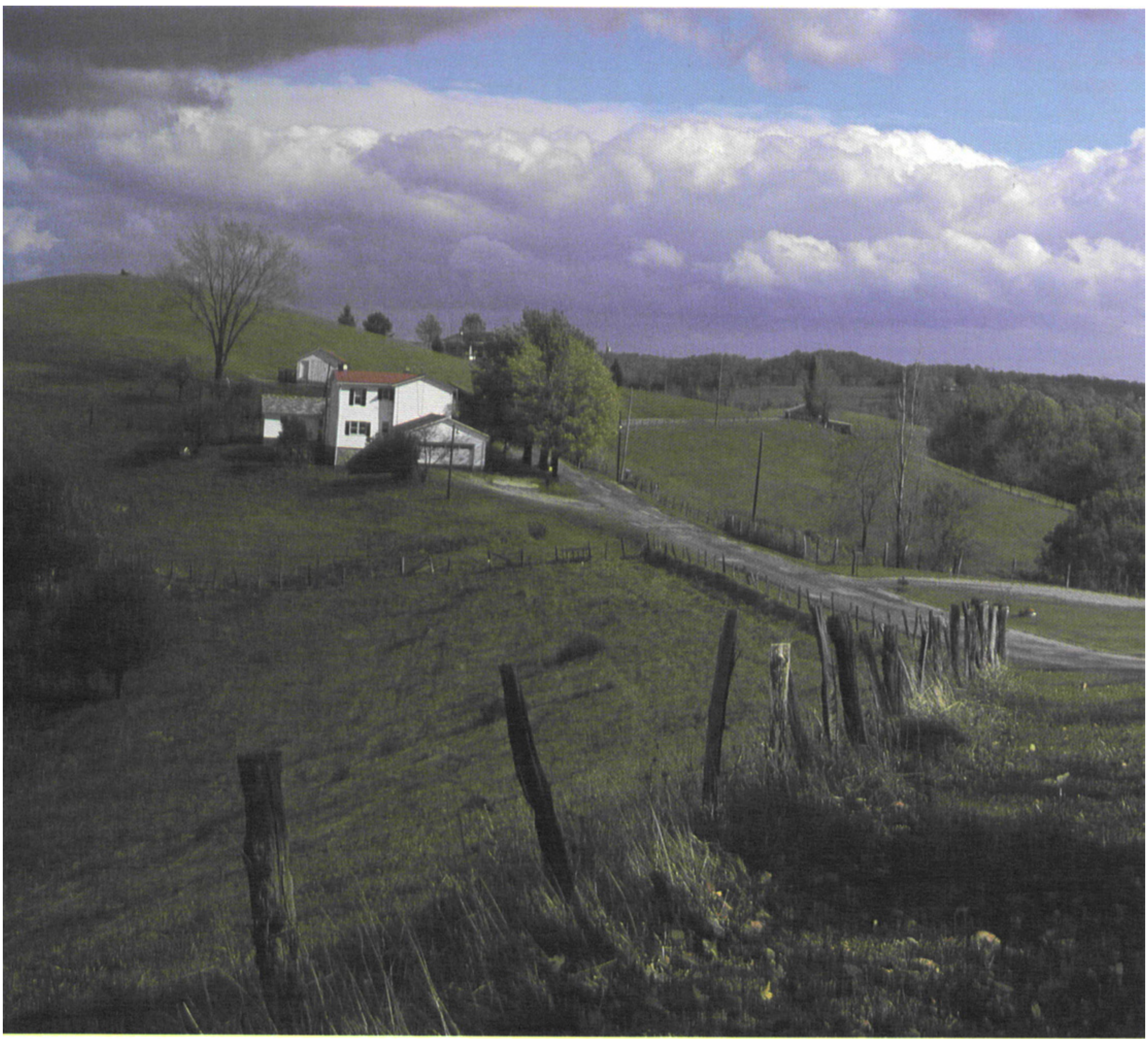
United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
West Virginia Agricultural
and Forestry Experiment
Station

Soil Survey of Wetzel County, West Virginia



How To Use This Soil Survey

General Soil Map

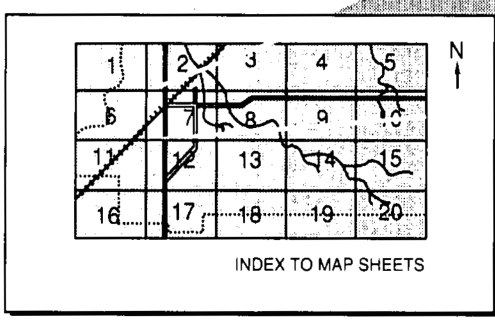
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

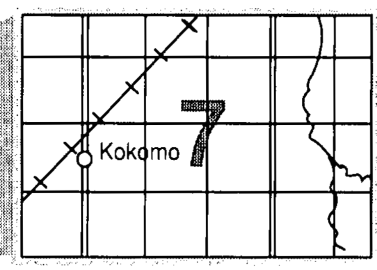
To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

