons. Russell soils do not have mottles in all B horizons.

Typical pedon of Xenia silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 800 feet south and 2,400 feet east of the northwest corner of sec. 13, T. 14 N., R. 4 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; many fine pores; slightly acid; abrupt smooth boundary.

B21t—10 to 18 inches; dark brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; few thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—18 to 30 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

IIB23t—30 to 50 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

IIC—50 to 60 inches; yellowish brown (10YR 5/4) loam; light brownish gray (10YR 6/2) mottles; massive; friable; slight effervescence; moderately alkaline.

The thickness of the solum and commonly the depth to effervescent material are 36 to 56 inches. The loess capping is 20 to 40 inches thick.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. It ranges from medium acid to neutral.

The A2 horizon in some pedons has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

A thin B1 horizon is present in some pedons.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6 and is mottled. Reaction is strongly acid to neutral, but the range includes medium acid in the upper part of the horizon.

The IIC horizon is loam and is mildly alkaline or moderately alkaline.

formation of the soils

In this section the major factors of soil formation and their degree of importance in the formation of the soils in the county are discussed.

factors of soil formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. Generally, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

parent material

Parent material is the unconsolidated mass from which a soil is formed. The dominant parent materials of the soils of Putnam County consist of till of Illinoian and Wisconsin age, loess and windblown sands of Wisconsin age, outwash of Illinoian and Wisconsin age, lacustrine material of Wisconsin age, and residuum of limestone and sandstone that is covered by a thin to moderately thick layer of glacial drift.

The approximate boundary between the parent material of the Wisconsin Glaciation and the material of the Illinoian Glaciation is a line drawn diagonally from a point on the west county line about 2 miles north of Vivalia to the southwestern limits of Greencastle and southeast to the point where Mill Creek enters the county. This boundary is irregular, with short lobes or fingers extending in some places for a mile or more beyond the general boundary. The material of the Wisconsin Glaciation is 12,000 to 20,000 years old and that of the Illinoian age Glaciation is approximately 40,000 to 45,000 years old.

As the ice receded from the uplands, a mantle of mixed stones, sand, silt, and clay known as glacial till was left over the bedrock. The depth to glacial till of Wisconsin age is less than the depth to Illinoian glacial till. The till is calcareous loam or clay loam. Examples of soils formed in glacial till are Miami soils of Wisconsin age and Ava and Cincinnati soils of Illinoian age.

Loess is fine-grained material, consisting dominantly of silt-size particles, carried by wind. In Putnam County a mantle of loess was deposited on the entire upland area during the Wisconsin and Illinoian glacial periods. This mantle ranges from a few inches to several feet in thickness and contributed much toward the formation of the soils in the county. Examples of soils formed in this loess mantle are Ragsdale and Reesville soils of Wisconsin age and Alford, Hoosierville, Iva, and Muren soils of Illinoian age.

Outwash material is deposited by running water from melting glaciers. The size of the particles that make up outwash material varies according to speed of the stream. The coarser particles are deposited first. Finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally consist of layers of particles of similar size, such as sandy loam, sand, and gravel. Fox, Martinsville, Chetwynd, Ockley, Parke, and Whitaker soils, for example, formed in deposits of outwash material.

In some areas along Big Walnut Creek and its minor tributaries, mainly on breaks between terraces and uplands and in narrow draws dissecting the uplands, sandstone and shale are within a depth of 20 to 40 inches. Gilpin soils are an example of soils that formed in residuum of shale or sandstone.

In a few areas, mainly on breaks between the bottom land and upland, limestone bedrock is within a depth of 20 inches. Corydon soils are an example of soils that formed in residuum of limestone. Near these breaks are soils that formed in a thin capping of loess and a thin layer of glacial till over residuum of limestone bedrock. Grayford soils, for example, formed in this parent material.

Coarse-textured sandy material was carried by the wind and deposited as dunes on the uplands to the

eastern side of the Big Walnut Creek Valley. This material was blown up out of the outwash area associated with the meltwater deposits of the Illinoian glacial age. It ranges in depth from a few feet to 15 feet or more. Alvin soils formed in this material.

Alluvium is material deposited by floodwaters of present streams in recent time. There are minor areas of alluvial soils of older glaciation. The material ranges in texture, depending on the speed of water from which it is deposited. Examples of alluvial soils are Chagrin, Shoals, Stonelick, and Wakeland soils.

Soils that formed in lacustrine deposits are along Mill Creek in the southeastern part of the county. These soils are neutral and have a fine-textured subsoil of silty clay loam or silty clay. Evansville soils are an example of soils formed in lacustrine material.

Some soils formed mainly in residuum of the underlying bedrock. They may have a thin loess capping or no capping at all. Gilpin soils developed from underlying sandstone bedrock.

plant and animal life

Plants have been the principal organisms influencing the soils in Putnam County; however, bacteria, fungi, earthworms, and men have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kind of plants that grew on the soil. The remains of these plants accumulate on the surface and decay. Roots of plants provide channels for downward movement of water through the soil and also add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The vegetation in Putnam County is mainly deciduous forest. Differences in natural soil drainage and changes in plant material have affected the relative proportion of the forest species.

In general, the well drained soils, such as Alford, Ockley, and Russell soils were covered mainly with sugar maple, ash, hickory, oak, and poplar and the wetter soils were covered with gum, elm, and oak. A few of the wetter soils also had a covering of sphagnum and other mosses, which contributed substantially to the accumulation of organic matter. The Ragsdale soils developed under wet conditions and contain considerable organic matter.

climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil. It determines the amount of water available for weathering of minerals and transporting of soil material. Climate, through its influence on temperatures in the soil, determines the rate of chemical reaction that occurs in the soil. The influence of climate, however, is more noticeable over broad areas than over relatively small areas such as counties.

The climate in Putnam County is cool and humid. This is presumably similar to that which existed when the soils were being formed. The climate generally is uniform throughout the county. It is modified locally by large bodies of water and other features of the landscape. For more detailed information on the climate of this county, see the section "General nature of the survey area."

relief

Relief or topography has a marked influence on the soils of Putnam County through its influence on natural drainage, erosion, plant cover, and soil temperature. Slopes range from 0 to 70 percent. Natural soil drainage ranges from well drained on the ridgetops to very poorly drained in the depressions.

Relief influences the formation of soils by affecting runoff and drainage; drainage in turn, through its affect on aeration of the soil, determines the color of the soil. The volume of runoff is greatest on the steeper slopes. Water and air move freely through soils that are well drained but slowly through soils that are very poorly drained. In soils that are well aerated the colors are bright because the iron and aluminum compounds that give soils their color are oxidized. In soils that are poorly aerated the color is dull gray and mottled because of reduction. The Russell soils, are an example of well aerated soils, and the Ragsdale soils are examples of poorly aerated soils.

time

Time, usually a long time, is required by the soil forming processes to form distinct horizons from the parent material. The differences in length of time that the parent materials have been in place are commonly reflected in the degree of development of the soil profile. Some soils develop rapidly; others develop slowly.

The soils in Putnam County range from young to mature. The glacial deposits from which many soils in Putnam County formed have been exposed to soil-forming processes for a long enough period to allow distinct horizons to develop within the soil profile. Some soils—those formed in recent alluvial sediments—have not been in place long enough for distinct horizons to develop.

The Chagrin soils are an example of young soils that formed in alluvial material. The Russell and Xenia soils are examples of older soils. The Xenia soils have been leached of lime to a depth of 36 to 52 inches. Parke soils, which are even older, have been leached of lime to a depth of more than 80 inches.

processes of soil formation

Several processes have been involved in the formation of the soils of this county. These processes are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and other bases; and

the liberation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all the soils. The organic matter content of some soils is low, but that of others is high. Generally, the soils that have the most organic matter, such as Ragsdale or Rensselear soils, have a thick, black surface horizon.

Carbonates and bases have been leached from the upper horizons of nearly all the soils in the county. Leaching is generally believed to precede the translocation of silicate clay minerals. Most of the carbonates and some of the bases have been leached from the A and B horizons of the well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by an acid reaction. Leaching of wet soils is slow because of a high water table or because water moves slowly through such soils.

Clay accumulates in pores and other voids and forms films on the surfaces along which water moves. Leaching of bases and translocation of silicate clays are among the more important processes in the differentiation of horizons in soils. Miami soils are an example of soils in which translocated silicate clays have accumulated as clay films in the B2t horizon.

The reduction and transfer of iron, or gleying, has occurred in all of the very poorly drained and somewhat poorly drained soils of this county. In the naturally wet soils, this process has been significant in horizon differentiation. The gray color of the subsoil indicates the redistribution of iron oxides. The reduction is commonly accompanied by some transfer of the iron, either from upper horizons to lower horizons or completely out of the profile. Mottles, which are in some horizons, indicate segregation of iron.

references

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Indiana State Conservation Needs Committee. 1968. Indiana soil and water conservation needs inventory. 224 pp., illus.

(4) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(5) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(6) Watkins, F.A. Jr., and D.J. Jordan. 1964. Ground-water resources of west-central Indiana, Prelim. report. Putnam County, Indiana. Div. of Water Resour. Bull. 21, 83 pp., illus.

glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

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.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

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.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

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.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

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 all or part of the 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.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage subsurface. Removal of excess ground water through buried drains installed within the soil profile. The drains collect the water and convey it to a gravity or pump outlet.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide 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.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

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 melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

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, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A 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) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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.

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.

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).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

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.

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 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

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-size particles.

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 runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

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.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

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 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A 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.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all the subdivisions of this horizon (A1, A2, and A3).

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. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural

classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

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.

Underlying material. The part of the soil below the solum.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-74 at Greencastle, Ind.]