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

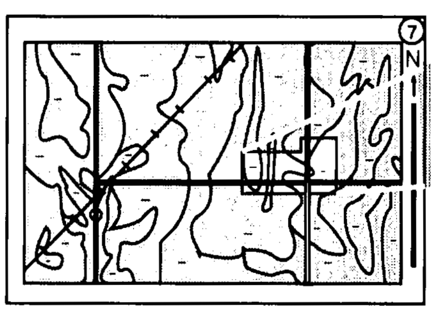
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



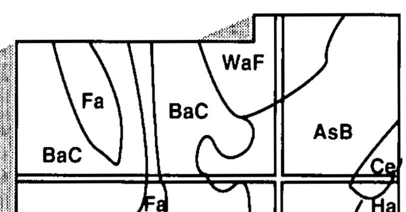


MAP SHEET

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



MAP SHEET



AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1988. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1988. This survey was made cooperatively by the Natural Resources Conservation Service and the West Virginia Agricultural and Forestry Experiment Station. The survey is part of the technical assistance furnished to the Upper Ohio Soil Conservation District.

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

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

Cover: A typical area of Gilpin and Peabody soils, which are on ridgetops, benches, and hillsides in Wetzel County.

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Issued September 1995

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Summary of Tables

Foreword

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

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

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are 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 Natural Resources Conservation Service or the Cooperative Extension Service.

Rollin N. Swank
State Conservationist
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Soil Survey of Wetzel County, West Virginia

By Alex R. Topalanchik, Natural Resources Conservation Service

Soils surveyed by Alex R. Topalanchik, Claude L. Marra, and Cheryl L. Lobb, Natural Resources Conservation Service

Map finishing work by D. Paul Amick, Debra Murphy, Linda Handley, and Denise Donelson, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with West Virginia Agricultural and Forestry Experiment Station

WETZEL COUNTY is in the northwestern part of West Virginia (fig. 1). It has a total area of 231,200 acres, or approximately 361 square miles. In 1980, it had a population of 21,874. New Martinsville, which is at the confluence of the Ohio River and Fishing Creek, is the county seat. The Ohio River forms the western border of the county. Fishing Creek is the dominant stream in the county. It empties into the Ohio River at New Martinsville.

This soil survey updates the survey of the Middlebourne area in West Virginia published in 1909 *(6)*. It provides additional information and has larger maps, which show the soils in greater detail.

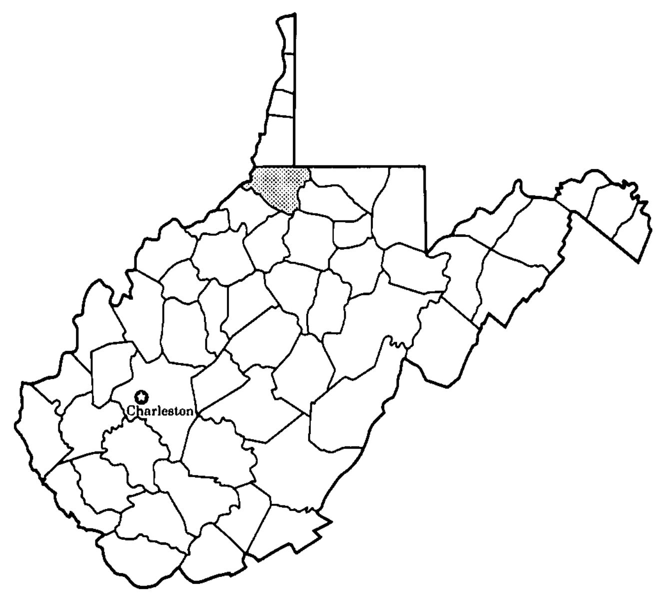

Figure 1.—Location of Wetzel County in West Virginia.

General Nature of the County

This section provides general information about the county. It describes settlement, farming, transportation facilities and industry, relief and drainage, geology, and climate.

Settlement

The first permanent settlers in Wetzel County came from Virginia, Maryland, and North Carolina in about 1775. They located in an area along the Ohio River near the present site of New Martinsville. Settlers were attracted to the survey area because of the rich lands and the transportation advantages afforded by the Ohio River.

In 1846, Wetzel County was formed from Tyler County by an act of the Virginia Assembly, 17 years before West Virginia became a state *(6)*. The county was named for Lewis Wetzel, a famous frontier character and Indian fighter.

Farming

In 1982, Wetzel County had 269 farms and a total of 45,877 acres of farmland *(10)*. During the period 1978 to 1982, the number of farms increased by 27. The average size of the farms decreased from 181 acres in 1978 to 171 acres in 1982. The main types of farming are raising beef cattle and producing hay, pasture, and grain crops. Much of the farming is done on a part-time basis by those who live or work in urban areas.

Transportation Facilities and Industry

The transportation needs of Wetzel County are met by a network of highways, one railroad, and the Ohio River. The highways include West Virginia Routes 2, 7, 20, 89, and 180 and U.S. Route 250. The Ohio River serves as a major artery in the transportation of coal, other raw materials, and refined petroleum. Locks built in the Ohio River and located at New Martinsville provide a means of transportation for the barge traffic.