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days[1]	Average	Less than--	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	35.6	18.0	26.8	64	-11	12	2.68	1.59	3.64	5	6.8
February	40.0	21.1	30.6	66	-6	24	2.28	1.17	3.18	5	7.1
March	49.6	29.6	39.6	80	8	140	3.50	1.93	4.77	7	5.8
April	63.9	41.8	52.9	85	22	387	4.02	2.43	5.44	8	.7
May	74.1	51.2	62.7	91	31	704	4.42	2.71	5.95	8	.0
June	83.5	60.4	72.0	97	44	960	4.77	2.77	6.39	7	.0
July	87.0	63.6	75.3	99	48	1,094	4.08	2.15	5.65	6	.0
August	85.8	61.6	73.7	98	47	1,045	3.43	2.14	4.59	5	.0
September	79.8	54.8	67.3	96	37	819	3.59	1.42	5.34	5	.0
October	68.1	43.9	56.0	88	25	496	2.59	1.14	3.76	5	.1
November	51.2	32.9	42.1	76	11	126	3.23	1.92	4.39	6	2.3
December	39.3	23.2	31.2	68	-5	45	3.14	1.41	4.54	7	6.4
Yearly:											
Average	63.2	41.8	52.5	---	---	---	---	---	---	---	---
Extreme	---	---	---	100	-12	---	---	---	---	---	---
Total	---	---	---	---	---	5,852	41.73	36.71	46.58	74	29.2

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at Greencastle, Ind.]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 10	April 23	May 6
2 years in 10 later than--	April 6	April 19	April 30
5 years in 10 later than--	March 29	April 11	April 20
First freezing temperature in fall:			
1 year in 10 earlier than--	October 27	October 16	October 3
2 years in 10 earlier than--	October 31	October 21	October 8
5 years in 10 earlier than--	November 7	October 30	October 18

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-74 at Greencastle, Ind.]

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	205	181	159
8 years in 10	211	188	166
5 years in 10	223	201	180
2 years in 10	234	214	193
1 year in 10	240	220	200

TABLE 4.--POTENTIAL AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map unit	Percentage of survey area	Cultivated crops	Woodland	Urban uses	Intensive recreation areas	Extensive recreation areas
1. Xenia-Reesville-Fincastle.	19	Fair: slope.	Good	Poor: slope and wetness.	Fair: slope and wetness.	Good.
2. Xenia-Russell	15	Fair: slope.	Good	Fair: slope and wetness.	Fair: slope and wetness.	Good.
3. Chagrin-Shoals	12	Fair: flooding.	Good	Poor: flooding and wetness.	Poor: flooding and wetness.	Poor: flooding and wetness.
4. Haymond-Wakeland	2	Fair: flooding.	Good	Poor: flooding and wetness.	Poor: flooding and wetness.	Poor: flooding and wetness.
5. Reesville-Ragsdale-Fincastle.	11	Good	Fair: wetness.	Poor: wetness.	Poor: wetness.	Poor: wetness.
6. Ava-Cincinnati	14	Fair: slope.	Good	Fair: slope and wetness.	Fair: slope and wetness.	Fair: slope and wetness.
7. Hennepin-Miami-Russell.	10	Poor: slope.	Good	Poor: slope.	Fair: slope.	Fair: slope.
8. Hickory-Chetwynd	8	Poor: slope.	Good	Poor: slope.	Poor: slope.	Poor: slope.
9. Iva-Ava	9	Good	Fair: wetness.	Poor: wetness and slope.	Fair: wetness and slope.	Fair: wetness and slope.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AlB	Alford silt loam, 2 to 6 percent slopes	5,056	1.6
AlC2	Alford silt loam, 6 to 12 percent slopes, eroded	2,025	0.6
AnC	Alvin sandy loam, 6 to 12 percent slopes	612	0.2
AvB	Ava silt loam, 1 to 4 percent slopes	12,558	4.0
AwB2	Ava silt loam, 3 to 6 percent slopes, eroded	2,160	0.7
AwC2	Ava silt loam, 6 to 12 percent slopes, eroded	5,040	1.6
Ba	Bartle silt loam	276	0.1
Bd	Birds silt loam	508	0.2
Ch	Chagrin silt loam	18,432	5.9
CkG	Chetwynd silt loam, 25 to 50 percent slopes	6,104	2.0
CnC2	Cincinnati silt loam, 6 to 12 percent slopes, eroded	3,451	1.1
CnD2	Cincinnati silt loam, 12 to 18 percent slopes, eroded	2,768	0.9
CoG	Corydon silt loam, 25 to 50 percent slopes	887	0.3
ElB	Elkinsville silt loam, 2 to 6 percent slopes	227	0.1
Ev	Evansville silt loam	627	0.2
FdA	Fincastle silt loam, 1 to 3 percent slopes	18,274	5.8
FoB2	Fox loam, 2 to 6 percent slopes, eroded	543	0.2
FxC3	Fox clay loam, 6 to 15 percent slopes, severely eroded	593	0.2
GnE	Gilpin silt loam, 15 to 25 percent slopes	1,532	0.5
GrC2	Grayford silt loam, 6 to 12 percent slopes, eroded	1,119	0.4
GrD2	Grayford silt loam, 12 to 18 percent slopes, eroded	977	0.3
GrE2	Grayford silt loam, 18 to 25 percent slopes, eroded	601	0.2
Hb	Haymond silt loam	1,866	0.6
HeG	Hennepin loam, 25 to 50 percent slopes	18,592	5.9
HoG	Hickory loam, 25 to 70 percent slopes	18,021	5.8
Hv	Hoosierville silt loam	2,004	0.6
IvA	Iva silt loam, 0 to 2 percent slopes	18,147	5.8
McA	Martinsville loam, 0 to 2 percent slopes	400	0.1
McB	Martinsville loam, 2 to 6 percent slopes	527	0.2
MeD2	Miami silt loam, 12 to 18 percent slopes, eroded	2,052	0.7
MgC3	Miami clay loam, 6 to 12 percent slopes, severely eroded	14,986	4.8
MgD3	Miami clay loam, 12 to 18 percent slopes, severely eroded	4,154	1.3
MuB	Muren silt loam, 1 to 4 percent slopes	2,847	0.9
OcA	Ockley silt loam, 0 to 2 percent slopes	600	0.2
OcB2	Ockley silt loam, 2 to 6 percent slopes, eroded	717	0.2
PeB2	Parke silt loam, 2 to 6 percent slopes, eroded	893	0.3
PeC2	Parke silt loam, 6 to 12 percent slopes, eroded	1,205	0.4
Po	Pits, quarries	1,048	0.3
Ra	Ragsdale silt loam	14,145	4.5
ReA	Reesville silt loam, 0 to 2 percent slopes	32,499	10.0
Rn	Rensselaer silt loam	302	0.1
RuB	Russell silt loam, 2 to 6 percent slopes	10,842	3.5
RuC	Russell silt loam, 6 to 12 percent slopes	9,242	3.0
Sh	Shoals silt loam	15,499	5.0
Sm	Shoals-Hennepin complex, 0 to 50 percent slopes	3,449	1.1
Sw	Stonelick sandy loam	4,446	1.4
Ud	Udorthents, loamy	600	0.2
Wa	Wakeland silt loam	1,628	0.5
WeG	Weikert silt loam, 25 to 70 percent slopes	2,102	0.7
Wh	Whitaker silt loam	589	0.2
XeA	Xenia silt loam, 0 to 2 percent slopes	2,009	0.6
XeB2	Xenia silt loam, 2 to 6 percent slopes, eroded	40,871	13.1
	Water	2,948	0.9
	Total	313,600	100.0

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
AlB---- Alford	120	42	48	4.0	8.0
AlC2---- Alford	110	38	44	3.6	7.2
AnC---- Alvin	80	28	36	3.0	6.0
AvB, AwB2---- Ava	100	33	48	4.3	7.1
AwC2---- Ava	95	32	46	4.1	6.9
Ba---- Bartle	110	38	50	3.6	7.2
Bd---- Birds	122	42	52	4.4	8.8
Ch---- Chagrin	115	35	---	4.5	9.0
CkG---- Chetwynd	---	---	---	---	3.2
CnC2---- Cincinnati	90	30	40	4.0	8.0
CnD2---- Cincinnati	80	25	35	3.5	7.0
CoG---- Corydon	---	---	---	---	0.2
ElB---- Elkinsville	120	42	48	4.0	8.0
Ev---- Evansville	145	51	58	4.8	9.6
FdA---- Fincastle	130	46	52	4.3	8.6
FoB2---- Fox	80	27	40	4.0	8.0
FxC3---- Fox	65	20	35	3.5	7.0
GnE---- Gilpin	---	---	---	2.5	5.0
GrC2---- Grayford	105	37	42	3.4	6.8
GrD2---- Grayford	90	32	36	3.0	6.0
GrE2---- Grayford	---	---	---	2.0	4.0

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
Hb---------- Haymond	110	39	42	3.7	8.0
HeG---------- Hennepin	---	---	---	1.2	---
HoG---------- Hickory	---	---	---	---	---
Hv---------- Hoosierville	145	50	58	4.8	9.6
IvA---------- Iva	135	47	54	4.4	8.8
McA---------- Martinsville	120	42	48	4.0	8.0
McB---------- Martinsville	120	42	48	4.0	8.0
MeD2---------- Miami	80	28	36	2.6	5.2
MgC3---------- Miami	75	25	36	2.6	5.2
MgD3---------- Miami	---	---	---	2.5	5.0
MuB---------- Muren	125	44	50	4.1	8.2
OcA---------- Ockley	110	38	44	3.6	7.2
OcB2---------- Ockley	105	37	42	3.4	6.8
PeB2---------- Parke	115	40	46	3.8	7.6
PeC2---------- Parke	105	37	42	3.4	6.8
Po. Pits					
Ra---------- Ragsdale	155	54	62	5.1	10.2
ReA---------- Reesville	140	45	50	4.5	9.0
Rn---------- Rensselaer	150	53	60	5.0	10.0
RuB---------- Russell	120	42	48	4.0	8.0
RuC---------- Russell	110	38	44	3.6	7.2
Sh---------- Shoals	100	40	38	3.0	8.0
Sm---------- Shoals-Hennepin	---	---	---	---	4.8

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
Sw---------- Stonelick	80	28	---	3.5	7.0
Ud. Udorthents					
Wa---------- Wakeland	115	40	46	4.4	8.8
WeG---------- Weikert	---	---	---	---	---
Wh---------- Whitaker	130	46	52	4.3	8.6
XeA---------- Xenia	120	42	48	4.0	8.0
XeB2---------- Xenia	115	40	46	3.8	7.6

* 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.

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
I	3,009	---	---	---
II	200,659	77,241	123,418	---
III	29,652	22,694	6,958	---
IV	21,376	21,376	---	---
V	---	---	---	---
VI	12,391	12,391	---	---
VII	40,637	40,637	---	---
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
AlB, AlC2---------- Alford	1o	Slight	Slight	Slight	Slight	White oak----------	90	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
						Yellow-poplar-------	98	
						Sweetgum----------	76	
AnC---------- Alvin	2o	Slight	Slight	Slight	Slight	White oak----------	80	Green ash, black walnut, yellow-poplar, white oak, eastern white pine, American sycamore, sugar maple.
						Northern red oak----	80	
						Black walnut--------	---	
						Yellow-poplar-------	90	
AvB, AwB2, AwC2---- Ava	2o	Slight	Slight	Slight	Slight	White oak----------	75	Black walnut, eastern cottonwood, sweetgum, yellow-poplar, white oak, American sycamore.
						Northern red oak----	80	
						Yellow-poplar-------	90	
						Black walnut--------	---	
Ba---------- Bartle	3o	Slight	Slight	Slight	Slight	White oak----------	75	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
						Pin oak------------	85	
						Yellow-poplar-------	85	
						Sweetgum----------	80	
Bd---------- Birds	2w	Slight	Severe	Moderate	Slight	Eastern cottonwood--	100	Eastern cottonwood, red maple, American sycamore.
						Pin oak------------	90	
						Sweetgum----------	---	
						American sycamore---	---	
Ch---------- Chagrin	1o	Slight	Slight	Slight	Slight	Northern red oak----	86	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
						Yellow-poplar-------	96	
						Sugar maple---------	86	
						White oak----------	---	
						Black cherry--------	---	
						White ash----------	---	
						Black walnut--------	---	
CkG---------- Chetwynd	1r	Severe	Severe	Slight	Slight	Yellow-poplar-------	99	Eastern white pine, black walnut, yellow-poplar, red pine.
						Northern red oak----	88	
CnC2---------- Cincinnati	2d	Slight	Slight	Moderate	Moderate	Northern red oak----	80	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
						White oak----------	---	
						Black walnut--------	---	
						Black cherry--------	---	
						Sugar maple---------	---	
						White ash----------	---	
						Yellow-poplar-------	---	
CnD2---------- Cincinnati	2d	Moderate	Moderate	Moderate	Moderate	Northern red oak----	80	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
						White oak----------	---	
						Black walnut--------	---	
						Black cherry--------	---	
						Sugar maple---------	---	
						White ash----------	---	
						Yellow-poplar-------	---	
CoG---------- Corydon	3d	Severe	Severe	Severe	Moderate	Northern red oak----	70	Eastern white pine, red pine, Virginia pine, yellow-poplar.
						White oak----------	70	
						Yellow-poplar-------	85	

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	
ElB--- Elkinsville	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
Ev--- Evansville	2w	Slight	Severe	Moderate	Moderate	Pin oak White oak Sweetgum	90 75 90	Eastern white pine, red maple, white ash, sweetgum.
FdA--- Fincastle	3o	Slight	Slight	Slight	Slight	Northern red oak White oak Pin oak Yellow-poplar Sweetgum	75 75 85 85 80	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
FoB2, FxC3--- Fox	2o	Slight	Slight	Slight	Slight	Northern red oak White oak Sugar maple	80 --- ---	Yellow-poplar, white ash, eastern white pine, red pine.
GnE--- Gilpin	2r	Moderate	Moderate	Slight	Slight	Northern red oak Yellow-poplar	80 95	Japanese larch, Virginia pine, eastern white pine, black cherry, yellow-poplar.
GrC2, GrD2--- Grayford	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
GrE2--- Grayford	1r	Moderate	Moderate	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
Hb--- Haymond	1o	Slight	Slight	Slight	Slight	Yellow-poplar White oak Black walnut	100 90 70	Eastern white pine, black walnut, yellow-poplar.
HeG--- Hennepin	1r	Severe	Severe	Slight	Slight	Northern red oak White oak	85 ---	Northern red oak, white oak, green ash, black walnut, eastern white pine, red pine.
HoG--- Hickory	1r	Severe	Severe	Slight	Slight	White oak Northern red oak Black oak Green ash Bitternut hickory Yellow-poplar	85 85 --- --- --- 95	Eastern white pine, red pine, yellow-poplar, sugar maple, white oak, black walnut.
Hv--- Hoosierville	3w	Slight	Severe	Moderate	Moderate	Pin oak White oak Sweetgum	85 70 85	Eastern white pine, red maple, white ash, sweetgum.
IvA--- Iva	2o	Slight	Slight	Slight	Slight	White oak Pin oak Yellow-poplar Sweetgum	75 85 85 80	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.

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	
McA, McB---------- Martinsville	1o	Slight	Slight	Slight	Slight	White oak----------	90	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Yellow-poplar-------	98	
						Sweetgum----------	76	
MeD2, MgC3, MgD3--- Miami	1o	Slight	Slight	Slight	Slight	White oak----------	90	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Yellow-poplar-------	98	
						Sweetgum----------	76	
MuB---------- Muren	1o	Slight	Slight	Slight	Slight	White oak----------	90	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
						Yellow-poplar-------	98	
						Sweetgum----------	76	
OcA, OcB2---------- Ockley	1o	Slight	Slight	Slight	Slight	White oak----------	90	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Northern red oak----	90	
						Yellow-poplar-------	98	
						Sweetgum----------	76	
PeB2, PeC2--------- Parke	1o	Slight	Slight	Slight	Slight	White oak----------	90	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
						Yellow-poplar-------	98	
						Sweetgum----------	76	
Ra---------- Ragsdale	2w	Slight	Severe	Severe	Severe	Pin oak----------	90	Red maple, white ash, sweetgum.
						White oak----------	75	
						Sweetgum----------	90	
ReA---------- Reesville	2o	Slight	Slight	Slight	Slight	Northern red oak----	76	Eastern white pine, white ash, red maple, black cherry, black walnut, red pine, northern red oak.
						Yellow-poplar-------	86	
						Sugar maple---------	90	
						White ash----------	---	
						White oak----------	---	
						Black walnut--------	---	
						Black cherry--------	---	
Rn---------- Rensselaer	2w	Slight	Severe	Severe	Severe	Pin oak----------	86	Red maple, white ash, sweetgum.
						White oak----------	75	
						Sweetgum----------	90	
						Northern red oak----	76	
RuB, RuC---------- Russell	1o	Slight	Slight	Slight	Slight	White oak----------	90	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Northern red oak----	90	
						Yellow-poplar-------	98	
						Sweetgum----------	76	
Sh---------- Shoals	2o	Slight	Slight	Slight	Slight	Pin oak----------	90	Sweetgum, red maple, swamp chestnut oak, pin oak, yellow-poplar.
						Sweetgum----------	86	
						Yellow-poplar-------	90	
						Virginia pine-------	90	
						Eastern cottonwood--	---	
						White ash----------	---	
Sm*:								
Shoals----------	2o	Slight	Slight	Slight	Slight	Pin oak----------	90	Sweetgum, red maple, swamp chestnut oak, pin oak, yellow-poplar.
						Sweetgum----------	86	
						Yellow-poplar-------	90	
						Virginia pine-------	90	
						Eastern cottonwood--	---	
						White ash----------	---	

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	
Sm*:								
Hennepin	1r	Severe	Severe	Slight	Slight	Northern red oak	85	Northern red oak, white oak, green ash, black walnut, eastern white pine, red pine.
						White oak	---	
Sw Stonelick	2o	Slight	Slight	Slight	Slight	Northern red oak	80	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, white oak.
						White oak	---	
						Black walnut	---	
						Black cherry	---	
						Sugar maple	---	
						White ash	---	
						Yellow-poplar	---	
Wa Wakeland	2o	Slight	Slight	Slight	Slight	Pin oak	90	Eastern white pine, American sycamore, red maple, white ash.
						Sweetgum	88	
						Yellow-poplar	90	
						Virginia pine	85	
WeG Weikert	4d	Moderate	Severe	Severe	Moderate	Northern red oak	64	Eastern white pine.
						Virginia pine	60	
Wh Whitaker	3o	Slight	Slight	Slight	Slight	White oak	70	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
						Pin oak	85	
						Yellow-poplar	85	
						Sweetgum	80	
						Northern red oak	75	
XeA, XeB2 Xenia	1o	Slight	Slight	Slight	Slight	White oak	90	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
						Yellow-poplar	98	
						Sweetgum	76	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AlB, AlC2--------- Alford	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Eastern white pine, honeylocust.
AnC--------------- Alvin	Redosier dogwood, arrowwood, gray dogwood.	Silky dogwood, autumn-olive.	Amur maple, eastern redcedar, flowering dogwood.	Eastern white pine, Norway spruce, Douglas-fir.	Eastern cottonwood.
AvB, AwB2, AwC2--- Ava	Redosier dogwood, gray dogwood, arrowwood.	Silky dogwood, autumn-olive.	Amur maple, eastern redcedar, flowering dogwood.	Eastern white pine, Norway spruce, Douglas-fir.	Eastern cottonwood.
Ba---------------- Bartle	Cutleaf staghorn sumac.	Blackhaw, arrowwood, cornelian cherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.
Bo---------------- Birds	Gray dogwood, arrowwood, redosier dogwood.	Silky dogwood, forsythia.	Amur maple, baldcypress.	Pin oak, green ash	American sycamore, eastern cottonwood, red maple.
Ch---------------- Chagrin	---	Winged euonymus, autumn-olive, forsythia, Tatarian honeysuckle, nannyberry viburnum.	Norway spruce, Scotch pine, red pine.	Eastern white pine, Austrian pine.	---
CkG--------------- Chetwynd	---	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Honeylocust, eastern white pine.
CnC2, CnD2-------- Cincinnati	---	Winged euonymus, autumn-olive, Tatarian honeysuckle, nannyberry viburnum, forsythia.	Norway spruce, Scotch pine, red pine.	Austrian pine, eastern white pine.	---
CoG. Corydon					