The county is part of the highly industrialized valley of the Ohio River. The major industrial products in the county are oil, natural gas, chemicals, glass and glassware, sand and gravel, and pottery.

Relief and Drainage

Wetzel County is in the Appalachian Plateau physiographic province. It is a highly dissected plateau. Most areas are characterized by narrow ridgetops and deep, V-shaped, narrow valleys that have steep or very steep hillsides. The hillsides are commonly separated by long, narrow, less sloping benches. Most of the flood plains along the smaller streams are narrow. The largest flood plains and terraces are along the Ohio River and Fishing Creek. The county is drained primarily by Fishing Creek and the Ohio River.

Elevation ranges from 588 feet above sea level in an area along the Ohio River near Paden City, in the southwestern part of the county, to 1,652 feet on Honsocker Knob, in the northeastern part, on the boundary between Wetzel and Monongalia Counties.

Geology

Gordon B. Bayles, geologist, Natural Resources Conservation Service, helped prepare this section.

The exposed bedrock in the county generally is part of the Dunkard Group. It includes interbedded red clay and olive yellow shale; acid, gray and brown siltstone; sandstone; coal; and limestone *(4)*. The dominant rock types in the Dunkard Group are red and olive yellow clay shale, siltstone, and sandstone. The rocks have thin seams of coal in the central and eastern parts of the county. A few small outcrops of limestone are in the north-central and eastern parts and along Fish Creek and Proctor Creek. Erosion has removed the Dunkard rocks in all areas along the Ohio River, except for those in a short span near New Martinsville. Many of the soils in the county formed in material weathered from these rocks.

Climate

Winters are cold and snowy at the higher elevations in Wetzel County. The valleys are frequently cold, but intermittent thaws preclude a long-lasting snow cover. Summers are fairly warm in the mountains and very warm in the valleys. Very hot days occasionally occur in the valleys. Rainfall is evenly distributed throughout the year. It is appreciably heavier on the windward, west-facing slopes than in the valleys. The normal annual precipitation is adequate for all of the crops commonly grown in the county, but summer temperatures and the length of the growing season may be inadequate, particularly at the higher elevations.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Middlebourne, West Virginia, in the period 1951 to 1981. 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 32 degrees F and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Middlebourne on January 29, 1963, is -22 degrees. In summer, the average temperature is 71 degrees and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on September 4, 1953, is 103 degrees.

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

The total annual precipitation is about 43 inches. Of this, about 25 inches, or nearly 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 21 inches. The heaviest 1-day rainfall during the period of record was 3.7 inches at Middlebourne on August 15, 1975. Thunderstorms occur on about 44 days each year. Heavy rains, which can occur at any time of the year, and severe thunderstorms in summer sometimes cause flash flooding, especially in narrow valleys.

The average seasonal snowfall is about 26 inches. The greatest snow depth at any one time during the period of record was 22 inches. On the average, 17 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 60 percent of the time possible in summer and 35 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 8 miles per hour, in spring.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

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, it 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 another but in a different pattern.

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

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

The general soil map of this county joins the maps of Harrison, Marion, Marshall, Monongalia, and Tyler Counties, West Virginia, and Greene County, Pennsylvania. In some areas the names of the general soil map units and the composition of the component soils are not the same as those of the map units in the adjacent counties. Differences result from variations in the scale of mapping and in the degree of generalization.

Soil Descriptions

1. Huntington-Urban Land-Wheeling

Areas of very deep, well drained, nearly level and gently sloping soils and areas of Urban land; on flood plains and terraces

This map unit is along the Ohio River. Slope ranges from 0 to 8 percent.

This map unit makes up less than 1 percent of the county. It is about 19 percent Huntington soils, 19 percent Urban land, 13 percent Wheeling soils, and 49 percent soils of minor extent and areas of water (fig. 2).

The nearly level Huntington soils are on flood plains along the Ohio River. They are occasionally flooded in winter and spring. They formed in alluvial material washed from soils on uplands. They have a very dark grayish brown, medium textured surface layer and a dark brown and dark yellowish brown, medium textured subsoil.

Urban land consists of areas that are covered by streets, highways, parking lots, buildings, and other urban structures.

The nearly level and gently sloping Wheeling soils are on terraces. They formed in alluvial material. They have a dark brown surface layer and a dark yellowish brown subsoil. They are medium textured throughout.

The soils of minor extent in this map unit are the well drained Gilpin and Peabody soils on hillsides, the well drained Vandalia soils on foot slopes, and the well drained Nolin and Skidmore soils on flood plains.

About 90 percent of the acreage in this unit has been cleared of trees and is used mainly for urban or industrial development. A few areas are used for farming. The major cities and industries in the county are in areas of this unit. The wooded areas in the unit support mixed hardwoods. They are along the banks of the Ohio River, in drainageways, and in small woodlots, including some areas of Paden Island, which is in the Ohio River.