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
ElB---------- Elkinsville	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Honeylocust, eastern white pine.
Ev---------- Evansville	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
FdA---------- Fincastle	Cutleaf staghorn sumac.	Blackhaw, arrowwood, cornelian cherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.
FoB2, FxC3-------- Fox	---	Autumn-olive, Amur honeysuckle, blackhaw, shadblow serviceberry, American cranberrybush, cornelian cherry dogwood.	---	Norway spruce, white spruce, American basswood.	Eastern white pine.
GnE---------- Gilpin	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	---	Honeylocust, eastern white pine, Norway spruce.
GrC2, GrD2, GrE2-- Grayford	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Eastern white pine, honeylocust.
Hb---------- Haymond	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Eastern white pine, Norway spruce, honeylocust.	---
HeG. Hennepin					

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
HoG. Hickory					
Hv---------- Hoosierville	Gray dogwood, dwarf purple willow.	Medium purple willow, Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow.	---	Lombardy poplar.
IvA---------- Iva	Cutleaf staghorn sumac.	Blackhaw, arrowwood, cornelian cherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.
McA, McB---------- Martinsville	Mockorange---------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Eastern white pine, honeylocust.
MeD2, MgC3, MgD3-- Miami	---	Blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, winged euonymus, American cranberrybush, autumn-olive.	Eastern hemlock, European burningbush.	Norway spruce-----	Eastern white pine, honeylocust.
MuB---------- Muren	Mockorange---------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Eastern white pine, honeylocust.
OcA, OcB2--------- Ockley	Mockorange---------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Eastern white pine, honeylocust.
PeB2, PeC2-------- Parke	Mockorange---------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Eastern white pine, honeylocust.

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
Po*. Pits					
Ra---------- Ragsdale	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
ReA---------- Reesville	Cutleaf staghorn sumac.	Blackhaw, arrowwood, cornelian cherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.
Rn---------- Rensselaer	Gray dogwood, dwarf purple willow.	Redosier dogwood, Amur honeysuckle, silky dogwood.	Northern white-cedar, medium purple willow, tall purple willow.	---	Lombardy poplar.
RuB, RuC---------- Russell	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Eastern white pine, honeylocust.
Sh---------- Shoals	Gray dogwood, dwarf purple willow.	Redosier dogwood, silky dogwood, Amur honeysuckle.	Northern white-cedar, medium purple willow, tall purple willow.	---	Lombardy poplar.
Sm*: Shoals----------	Gray dogwood, dwarf purple willow.	Redosier dogwood, silky dogwood, Amur honeysuckle.	Northern white-cedar, medium purple willow, tall purple willow.	---	Lombardy poplar.
Hennepin.					
Sw---------- Stonelick	Tatarian honeysuckle, Amur honeysuckle, wayfaringtree, winged euonymus.	Scotch pine, nannyberry viburnum, autumn-olive.	Austrian pine, eastern redcedar, red pine.	Eastern white pine	---
Ud*. Udorthents					
Wa---------- Wakeland	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
WeG---------- Weikert	American hazel, flowering quince.	Blackhaw, cutleaf staghorn sumac, forsythia, autumn-olive.	Jack pine, Austrian pine, Russian-olive.	Virginia pine, red pine, scarlet 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
Wh---------- Whitaker	---	Autumn-olive, Amur honeysuckle, American cranberrybush, blackhaw, shadblow serviceberry, arrowwood, cornelian cherry dogwood, rose-of-sharon.	---	Norway spruce, white spruce, American basswood.	Eastern white pine.
XeA, XeB2--------- Xenia	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Eastern white pine, honeylocust.

* 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
AlB---- Alford	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
AlC2---- Alford	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
AnC---- Alvin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
AvB, AwB2---- Ava	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Severe: erodes easily.	Slight.
AwC2---- Ava	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
Ba---- Bartle	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
Bd---- Birds	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, erodes easily.	Severe: wetness, floods.
Ch---- Chagrin	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
CkG---- Chetwynd	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CnC2---- Cincinnati	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
CnD2---- Cincinnati	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
CoG---- Corydon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, thin layer.
ElB---- Elkinsville	Severe: floods.	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
Ev---- Evansville	Severe: floods, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, erodes easily.	Severe: ponding.
FdA---- Fincastle	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
FoB2---- Fox	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
FxC3---- Fox	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
GnE---- Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
GrC2---- Grayford	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
GrD2, GrE2---------- Grayford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Hb---------- Haymond	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
HeG---------- Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HoG---------- Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Hv---------- Hoosierville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
IvA---------- Iva	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
McA---------- Martinsville	Slight----------	Slight----------	Slight----------	Severe: erodes easily.	Slight.
McB---------- Martinsville	Slight----------	Slight----------	Moderate: slope.	Severe: erodes easily.	Slight.
MeD2---------- Miami	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
MgC3---------- Miami	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
MgD3---------- Miami	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
MuB---------- Muren	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
OcA---------- Ockley	Slight----------	Slight----------	Slight----------	Severe: erodes easily.	Slight.
OcB2---------- Ockley	Slight----------	Slight----------	Moderate: slope.	Severe: erodes easily.	Slight.
PeB2---------- Parke	Slight----------	Slight----------	Moderate: slope.	Severe: erodes easily.	Slight.
PeC2---------- Parke	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Po*. Pits					
Ra---------- Ragsdale	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
ReA---------- Reesville	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
Rn---------- Rensselaer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
RuB---------- Russell	Slight----------	Slight----------	Moderate: slope.	Severe: erodes easily.	Slight.

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
RuC---------- Russell	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Sh---------- Shoals	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods.
Sm*: Shoals----------	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods.
Hennepin----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sw---------- Stonelick	Severe: floods.	Moderate: floods, small stones.	Severe: small stones, floods.	Moderate: floods.	Severe: floods.
Ud*. Udorthents					
Wa---------- Wakeland	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Moderate: floods, wetness.	Severe: floods.
WeG---------- Weikert	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, depth to rock, small stones.	Severe: slope.	Severe: slope, thin layer, small stones.
Wh---------- Whitaker	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
XeA---------- Xenia	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: erodes easily.	Slight.
XeB2---------- Xenia	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AlB---- Alford	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AlC2---- Alford	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AnC---- Alvin	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AvB, AwB2, AwC2---- Ava	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ba---- Bartle	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Bd---- Birds	Good	Fair	Good	Good	Fair	Good	Good	Good	Good	Good.
Ch---- Chagrin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CkG---- Chetwyrd	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CnC2---- Cincinnati	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CnD2---- Cincinnati	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CoG---- Corydon	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
ElB---- Elkinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ev---- Evansville	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
FdA---- Fincastle	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
FoB2, FxC3---- Fox	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
GnE---- Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
GrC2---- Grayford	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
GrD2, GrE2---- Grayford	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Hb---- Haymond	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
HeG---- Hennepin	Very poor.	Poor	Good	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
HoG---- Hickory	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	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
Hv---- Hoosierville	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
IvA---- Iva	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
McA, McB---- Martinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MeD2---- Miami	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MgC3---- Miami	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MgD3---- Miami	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MuB---- Muren	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
OcA, OcB2---- Ockley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PeB2---- Parke	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PeC2---- Parke	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Po*. Pits										
Ra---- Ragsdale	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Poor.
ReA---- Reesville	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Rn---- Rensselaer	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
RuB---- Russell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RuC---- Russell	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.
Sm*: Shoals----	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
Hennepin----	Very poor.	Poor	Good	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
Sw---- Stonelick	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Ud*. Udorthents										
Wa---- Wakeland	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
WeG---- Weikert	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Wh---- Whitaker	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
XeA, XeB2---- Xenia	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	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]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AlB---- Alford	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
AlC2---- Alford	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
AnC---- Alvin	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
AvB, AwB2---- Ava	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.
AwC2---- Ava	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Ba---- Bartle	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Bd---- Birds	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: wetness, floods.
Ch---- Chagrin	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
CkG---- Chetwynd	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CnC2---- Cincinnati	Moderate: dense layer, wetness, slope.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
CnD2---- Cincinnati	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
CoG---- Corydon	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, low strength, slope.	Severe: slope, thin layer.
ElB---- Elkinsville	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, frost action.	Slight.
Ev---- Evansville	Severe: ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
FdA---- Fincastle	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
FoB2---- Fox	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Slight.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
FxC3---------- Fox	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: slope.
GnE---------- Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
GrC2---------- Grayford	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
GrD2, GrE2-------- Grayford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
Hb---------- Haymond	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Severe: floods.
HeG---------- Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HoG---------- Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Hv---------- Hoosierville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action, low strength.	Severe: wetness.
IvA---------- Iva	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
McA---------- Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
McB---------- Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.	Slight.
MeD2---------- Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MgC3---------- Miami	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, low strength.	Moderate: slope.
MgD3---------- Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MuB---------- Muren	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
OcA---------- Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
OcB2---------- Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
PeB2---------- Parke	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
PeC2--Parke	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Po*. Pits						
Ra--Ragsdale	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
ReA--Reesville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Rn--Rensselaer	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
RuB--Russell	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
RuC--Russell	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Sh--Shoals	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.	Severe: floods.
Sm*: Shoals	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods frost action.	Severe: floods.
Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sw--Stonelick	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Ud*. Udorthents						
Wa--Wakeland	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.	Severe: floods.
WeG--Weikert	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope, thin layer, small stones.
Wh--Whitaker	Severe: cutbanks cave, wetness.	Severe: wetness	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
XeA--Xenia	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
XeB2--Xenia	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AlB Alford	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
AlC2 Alford	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
AnC Alvin	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope, thin layer.
AvB, AwB2 Ava	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
AwC2 Ava	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
Ba Bartle	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Bd Birds	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Ch Chagrin	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Good.
CkG Chetwynd	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: slope.
CnC2 Cincinnati	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
CnD2 Cincinnati	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
CoG Corydon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
ElB Elkinsville	Slight	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
Ev Evansville	Severe: ponding.	Severe: floods, ponding.	Severe: ponding.	Severe: ponding.	Poor: hard to pack, ponding.
FdA Fincastle	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
FoB2---------- Fox	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
FxC3---------- Fox	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
GnE---------- Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
GrC2---------- Grayford	Moderate: slope, percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
GrD2, GrE2---------- Grayford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Hb---------- Haymond	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
HeG---------- Hennepin	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
HoG---------- Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Hv---------- Hoosierville	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness, hard to pack.
IvA---------- Iva	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
McA---------- Martinsville	Slight----------	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey, thin layer.
McB---------- Martinsville	Slight----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey, thin layer.
MeD2---------- Miami	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
MgC3---------- Miami	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
MgD3---------- Miami	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
MuB---------- Muren	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
OcA, OcB2---------- Ockley	Slight----------	Severe: seepage.	Severe: seepage.	Slight----------	Poor: small stones.
PeB2---------- Parke	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Good.