The main hazard affecting most uses of the soils on flood plains is flooding. In most years the flooding occurs in late winter or early spring, before crops are planted. Few limitations affect most farm and urban uses of the soils on terraces.

2. Skidmore-Vandalia-Nolin

Very deep, well drained, nearly level and moderately steep or steep soils; on flood plains and foot slopes

This map unit consists of soils along the major streams and their tributaries and on foot slopes. It is throughout the county. Slope ranges from 0 to 35 percent.

This map unit makes up about 11 percent of the county. It is about 46 percent Skidmore soils, 37

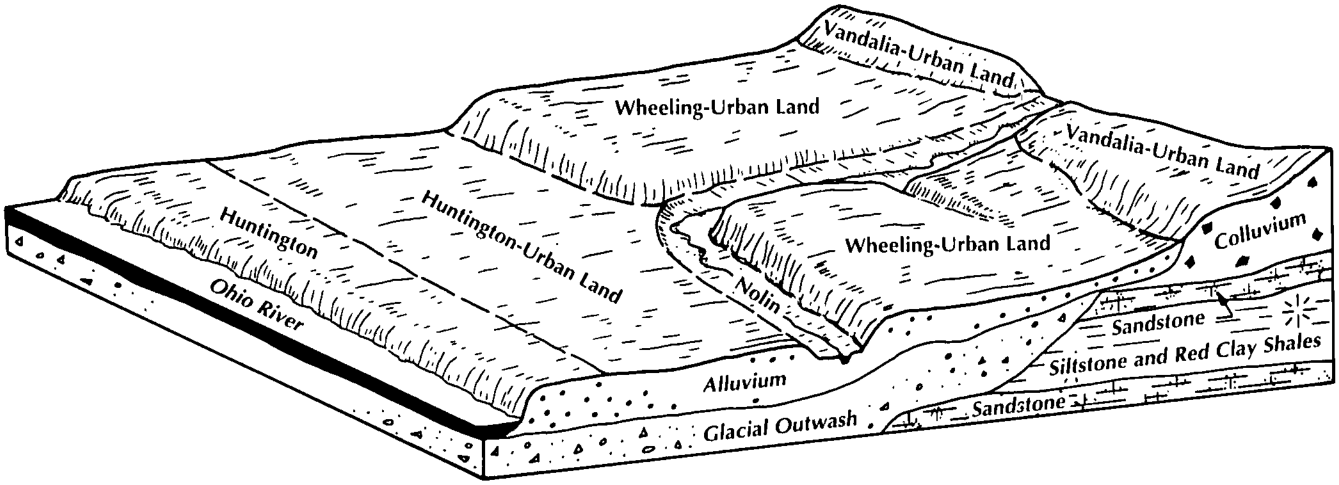

Figure 2.—Pattern of soils and parent material in the Huntington-Urban land-Wheeling general soil map unit.

percent Vandalia soils, 12 percent Nolin soils, and 5 percent soils of minor extent.

The nearly level Skidmore soils are on flood plains. They are occasionally flooded. They formed in alluvial material washed from soils on uplands. They have a dark brown, medium textured surface layer and a dark brown and dark yellowish brown, loamy subsoil.

The moderately steep and steep Vandalia soils are on foot slopes. They formed in colluvial material that moved downslope mainly from areas of Gilpin and Peabody soils. The Vandalia soils have a reddish brown, moderately fine textured surface layer and subsoil.

The nearly level Nolin soils are on flood plains. They are occasionally flooded in winter and spring, before crops are planted. These soils formed in alluvial material washed from soils on uplands. They have a dark brown, medium textured surface layer and subsoil.

The soils of minor extent in this map unit are the well drained Elk soils on flood plains and the moderately well drained Otwell and Glenford soils on terraces.

Most of the acreage in this map unit is used as pasture or hayland or is idle land. The Vandalia soils are used mainly as woodland. Some corn is grown on the Nolin soils. The Skidmore soils are used as pasture or hayland. Raising beef cattle is an important enterprise. The wooded areas support mixed hardwoods.

The main limitations affecting most uses of these soils are flooding, the slope, the hazard of slippage, a high shrink-swell potential, and moderately rapid, moderately slow, or slow permeability.

3. Gilpin-Peabody

Moderately deep, well drained, moderately steep to very steep soils; on uplands

This map unit is throughout the county. The Gilpin and Peabody soils occur as closely intermingled areas. Slope ranges from 15 to 70 percent.

This map unit makes up about 88 percent of the county. It is about 50 percent Gilpin soils, 35 percent Peabody soils, and 15 percent soils of minor extent (fig. 3).

Gilpin soils formed in material weathered from shale, siltstone, and sandstone. They have a dark yellowish brown, medium textured surface layer and a yellowish brown, medium textured and moderately fine textured subsoil.

Peabody soils formed in material weathered from siltstone and shale. They have a dark brown, moderately fine textured surface layer and a reddish brown and dark reddish brown, moderately fine textured and fine textured subsoil.

The soils of minor extent in this map unit are the well drained Skidmore and Elk soils on flood plains and the well drained Vandalia soils on foot slopes.

About 85 percent of this map unit is wooded or is reverting to woody species. Many areas that were formerly cleared have reseeded naturally to yellow-poplar and other hardwoods. The slope restricts the use of logging equipment. Erosion is a hazard on logging roads and skid trails.

Some of the broader ridgetops and the less sloping hillsides have been cleared of trees and are used for hay or pasture. The narrow flood plains are generally isolated and are too small for row cropping. They are used mainly for hay or pasture.

The main limitations affecting most uses of these soils are the slope, the depth to bedrock, a high shrink-swell potential, the hazard of slippage, and a clayey texture. Some of the broader ridgetops are used as sites for dwellings, but the soils generally are not suited to urban or industrial uses that require large sites. Slippage is common in areas of the Peabody soils. It is a management concern in the areas used as pasture or hayland or as sites for urban uses.

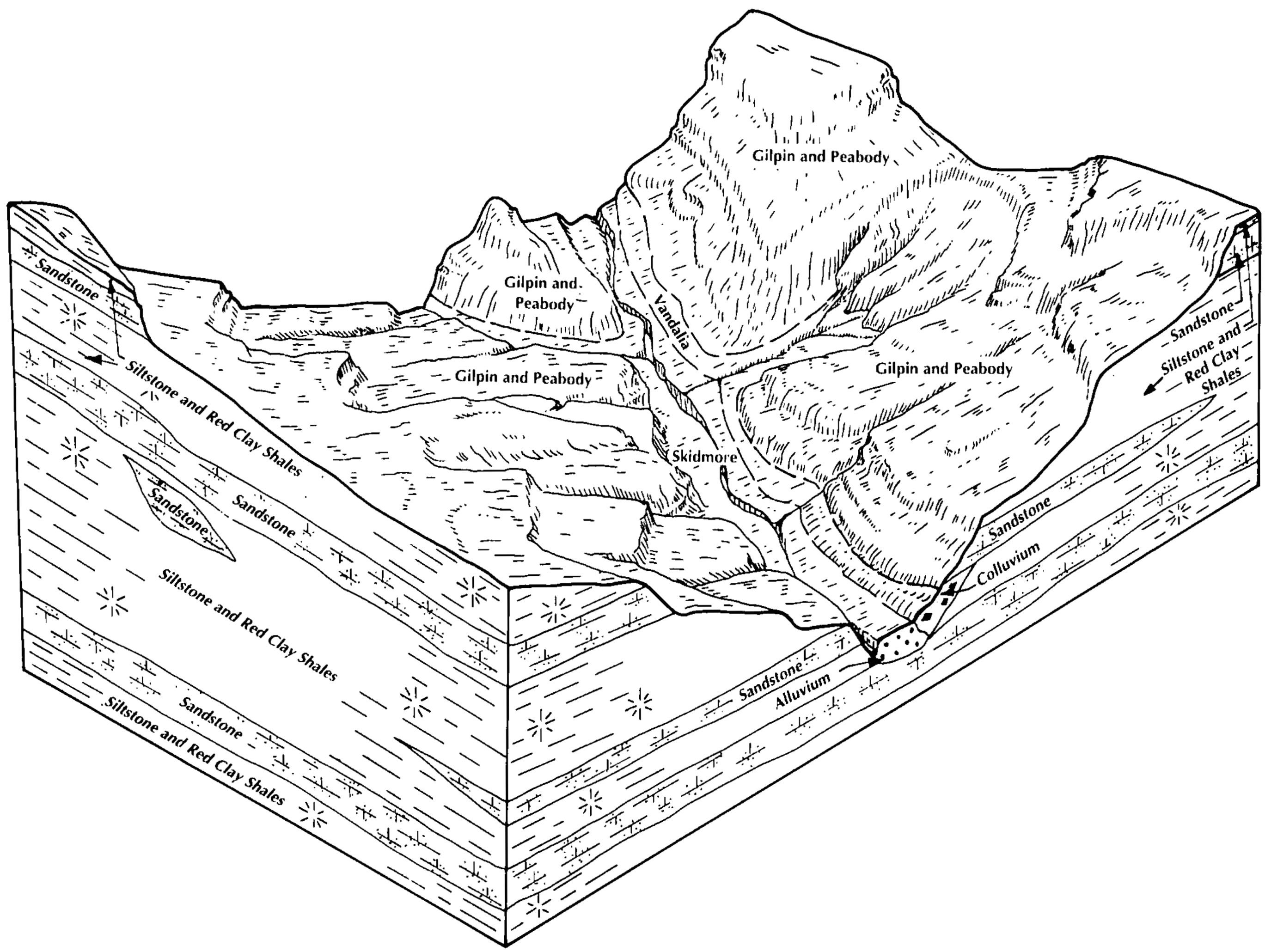

Figure 3.—Pattern of soils and parent material in the Gilpin-Peabody general soil map unit.