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
PeC2---------- Parke	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Po*. Pits					
Ra---------- Ragsdale	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
ReA---------- Reesville	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Rn---------- Rensselaer	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too sandy.	Severe: ponding.	Poor: too sandy, ponding.
RuB---------- Russell	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
RuC---------- Russell	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Sh---------- Shoals	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Sm*: Shoals----------	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Hennepin----------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Sw---------- Stonelick	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Poor: seepage.
Ud*. Udorthents					
Wa---------- Wakeland	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
WeG---------- Weikert	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage, depth to rock.	Poor: slope, area reclaim, seepage.
Wh---------- Whitaker	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
XeA, XeB2---------- Xenia	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AlB Alford	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
AlC2 Alford	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
AnC Alvin	Good	Probable	Improbable: too sandy.	Fair: slope.
AvB, AwB2 Ava	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
AwC2 Ava	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Ba Bartle	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Bd Birds	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ch Chagrin	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
CkG Chetwynd	Poor: slope.	Probable	Probable	Poor: slope.
CnC2 Cincinnati	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
CnD2 Cincinnati	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
CoG Corydon	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
ElB Elkinsville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Ev Evansville	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
FdA Fincastle	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
FoB2, FxC3 Fox	Good	Probable	Probable	Poor: small stones, area reclaim.
GnE Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
GrC2 Grayford	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
GrD2, GrE2 Grayford	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Hb---------- Haymond	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
HeG---------- Hennepin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
HoG---------- Hickory	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Hv---------- Hoosierville	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
IvA---------- Iva	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
McA, McB---------- Martinsville	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
MeD2---------- Miami	Fair: slope, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
MgC3---------- Miami	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
MgD3---------- Miami	Fair: slope, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
MuB---------- Muren	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
OcA, OcB2---------- Ockley	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
PeB2---------- Parke	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
PeC2---------- Parke	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Po*. Pits				
Ra---------- Ragsdale	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
ReA---------- Reesville	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Rn---------- Rensselaer	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
RuB---------- Russell	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
RuC---------- Russell	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Sh---------- Shoals	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Sm*: Shoals----------	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hennepin----------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Sw---------- Stonelick	Good----------	Probable----------	Improbable: too sandy.	Poor: small stones.
Ud*. Udorthents				
Wa---------- Wakeland	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
WeG---------- Weikert	Poor: slope, area reclaim.	Improbable: small stones.	Improbable: thin layer	Poor: slope, small stones, area reclaim.
Wh---------- Whitaker	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
XeA, XeB2---------- Xenia	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
AlB---- Alford	Moderate: seepage, slope.	Slight----	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
AlC2---- Alford	Severe: slope.	Slight----	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
AnC---- Alvin	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
AvB, AwB2---- Ava	Moderate: slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
AwC2---- Ava	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
Ba---- Bartle	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
Bd---- Birds	Slight----	Severe: wetness.	Severe: slow refill.	Floods, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Ch---- Chagrin	Moderate: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Favorable----	Favorable.
CkG---- Chetwynd	Severe: slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope----	Slope.
CnC2, CnD2---- Cincinnati	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily, rooting depth.	Slope, erodes easily, rooting depth.
CoG---- Corydon	Severe: depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
ElB---- Elkinsville	Moderate: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Ev---- Evansville	Moderate: seepage.	Severe: ponding.	Moderate: slow refill.	Ponding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
FdA---- Fincastle	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
FoB2---- Fox	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy----	Rooting depth.
FxC3---- Fox	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, too sandy.	Slope, rooting depth.
GnE---- Gilpin	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
GrC2, GrD2, GrE2-- Grayford	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Hb---- Haymond	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.

TABLE 15.--WATER MANAGEMENT--Continued

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
HeG---------- Hennepin	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, droughty, percs slowly.
HoG---------- Hickory	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Hv---------- Hoosierville	Slight---------	Severe: wetness.	Severe: slow refill.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
IvA---------- Iva	Moderate: seepage.	Severe: thin layer, wetness.	Severe: slow refill.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
McA---------- Martinsville	Moderate: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
McB---------- Martinsville	Moderate: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
MeD2, MgC3, MgD3-- Miami	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
MuB---------- Muren	Moderate: seepage, slope.	Moderate: thin layer, wetness.	Severe: slow refill.	Deep to water	Erodes easily	Erodes easily.
OcA---------- Ockley	Moderate: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
OcB2---------- Ockley	Moderate: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
PeB2---------- Parke	Moderate: seepage, slope.	Slight---------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
PeC2---------- Parke	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Po*. Pits						
Ra---------- Ragsdale	Slight---------	Severe: thin layer, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Wetness, percs slowly.
ReA---------- Reesville	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
Rn---------- Rensselaer	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, percs slowly, frost action.	Ponding, too sandy.	Wetness, percs slowly.
RuB---------- Russell	Moderate: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
RuC---------- Russell	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Sh---------- Shoals	Moderate: seepage.	Severe: wetness, piping.	Moderate: slow refill.	Floods, frost action.	Erodes easily, wetness.	Wetness, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Sm*:						
Shoals	Moderate: seepage.	Severe: wetness, piping.	Moderate: slow refill.	Floods, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Hennepin	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, droughty, percs slowly.
Sw	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
Stonelick						
Ud*.						
Udorthents						
Wa	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Floods, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Wakeland						
WeG	Severe: depth to rock, slope, seepage.	Severe: seepage, thin layer.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, droughty.
Weikert						
Wh	Moderate: seepage.	Severe: wetness.	Moderate: slow refill, cutbanks cave.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
Whitaker						
XeA	Moderate: seepage.	Moderate: thin layer, wetness.	Severe: slow refill.	Frost action---	Erodes easily, wetness.	Erodes easily.
Xenia						
XeB2	Moderate: seepage, slope.	Moderate: thin layer, wetness.	Severe: slow refill.	Frost action, slope.	Erodes easily, wetness.	Erodes easily.
Xenia						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AlB, AlC2-------- Alford	0-9	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	9-58	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	58-80	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
AnC-------------- Alvin	0-10	Sandy loam, fine sandy loam.	SM, ML	A-4, A-2	0	100	100	80-95	30-60	<25	NP-4
	10-41	Very fine sandy loam, sandy loam, sandy clay loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	100	100	90-100	20-80	15-38	NP-13
	41-60	Stratified sandy loam to fine sand.	SM, SP, SP-SM	A-2, A-3	0-5	95-100	90-100	70-95	4-35	<20	NP-4
AvB, AwB2, AwC2-- Ava	0-8	Silt loam---------	CL	A-6, A-4	0	100	95-100	95-100	85-100	25-40	9-17
	8-22	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	95-100	30-45	15-25
	22-80	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	30-50	15-30
Ba--------------- Bartle	0-10	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-90	20-35	5-15
	10-28	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	28-59	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
	59-70	Silty clay loam, sandy loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
Bd--------------- Birds	0-10	Silt loam---------	CL	A-4, A-6	0	100	95-100	90-100	80-100	24-34	8-15
	10-60	Silt loam, silty clay loam.	CL	A-4, A-6	0	100	95-100	90-100	80-100	24-34	8-15
Ch--------------- Chagrin	0-10	Silt loam---------	ML, CL, CL-ML	A-4	0	95-100	85-100	80-100	70-90	20-35	2-10
	10-52	Silt loam, loam, sandy loam.	ML, SM	A-4, A-2, A-6	0	90-100	75-100	55-90	30-80	20-40	NP-14
	52-60	Stratified silt loam to fine sand.	ML, SM	A-4, A-2	0	85-100	75-100	50-85	15-80	20-40	NP-10
CkG-------------- Chetwynd	0-12	Silt loam, loam	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	60-95	22-33	4-12
	12-40	Clay loam, sandy clay loam, loam.	SC, CL	A-4, A-6	0	90-100	85-100	70-95	40-75	20-35	8-18
	40-48	Sandy loam, loam, gravelly sandy clay loam.	SM-SC, SC, CL-ML, CL	A-2-4, A-2-6, A-4, A-6	0	70-95	65-95	60-90	30-65	20-32	5-15
	48-70	Stratified sand to sandy loam.	SW-SM, SM, SP-SM	A-2, A-1, A-3, A-4	0	70-95	65-95	35-65	6-38	---	NP
CnC2, CnD2------- Cincinnati	0-11	Silt loam---------	ML, CL	A-4, A-6	0	100	100	90-100	80-100	25-40	3-16
	11-29	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-100	26-40	8-15
	29-54	Clay loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	25-40	6-20
	54-80	Clay loam, loam	CL, ML, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	25-40	5-20
CoG-------------- Corydon	0-6	Silt loam---------	CL, CL-ML	A-4, A-6	0-2	85-95	85-95	75-95	60-85	25-35	5-15
	6-13	Silty clay loam, clay, silty clay.	CL, CH	A-6, A-7	0-2	85-95	85-95	80-95	70-90	35-60	20-35
	13	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