Detailed Soil Map Units

Dr. John Sencindiver, professor of agronomy, West Virginia Agricultural and Forestry Experiment Station, helped prepare this section.

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 the heading "Use and Management of the Soils."

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Vandalia silty clay loam, 15 to 25 percent slopes, is a phase of the Vandalia series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Gilpin-Peabody complex, 15 to 25 percent slopes, is an example.

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Urban land is an example. Miscellaneous areas are shown on the soil maps.

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

Soil Descriptions

EkB—Elk silt loam, 3 to 8 percent slopes. This soil is very deep and well drained. It is on high flood plains and low stream terraces along Fishing Creek and the other major streams in the survey area. The soil is subject to rare flooding. Slopes are dominantly less than 5 percent.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of about 43 inches. It is dark brown silt loam and silty clay loam. The substratum to a depth of at least 65 inches is dark brown silt loam.

Included with this soil in mapping are a few small areas of the well drained Nolin and Skidmore soils and the moderately well drained Glenford soils. Also included are small areas of soils that have more sand in the subsoil than the Elk soil; areas where slopes are less than 3 percent; and, near the mouth of Fishing Creek, some small areas that are frequently flooded. Included soils make up about 25 percent of this map unit.

The available water capacity of the Elk soil is high.

Figure 4.—Harvesting hay in an area of Elk silt loam, 3 to 8 percent slopes.

Permeability is moderate in the subsoil. Runoff is medium. Natural fertility is high. In unlimed areas reaction is very strongly acid to slightly acid. The depth to bedrock is more than 60 inches.

Most areas are used for hay (fig. 4) or pasture. Some areas are used for corn. The hazard of erosion is moderate in unvegetated areas. Applying a system of conservation tillage, farming on the contour, including hay in the cropping sequence, and returning crop residue to the soil help to control erosion and maintain fertility and tilth. The main management needs in pastured areas are proper stocking rates, which help to maintain desirable grasses and legumes, and a rotational grazing system.

Only a small acreage is wooded. This soil has moderately high potential productivity for trees. Few limitations affect woodland management.

The flooding and low strength are the main limitations affecting most urban uses. The flooding limits the use of this soil as a site for dwellings and septic tank absorption fields. Better suited soils that are not subject to flooding should be selected. Some of the higher areas that are not so frequently flooded are better sites for septic tank absorption fields than the lower areas.

The flooding and low strength limit the use of this soil as a site for local roads and streets. Constructing the roads and streets on raised fill, over coarse grained base material, can minimize the damage caused by flooding and low strength.

Occasional flooding on the included Nolin and Skidmore soils and the seasonal high water table in the included Glenford soils limit most urban uses.

The capability subclass is IIe.

GpD—Gilpin-Peabody complex, 15 to 25 percent slopes. These moderately deep, well drained soils are on ridgetops and benches throughout the survey area. The benches are commonly dissected by drainageways. Land slips are common in some areas. These soils are moderately eroded. The two soils occur as long, very narrow, contour areas in a repeating, alternating pattern. Consequently, it was not practical to map them separately at the scale selected for mapping. This unit is about 40 percent Gilpin soil, 30 percent Peabody soil, and 30 percent other soils.

Typically, the surface layer of the Gilpin soil is dark yellowish brown silt loam about 3 inches thick. The subsoil is about 32 inches thick. The upper 10 inches is yellowish brown channery silt loam. The next 15 inches is yellowish brown channery silty clay loam. The lower 7 inches is yellowish brown very channery silt loam. Bedrock is at a depth of about 35 inches.

Typically, the surface layer of the Peabody soil is dark brown silty clay loam about 2 inches thick. The subsoil is about 22 inches thick. The upper 9 inches is reddish brown silty clay loam. The lower 13 inches is dark reddish brown silty clay. The substratum is dark reddish brown channery silty clay. It is underlain by bedrock at a depth of about 29 inches.

Included with these soils in mapping are a few small areas of the well drained Skidmore and Vandalia soils and the moderately well drained Otwell soils. Also included are a few small areas of soils that are shallower over bedrock than the Gilpin and Peabody soils, a few areas where stones cover 1 to 3 percent of the surface, a few areas of escarpments, and areas where erosion has removed much of the original surface layer and has exposed the subsoil in places.

The available water capacity of the Gilpin soil is low or moderate. Permeability is moderate in the subsoil. Runoff is rapid. Natural fertility is low or medium. In unlimed areas reaction is strongly acid or very strongly acid. The root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches.

The available water capacity of the Peabody soil is moderate. Permeability is moderately slow or slow in the subsoil. Runoff is rapid. Natural fertility is medium or high. In unlimed areas reaction is very strongly acid to slightly acid in the solum and very strongly acid to neutral in the substratum. The root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches. The shrink-swell potential is high in the subsoil. Slippage is a hazard.