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	
ElB---------- Elkinsville	0-13	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-15
	13-59	Silty clay loam, silt loam.	CL	A-6, A-4	0	100	100	85-100	65-90	30-40	8-18
	59-70	Stratified silty clay loam to sandy loam.	CL, CL-ML, ML, SM	A-4, A-6	0	100	100	70-100	45-80	<30	NP-15
Ev---------- Evansville	0-10	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-98	25-40	3-15
	10-48	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-98	35-55	20-35
	48-60	Stratified silt loam to silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-98	30-45	10-25
FdA---------- Fincastle	0-14	Silt loam--------	CL, ML	A-4, A-6	0	100	95-100	90-100	75-93	27-36	4-12
	14-28	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	38-54	20-32
	28-44	Clay loam, loam, silty clay loam.	CH, CL	A-7	0	95-100	90-98	85-95	75-85	45-58	30-38
	44-60	Loam, clay loam	CL, ML, CL-ML	A-4, A-6	0-3	88-96	82-90	70-86	50-66	20-35	3-12
FoB2---------- Fox	0-11	Loam----------	ML, CL, CL-ML	A-4	0	95-100	85-100	75-95	55-90	20-30	3-10
	11-26	Silty clay loam, silt loam, clay loam.	CL	A-6, A-7	0	85-100	70-100	70-95	55-90	25-50	10-25
	26-38	Clay loam, loam, sandy clay loam.	CL, SC	A-2, A-6, A-7	0-5	85-100	70-95	50-95	20-65	25-45	10-25
	38-60	Stratified sand to gravel.	SP, SM, GP, GM	A-1, A-2, A-3	0-10	40-100	35-100	15-95	2-20	---	NP
FxC3---------- Fox	0-7	Clay loam--------	CL	A-6	0	90-100	75-100	75-95	60-80	20-40	10-20
	7-26	Silty clay loam, silt loam, clay loam.	CL	A-6, A-7	0	85-100	70-100	70-95	55-90	25-50	10-25
	26-60	Stratified sand to gravel.	SP, SM, GP, GM	A-1, A-2, A-3	0-10	40-100	35-100	15-95	2-20	---	NP
GnE---------- Gilpin	0-8	Silt loam, loam	ML, CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	8-32	Channery loam, loam, silty clay loam.	SM, ML, CL, SC	A-4, A-6	0-5	65-95	60-90	55-85	40-80	20-40	4-15
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
GrC2, GrD2, GrE2- Grayford	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	8-24	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	95-100	85-95	35-50	20-30
	24-51	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0-5	95-100	85-100	75-100	60-95	35-50	20-30
	51-80	Clay, silty clay	CH	A-7	0-5	90-100	80-100	75-100	60-95	50-70	30-45
	80	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Hb---------- Haymond	0-7	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	7-47	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	47-60	Fine sandy loam, silt loam, loam.	ML, SM	A-4	0	95-100	90-100	80-100	35-90	27-36	4-10
HeG---------- Hennepin	0-4	Loam----------	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	70-100	60-95	25-40	5-20
	4-15	Loam, sandy loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25
	15-60	Loam, sandy loam, clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25
HoG---------- Hickory	0-16	Loam----------	CL	A-6, A-4	0-5	95-100	90-100	90-100	85-95	20-35	8-15
	16-52	Clay loam--------	CL	A-6, A-7	0-5	100	90-100	80-95	75-90	30-50	15-30
	52-60	Clay loam, sandy loam, loam.	CL-ML, CL	A-4, A-6	0-5	85-100	85-95	80-95	60-80	20-40	5-20

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	
Hv Hoosierville	0-8	Silt loam	CL	A-4, A-6	0	100	100	90-100	70-90	27-36	8-15
	8-13	Silt loam	CL	A-4, A-6	0	100	100	90-100	80-90	27-36	8-15
	13-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	90-100	85-95	38-54	20-32
	60-70	Silt loam	CL	A-4, A-6	0	100	100	90-100	70-90	27-36	8-15
IvA Iva	0-13	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	13-44	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	35-50	15-30
	44-60	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
McA, McB Martinsville	0-8	Loam	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-90	22-33	4-12
	8-28	Clay loam, loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	90-100	65-90	40-90	20-35	8-20
	28-70	Sandy loam, sandy clay loam, loam.	SM, ML	A-2-4, A-4	0	100	90-100	60-80	30-60	30-40	2-8
	70-80	Stratified sand to sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4	0	95-100	85-100	80-95	40-60	<25	4-9
MeD2 Miami	0-7	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-90	22-34	6-15
	7-32	Clay loam, silty clay loam, sandy clay loam.	CL	A-6, A-7	0	92-99	89-97	78-95	64-95	35-50	17-31
	32-60	Loam, clay loam, sandy loam.	CL, CL-ML, ML	A-4, A-6	0-3	88-94	83-89	74-87	50-64	20-40	2-20
MgC3, MgD3 Miami	0-4	Clay loam	CL	A-6, A-7	0	100	90-100	75-95	65-95	30-45	15-25
	4-32	Clay loam, silty clay loam, sandy clay loam.	CL	A-6, A-7	0	92-99	89-97	78-95	64-95	35-50	17-31
	32-60	Loam, clay loam, sandy loam.	CL, CL-ML, ML	A-4, A-6	0-3	88-94	83-89	74-87	50-64	20-40	2-20
MuB Muren	0-12	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	12-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-95	35-50	15-30
	60-70	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
OcA, OcB2 Ockley	0-8	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	3-12
	8-32	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	75-100	65-90	50-90	35-50	15-30
	32-52	Gravelly clay loam, gravelly sandy clay loam.	CL, SC, GC	A-6, A-7	0-2	70-85	45-75	40-70	35-55	30-50	15-30
	52-60	Stratified sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	5-20	2-10	---	NP
PeB2, PeC2 Parke	0-8	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	8-45	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	90-100	80-100	25-45	10-25
	45-60	Sandy clay loam, loam.	SC	A-2, A-6	0-3	90-100	85-95	75-90	30-50	25-35	10-15
Po*. Pits											
Ra Ragsdale	0-9	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	9-50	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-95	35-50	15-30
	50-80	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15

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	
ReA---------- Reesville	0-9	Silt loam--------	ML, CL-ML	A-4	0	100	90-100	90-100	85-100	24-36	4-10
	9-33	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	100	90-100	90-100	90-100	22-50	4-28
	33-60	Loam, silt loam	ML, CL, CL-ML	A-4, A-6	0	90-100	85-95	80-90	70-90	20-40	3-18
Rn---------- Rensselaer	0-8	Silt loam--------	CL, ML	A-4, A-6	0	100	100	90-100	70-90	27-36	4-12
	8-36	Clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	90-100	80-100	60-80	33-47	15-26
	36-45	Sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	75-95	35-55	25-35	11-16
	45-60	Stratified fine sand to clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-2	0	95-100	90-100	60-95	20-70	<30	4-9
RuB, RuC---------- Russell	0-13	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-90	20-35	5-15
	13-28	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	20-35
	28-53	Clay loam, loam	CL	A-6, A-7	0	90-100	90-95	80-90	65-75	35-50	17-31
	53-60	Loam, clay loam	CL, ML, CL-ML	A-4, A-6	0-3	85-95	80-90	75-85	50-65	<30	2-14
Sh---------- Shoals	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	22-36	6-15
	8-25	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-85	25-40	4-15
	25-60	Stratified silt loam to sandy loam.	ML	A-4	0-3	90-100	85-100	60-80	50-70	32-40	3-8
Sm*:											
Shoals----------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	22-36	6-15
	8-25	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-85	25-40	4-15
	25-60	Stratified silt loam to sandy loam.	ML	A-4	0-3	90-100	85-100	60-80	50-70	32-40	3-8
Hennepin--------	0-4	Loam----------	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	70-100	60-95	25-40	5-20
	4-15	Loam, sandy loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25
	15-60	Loam, sandy loam, clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25
Sw---------- Stonelick	0-10	Sandy loam-------	SM, ML, SM-SC, CL-ML	A-4, A-2	0	85-100	70-100	45-75	25-55	<24	NP-6
	10-60	Stratified loam to loamy sand.	SM, SP-SM	A-2, A-4, A-3, A-1-B	0	85-100	70-95	40-60	5-40	<15	NP
Ud*. Udorthents											
Wa---------- Wakeland	0-10	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	10-60	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
WeG---------- Weikert	0-2	Silt loam--------	GM, ML, SM	A-1, A-2, A-4	0-10	35-70	35-70	25-65	20-55	30-40	4-10
	2-16	Channery loam----	GM, GP-GM	A-1, A-2	0-20	15-60	10-55	5-45	5-35	28-36	3-9
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wh---------- Whitaker	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	4-12
	10-46	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-80	30-47	12-26
	46-60	Stratified coarse sand to clay.	CL, SC, ML, SM	A-4	0	98-100	98-100	60-85	40-60	15-25	3-9