Most areas are used for hay or pasture. The suitability for cultivated crops is limited. The hazard of erosion is severe in unvegetated areas. Applying a system of conservation tillage, growing crops in contour strips, including hay in the cropping sequence, and returning crop residue to the soils help to control erosion and maintain fertility and tilth. The main management needs in pastured areas are proper stocking rates, which help to maintain desirable grasses and legumes; a rotational grazing system; and deferment of grazing in spring until the Peabody soil is reasonably firm.

About one-third to one-half of the acreage is wooded. These soils have moderately high potential productivity for trees. During wet periods the use of equipment is restricted on the Peabody soil because of poor traction and low strength. Erosion on logging roads and skid trails is a major management concern. It can be controlled by constructing the roads and trails on the contour.

The slope and depth to bedrock in areas of the Gilpin soil and the slope, moderately slow or slow permeability, high shrink-swell potential, low strength, depth to bedrock, and hazard of slippage in areas of the Peabody soil are the main limitations affecting most urban uses.

The slope is the main limitation affecting the use of the Gilpin soil as a site for dwellings. Land shaping and grading can help to overcome the slope. The cost of excavation and construction can be increased on sites for dwellings with basements. Constructing dwellings without basements may be a better alternative. Erosion is a hazard in areas that have been cleared for construction. Designing the dwellings so that they conform to the natural slope of the land can help to keep land shaping and erosion to a minimum. Revegetating during or soon after construction also helps to control erosion.

The slope and the depth to bedrock are the main limitations affecting the use of the Gilpin soil as a site for septic tank absorption fields. The absorption fields should be installed on the contour. Enlarged lots may include areas of better suited soils. Also, using an alternative system can help to overcome the limitations.

The slope is the main limitation affecting the use of the Gilpin soil as a site for local roads and streets. Building the roads and streets on the contour can minimize this limitation.

The slope, the high shrink-swell potential, and the hazard of slippage are the main limitations affecting the use of the Peabody soil as a site for dwellings. Land shaping and grading can help to overcome the slope. The cost of excavation and construction can be increased on sites for dwellings with basements. Constructing dwellings without basements may be a better alternative. Erosion is a hazard in areas that have been cleared for construction. It can be controlled by revegetating during or soon after construction. Widening and reinforcing footings, keeping surface and subsurface water away from the building site through diversions and drainage tile, and installing properly constructed retaining walls can minimize the hazard of slippage.

The slope, the moderately slow or slow permeability, the depth to bedrock, and the hazard of slippage are the main limitations affecting the use of the Peabody soil as a site for septic tank absorption fields. The absorption fields should be installed on the contour. Enlarged lots may include areas of better suited soils. Also, using an alternative system can help to overcome the limitations.

The slope, the high shrink-swell potential, the hazard of slippage, and low strength are the main limitations affecting the use of the Peabody soil as a site for local roads and streets. Building the roads and streets on the contour helps to overcome the slope. Constructing the roads and streets on coarse grained base material and installing collector ditches with cross culverts that remove surface water can minimize the damage caused by shrinking and swelling and by low strength.

Most urban uses are limited by the slope, low strength, high shrink-swell potential, moderately slow or slow permeability, and hazard of slippage in areas of the included Vandalia soils; occasional flooding on the included Skidmore soils; and the seasonal high water table, low strength, very slow permeability, and potential for frost action in the included Otwell soils.

The capability subclass is IVe.

GpE—Gilpin-Peabody complex, 25 to 35 percent slopes. These moderately deep, well drained soils are on ridgetops and benches throughout the survey area. The benches are commonly dissected by drainageways. Land slips are common in some areas. These soils are moderately eroded. The two soils occur as long, very narrow, contour areas in a repeating, alternating pattern. Consequently, it was not practical to map them separately at the scale selected for mapping. This unit is about 45 percent Gilpin soil, 30 percent Peabody soil, and 25 percent other soils.

Typically, the surface layer of the Gilpin soil is dark yellowish brown silt loam about 3 inches thick. The subsoil is about 31 inches thick. The upper 9 inches is yellowish brown channery silt loam. The next 15 inches is yellowish brown channery silty clay loam. The lower 7 inches is yellowish brown very channery silt loam. Bedrock is at a depth of about 34 inches.

Typically, the surface layer of the Peabody soil is dark brown silty clay loam about 2 inches thick. The subsoil is about 21 inches thick. The upper 9 inches is reddish brown silty clay loam. The lower 12 inches is dark reddish brown silty clay. The substratum is dark reddish brown channery silty clay. It is underlain by bedrock at a depth of about 28 inches.

Included with these soils in mapping are a few small areas of the well drained Skidmore and Vandalia soils and the moderately well drained Otwell soils. Also included are a few small areas of soils that are shallower over bedrock than the Gilpin and Peabody soils, a few areas where stones cover 1 to 3 percent of the surface, a few areas of escarpments, and areas where erosion has removed much of the original surface layer and has exposed the subsoil in places.

The available water capacity of the Gilpin soil is low or medium. Permeability is moderate in the subsoil. Runoff is very rapid. Natural fertility is low or medium. In unlimed areas reaction is strongly acid or very strongly acid. The root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches.