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	
XeA, XeB2-------- Xenia	0-10	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	10-30	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-95	35-50	15-30
	30-50	Clay loam---------	CL	A-6, A-7	0-5	92-100	90-95	75-95	65-75	35-50	15-30
	50-60	Loam-------------	CL, ML, SC, SM	A-4, A-6	0-5	85-95	80-90	75-90	40-65	15-30	NP-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
AlB, AlC2--------	0-9	18-27	1.25-1.40	0.6-2.0	0.22-0.24	3.6-7.3	Low----------	0.37	5	5	.5-2
Alford	9-58	22-30	1.35-1.50	0.6-2.0	0.18-0.20	3.6-6.0	Moderate-----	0.37			
	58-80	8-20	1.30-1.45	0.6-2.0	0.20-0.22	4.5-7.3	Low----------	0.37			
AnC---------------	0-10	10-15	1.45-1.65	2.0-6.0	0.14-0.20	5.1-6.5	Low----------	0.24	5	3	.5-1
Alvin	10-41	15-18	1.45-1.65	0.6-6.0	0.12-0.20	4.5-6.0	Low----------	0.24			
	41-60	3-10	1.55-1.75	6.0-20	0.05-0.13	5.1-7.8	Low----------	0.24			
AvB, AwB2, AwC2--	0-8	20-27	1.40-1.60	0.6-2.0	0.22-0.24	3.6-6.5	Moderate-----	0.43	4	6	1-3
Ava	8-22	22-35	1.40-1.60	0.2-0.6	0.18-0.20	3.6-5.5	Moderate-----	0.43			
	22-80	25-35	1.60-1.75	0.06-0.2	0.09-0.10	3.6-5.5	Moderate-----	0.43			
Ba----------------	0-10	15-26	1.30-1.45	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.43	4	5	1-3
Bartle	10-28	22-35	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	Low----------	0.43			
	28-59	22-35	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low----------	0.43			
	59-70	22-35	1.40-1.60	0.2-0.6	0.15-0.18	5.1-7.3	Low----------	0.43			
Bd----------------	0-10	15-25	1.20-1.40	0.2-0.6	0.22-0.24	5.6-7.8	Low----------	0.43	5	6	1-3
Birds	10-60	18-27	1.40-1.60	0.2-0.6	0.20-0.22	5.1-7.8	Low----------	0.43			
Ch----------------	0-10	10-27	1.20-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	5	5	2-4
Chagrin	10-52	18-30	1.20-1.50	0.6-2.0	0.14-0.20	5.6-7.3	Low----------	0.32			
	52-60	5-25	1.20-1.40	0.6-2.0	0.08-0.20	5.6-7.3	Low----------	0.32			
CkG---------------	0-12	12-24	1.30-1.50	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	5	5	1-3
Chetwynd	12-40	18-25	1.40-1.60	0.6-2.0	0.13-0.17	4.5-5.5	Moderate-----	0.32			
	40-48	18-25	1.35-1.60	0.6-2.0	0.11-0.17	4.5-6.0	Low----------	0.32			
	48-70	3-10	1.40-1.60	2.0-6.0	0.12-0.19	5.1-6.0	Low----------	0.15			
CnC2, CnD2-------	0-11	15-25	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	4	6	1-3
Cincinnati	11-29	22-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Low----------	0.37			
	29-54	24-35	1.60-1.85	0.06-0.6	0.08-0.12	4.5-6.5	Moderate-----	0.37			
	54-80	24-40	1.55-1.75	0.06-0.6	0.08-0.12	4.5-6.5	Moderate-----	0.37			
CoG---------------	0-6	20-27	1.25-1.40	0.6-2.0	0.20-0.22	6.1-7.8	Low----------	0.32	2	6	2-4
Corydon	6-13	35-50	1.35-1.60	0.2-0.6	0.11-0.20	5.6-7.8	Moderate-----	0.32			
	13	---	---	---	---	---	-------------	----			
ElB---------------	0-13	15-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	5	.5-2
Elkinsville	13-59	22-30	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.0	Moderate-----	0.37			
	59-70	20-34	1.40-1.60	0.6-2.0	0.17-0.21	4.5-6.0	Low----------	0.37			
Ev----------------	0-10	20-26	1.30-1.45	0.6-2.0	0.20-0.24	6.1-7.3	Low----------	0.37	5	5	1-3
Evansville	10-48	25-34	1.40-1.55	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.37			
	48-60	25-34	1.40-1.55	0.6-2.0	0.19-0.21	6.6-8.4	Low----------	0.37			
FdA---------------	0-14	11-22	1.40-1.55	0.6-2.0	0.22-0.24	5.1-6.5	Low----------	0.37	5	5	1-3
Fincastle	14-28	20-35	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.37			
	28-44	20-35	1.45-1.65	0.2-0.6	0.15-0.19	5.1-7.3	Moderate-----	0.37			
	44-60	20-30	1.55-1.90	0.06-2.0	0.05-0.19	7.4-8.4	Low----------	0.37			
FoB2--------------	0-11	10-17	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.32	4	5	1-3
Fox	11-26	25-35	1.55-1.65	0.6-2.0	0.15-0.22	5.1-7.3	Moderate-----	0.32			
	26-38	25-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	Moderate-----	0.32			
	38-60	0-2	1.30-2.20	>6.0	0.02-0.04	7.4-8.4	Low----------	0.10			
FxC3--------------	0-7	27-35	1.55-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Moderate-----	0.32	3	6	.5-2
Fox	7-26	25-35	1.55-1.65	0.6-2.0	0.15-0.22	5.1-7.3	Moderate-----	0.32			
	26-60	0-2	1.30-2.20	>6.0	0.02-0.04	7.4-8.4	Low----------	0.10			
GnE---------------	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.32	3	---	1-4
Gilpin	8-32	18-35	1.20-1.50	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.28			
	32	---	---	---	---	---	-------------	----			

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		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm³	In/hr	In/in	pH					Pct
GrC2, GrD2, GrE2--	0-8	17-27	1.25-1.40	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.37	5	5	.5-2
Grayford	8-24	25-35	1.35-1.50	0.6-2.0	0.18-0.20	4.5-5.5	Moderate	0.37			
	24-51	25-35	1.40-1.60	0.6-2.0	0.16-0.20	4.5-5.5	Moderate	0.37			
	51-80	45-60	1.40-1.60	0.06-0.2	0.09-0.11	5.6-7.3	High	0.37			
	80	---	---	---	---	---	---	---			
Hb	0-7	10-18	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.37	5	5	1-3
Haymond	7-47	10-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.37			
	47-60	10-18	1.30-1.45	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.37			
HeG	0-4	20-30	1.20-1.40	0.6-2.0	0.18-0.24	6.1-7.8	Low	0.32	4	5	1-2
Hennepin	4-15	18-30	1.30-1.60	0.6-2.0	0.14-0.22	6.1-7.8	Low	0.32			
	15-60	18-30	1.45-1.70	0.2-0.6	0.07-0.11	6.1-8.4	Low	0.32			
HoG	0-16	19-25	1.30-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low	0.37	5	6	1-2
Hickory	16-52	27-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Moderate	0.37			
	52-60	15-22	1.50-1.70	0.6-2.0	0.11-0.19	5.1-8.4	Low	0.37			
Hv	0-8	10-18	1.30-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.43	3	5	2-4
Hoosierville	8-13	16-24	1.35-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low	0.43			
	13-60	26-32	1.40-1.60	0.2-0.6	0.18-0.20	4.5-6.0	Moderate	0.43			
	60-70	10-18	1.35-1.55	0.2-0.6	0.20-0.22	5.6-6.5	Low	0.43			
IvA	0-13	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.43	4	5	1-3
Iva	13-44	22-30	1.35-1.55	0.06-0.2	0.18-0.20	5.1-6.5	Moderate	0.43			
	44-60	10-20	1.35-1.55	0.6-2.0	0.20-0.22	5.6-6.5	Low	0.43			
McA, McB	0-8	8-17	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.37	5	5	1-3
Martinsville	8-28	18-30	1.40-1.60	0.6-2.0	0.17-0.20	5.1-6.0	Moderate	0.37			
	28-70	10-25	1.40-1.60	0.6-2.0	0.12-0.14	5.6-6.5	Low	0.24			
	70-80	3-23	1.50-1.70	0.6-2.0	0.19-0.21	7.4-8.4	Low	0.24			
MeD2	0-7	11-22	1.40-1.55	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.37	5	5	.5-3
Miami	7-32	25-35	1.45-1.65	0.6-2.0	0.15-0.20	5.6-6.0	Moderate	0.37			
	32-60	15-28	1.55-1.90	0.2-2.0	0.05-0.19	6.6-8.4	Moderate	0.37			
MgC3, MgD3	0-4	27-35	1.45-1.60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.37	4	6	.5-3
Miami	4-32	25-35	1.45-1.65	0.6-2.0	0.15-0.20	5.6-6.0	Moderate	0.37			
	32-60	15-28	1.55-1.90	0.2-2.0	0.05-0.19	6.6-8.4	Moderate	0.37			
MuB	0-12	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-6.0	Low	0.37	5	5	.5-3
Muren	12-60	22-30	1.35-1.50	0.2-0.6	0.18-0.20	5.1-6.0	Moderate	0.37			
	60-70	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.37			
OcA, OcB2	0-8	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
Ockley	8-32	27-35	1.45-1.60	0.6-2.0	0.15-0.20	4.5-6.0	Moderate	0.37			
	32-52	20-35	1.40-1.55	0.6-2.0	0.12-0.14	5.6-6.5	Moderate	0.24			
	52-60	2-5	1.60-1.80	>20	0.02-0.04	7.4-8.4	Low	0.10			
PeB2, PeC2	0-8	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-6.5	Low	0.37	5	5	.5-3
Parke	8-45	27-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-5.0	Moderate	0.37			
	45-60	20-30	1.55-1.65	0.6-2.0	0.16-0.18	4.5-5.5	Low	0.28			
Po*.											
Pits											
Ra	0-9	18-27	1.50-1.70	0.6-2.0	0.22-0.24	6.1-7.3	Low	0.28	5	5	4-6
Ragsdale	9-50	27-35	1.50-1.70	0.06-0.2	0.18-0.20	6.1-7.3	Moderate	0.28			
	50-80	20-27	1.50-1.70	0.06-0.2	0.20-0.22	6.6-8.4	Low	0.28			
ReA	0-9	12-20	1.20-1.45	0.6-2.0	0.17-0.24	5.6-7.3	Low	0.37	5	5	2-4
Reesville	9-33	22-35	1.30-1.55	0.2-0.6	0.17-0.22	5.1-8.4	Moderate	0.37			
	33-60	12-25	1.20-1.40	0.2-0.6	0.15-0.18	7.4-8.4	Low	0.37			

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		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
Rn	0-8	18-27	1.30-1.45	0.2-0.6	0.20-0.24	6.6-7.3	Low	0.28	5	5	2-6
Rensselaer	8-36	27-35	1.40-1.60	0.06-0.2	0.15-0.19	6.1-7.3	Moderate	0.28			
	36-45	25-35	1.40-1.60	0.06-0.2	0.16-0.18	7.4-7.8	Moderate	0.28			
	45-60	2-30	1.50-1.70	0.6-2.0	0.19-0.21	7.9-8.4	Low	0.28			
RuB, RuC	0-13	11-25	1.30-1.45	0.6-2.0	0.21-0.24	5.6-7.3	Low	0.37	5	5	.5-3
Russell	13-28	25-33	1.40-1.60	0.6-2.0	0.18-0.20	4.5-6.0	Moderate	0.37			
	28-53	23-33	1.40-1.60	0.6-2.0	0.15-0.19	5.6-7.3	Moderate	0.37			
	53-60	14-30	1.60-1.80	0.6-2.0	0.05-0.19	7.4-8.4	Low	0.37			
Sh	0-8	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
Shoals	8-25	18-32	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.8	Low	0.37			
	25-60	12-25	1.35-1.60	0.6-2.0	0.12-0.21	6.6-7.3	Low	0.37			
Sm*:											
Shoals	0-8	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
	8-25	18-32	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.8	Low	0.37			
	25-60	12-25	1.35-1.60	0.6-2.0	0.12-0.21	6.6-7.3	Low	0.37			
Hennepin	0-4	20-30	1.20-1.40	0.6-2.0	0.18-0.24	6.1-7.8	Low	0.32	4	5	1-2
	4-15	18-30	1.30-1.60	0.2-2.0	0.14-0.22	6.1-7.8	Low	0.32			
	15-60	18-30	1.45-1.70	0.06-0.6	0.07-0.11	6.1-8.4	Low	0.32			
Sw	0-10	8-18	1.25-1.50	2.0-6.0	0.09-0.14	7.4-8.4	Low	0.24	5	3	.5-2
Stonelick	10-60	5-18	1.20-1.55	2.0-6.0	0.05-0.11	7.4-8.4	Low	0.24			
Ud*.											
Udorthents											
Wa	0-10	10-17	1.30-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.37	5	5	1-3
Wakeland	10-60	10-17	1.30-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.37			
WeG	0-2	15-27	1.20-1.40	2.0-6.0	0.08-0.14	4.5-6.0	Low	0.28	2	---	1-3
Weikert	2-16	15-27	1.20-1.40	2.0-6.0	0.04-0.08	4.5-6.0	Low	0.28			
	16	---	---	---	---	---	---	---			
Wh	0-10	8-17	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.37	5	5	1-3
Whitaker	10-46	18-30	1.40-1.60	0.6-2.0	0.15-0.19	5.1-6.0	Moderate	0.37			
	46-60	3-18	1.50-1.70	0.6-6.0	0.19-0.21	6.6-8.4	Low	0.37			
XeA, XeB2	0-10	11-22	1.40-1.55	0.6-2.0	0.22-0.24	6.6-7.3	Low	0.37	5	5	1-3
Xenia	10-30	27-35	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.0	Moderate	0.37			
	30-50	27-35	1.45-1.65	0.2-0.6	0.15-0.19	5.1-7.3	Moderate	0.37			
	50-60	20-27	1.55-1.90	0.2-2.0	0.05-0.19	7.9-8.4	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 "rare," "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				
AlB, AlC2--------- Alford	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	High.
AnC--------------- Alvin	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	High.
AvB, AwB2, AwC2--- Ava	C	None---------	---	---	2.0-4.0	Perched	Mar-Jun	>60	---	High-----	Moderate	High.
Ba---------------- Bartle	D	None---------	---	---	1.0-2.0	Perched	Jan-Apr	>60	---	High-----	High-----	High.
Bd---------------- Birds	C/D	Frequent----	Long------	Mar-Jun	0-1.0	Apparent	Mar-Jun	>60	---	High-----	High-----	Moderate.
Ch---------------- Chagrin	B	Frequent----	Brief-----	Nov-May	4.0-6.0	Apparent	Feb-Mar	>60	---	Moderate	Low-------	Moderate.
CkG--------------- Chetwynd	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	High.
CnC2, CnD2-------- Cincinnati	C	None---------	---	---	>4.0	Perched	Jan-Apr	>60	---	High-----	Moderate	High.
CoG--------------- Corydon	D	None---------	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate	Low.
ElB--------------- Elkinsville	B	Rare---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	High.
Ev---------------- Evansville	B/D	Rare---------	---	---	+.5-1.0	Apparent	Jan-May	>60	---	High-----	High-----	Low.
FdA--------------- Fincastle	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.
FoB2, FxC3-------- Fox	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Moderate.
GnE--------------- Gilpin	C	None---------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low-------	High.
GrC2, GrD2, GrE2-- Grayford	B	None---------	---	---	>6.0	---	---	>60	---	High-----	High-----	Moderate.
Hb---------------- Haymond	B	Frequent----	Brief-----	Jan-May	>6.0	---	---	>60	---	High-----	Low-------	Low.
HeG--------------- Hennepin	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	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				
HoG---------- Hickory	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Hv---------- Hoosierville	C	None--------	---	---	0-1.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.
IvA---------- Iva	C	None--------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.
McA, McB---------- Martinsville	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
MeD2, MgC3, MgD3-- Miami	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
MuB---------- Muren	B	None--------	---	---	3.0-6.0	Apparent	Mar-Apr	>60	---	High-----	High-----	Moderate.
OcA, OcB2--------- Ockley	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
PeB2, PeC2-------- Parke	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	High.
Po*. Pits												
Ra---------- Ragsdale	B/D	None--------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Low.
ReA---------- Reesville	C	None--------	---	---	1.0-2.5	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.
Rn---------- Rensselaer	B/D	None--------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Low.
RuB, RuC---------- Russell	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
Sh---------- Shoals	C	Frequent----	Brief-----	Oct-Jun	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Low.
Sm*: Shoals----------	C	Frequent----	Brief-----	Oct-Jun	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Low.
Hennepin---------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Sw---------- Stonelick	B	Frequent----	Very brief	Nov-Jun	>6.0	---	---	>60	---	Moderate	Low------	Low.
Ud*. Udorthents												

See footnote at end of table.

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				
Wa---------- Wakeland	B/D	Frequent----	Brief-----	Jan-May	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Low.
WeG---------- Weikert	C/D	None--------	---	---	>6.0	---	---	10-20	Soft	Moderate	Moderate	Moderate.
Wh---------- Whitaker	C	None--------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.
XeA, XeB2---------- Xenia	B	None--------	---	---	2.0-6.0	Apparent	Mar-Apr	>60	---	High-----	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alford	Fine-silty, mixed, mesic Typic Hapludalfs
Alvin*	Coarse-loamy, mixed, mesic Typic Hapludalfs
Ava	Fine-silty, mixed, mesic Typic Fragiudalfs
Bartle	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Birds	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
Chagrin	Fine-loamy, mixed, mesic Dystric Fluventic Eutrochrepts
Chetwynd	Fine-loamy, mixed, mesic Typic Hapludults
Cincinnati	Fine-silty, mixed, mesic Typic Fragiudalfs
Corydon	Clayey, mixed, mesic Lithic Argiudolls
Elkinsville	Fine-silty, mixed, mesic Ultic Hapludalfs
Evansville	Fine-silty, mixed, nonacid, mesic Typic Haplaquepts
Fincastle	Fine-silty, mixed, mesic Aeric Ochraqualfs
Fox	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludalfs
Gilpin	Fine-loamy, mixed, mesic Typic Hapludults
Grayford	Fine-silty, mixed, mesic Typic Hapludalfs
Haymond	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Hennepin	Fine-loamy, mixed, mesic Typic Eutrochrepts
Hickory	Fine-loamy, mixed, mesic Typic Hapludalfs
Hoosierville	Fine-silty, mixed, mesic Typic Ochraqualfs
Iva	Fine-silty, mixed, mesic Aeric Ochraqualfs
Martinsville*	Fine-loamy, mixed, mesic Typic Hapludalfs
Miami	Fine-loamy, mixed, mesic Typic Hapludalfs
Muren	Fine-silty, mixed, mesic Aquic Hapludalfs
Ockley	Fine-loamy, mixed, mesic Typic Hapludalfs
Parke	Fine-silty, mixed, mesic Ultic Hapludalfs
Ragsdale	Fine-silty, mixed, mesic Typic Argiaquolls
Reesville	Fine-silty, mixed, mesic Aeric Ochraqualfs
Rensselaer	Fine-loamy, mixed, mesic Typic Argiaquolls
Russell	Fine-silty, mixed, mesic Typic Hapludalfs
Shoals	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Stonelick	Coarse-loamy, mixed (calcareous), mesic Typic Udifluvents
Udorthents	Loamy, mixed, nonacid, mesic Udorthents
Wakeland	Coarse-silty, mixed, nonacid, mesic Aeric Fluvaquents
Weikert	Loamy-skeletal, mixed, mesic Lithic Dystrochrepts
Whitaker	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Xenia	Fine-silty, mixed, mesic Aquic Hapludalfs

* 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.

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