The available water capacity of the Peabody soil is moderate. Permeability is moderately slow or slow in the subsoil. Runoff is very rapid. Natural fertility is medium or high. In unlimed areas reaction is very strongly acid to slightly acid in the solum and very strongly acid to neutral in the substratum. The root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches. The shrink-swell potential is high in the subsoil. Slippage is a hazard.

About one-third of the acreage is used as pasture. The rest is wooded (fig. 5). These soils are not suited to hay or cultivated crops. The hazard of erosion is very severe in unvegetated areas. Overgrazing of pastured areas also is a major management concern. The main management needs in these areas are proper stocking rates, which help to maintain desirable grasses and legumes; a rotational grazing system; and deferment of grazing in spring until the Peabody soil is reasonably firm.

These soils have moderately high potential productivity for trees. During wet periods the use of equipment is restricted on the Peabody soil because of poor traction and low strength. Erosion on logging roads and skid trails is a major management concern. It can be controlled by constructing the roads and trails on the contour.

These soils are not suited to most urban uses. They are better suited to pasture, woodland, and wildlife

Figure 5.—A wooded area of Gilpin-Peabody complex, 25 to 35 percent slopes.

habitat. The slope and depth to bedrock in areas of the Gilpin soil and the slope, moderately slow or slow permeability, high shrink-swell potential, low strength, depth to bedrock, and hazard of slippage in areas of the Peabody soil are the major limitations affecting most urban areas.

Most urban uses are limited by occasional flooding on the included Skidmore soils; the slope, low strength, high shrink-swell potential, moderately slow or slow permeability, and hazard of slippage in areas of the included Vandalia soils; and the seasonal high water table, low strength, very slow permeability, and potential for frost action in the included Otwell soils.

The capability subclass is VIe.

GpF—Gilpin-Peabody complex, 35 to 70 percent slopes. These moderately deep, well drained soils are on ridgetops and benches throughout the survey area. The benches are commonly dissected by drainageways. Land slips are common in some areas. These soils are moderately eroded. The two soils occur as long, very narrow, contour areas in a repeating, alternating pattern. Consequently, it was not practical to map them separately at the scale selected for mapping. This unit is about 50 percent Gilpin soil, 30 percent Peabody soil, and 20 percent other soils.

Typically, the surface layer of the Gilpin soil is dark yellowish brown silt loam about 3 inches thick. The subsoil is about 30 inches thick. The upper 9 inches is yellowish brown channery silt loam. The next 15 inches is yellowish brown channery silty clay loam. The lower 6 inches is yellowish brown very channery silt loam. Bedrock is at a depth of about 33 inches.

Typically, the surface layer of the Peabody soil is dark brown silty clay loam about 2 inches thick. The subsoil is about 20 inches thick. The upper 8 inches is reddish brown silty clay loam. The lower 12 inches is dark reddish brown silty clay. The substratum is dark reddish brown channery silty clay. It is underlain by bedrock at a depth of about 27 inches.

Included with these soils in mapping are a few small areas of the well drained Nolin, Skidmore, and Vandalia soils and the moderately well drained Otwell soils. Also included are a few small areas of soils that are shallower over bedrock than the Gilpin and Peabody soils, a few areas where stones cover 1 to 3 percent of the surface, a few areas of escarpments, and areas where erosion has removed much of the original surface layer and has exposed the subsoil in places.

The available water capacity of the Gilpin soil is low or moderate. Permeability is moderate in the subsoil. Runoff is very rapid. Natural fertility is low or medium. In unlimed areas reaction is strongly acid or very strongly acid. The root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches.

The available water capacity of the Peabody soil is moderate. Permeability is moderately slow or slow in the subsoil. Runoff is very rapid. Natural fertility is medium or high. In unlimed areas reaction is very strongly acid to slightly acid in the solum and very strongly acid to neutral in the substratum. The root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches. The shrink-swell potential is high in the subsoil. Slippage is a hazard.

About 90 percent of the acreage is wooded. The rest is used as pasture. These soils are not suited to cultivated crops or to hay and are poorly suited to pasture. The hazard of erosion is very severe in unvegetated areas. Overgrazing of pastured areas also is a major management concern. The main management needs in these areas are a rotational grazing system and deferment of grazing in spring until the Peabody soil is reasonably firm.

These soils have moderately high potential productivity for trees. The use of equipment is restricted by escarpments in some areas. During wet periods it is further restricted on the Peabody soil because of poor traction and low strength. Erosion on logging roads and skid trails is a major management concern. It can be controlled by constructing the roads and trails on the contour.

These soils are not suited to urban uses. They are better suited to woodland and wildlife habitat. The slope and depth to bedrock in areas of the Gilpin soil and the slope, moderately slow or slow permeability, high shrink-swell potential, depth to bedrock, low strength, and hazard of slippage in areas of the Peabody soil are the major limitations.

Most urban uses are limited by occasional flooding on the included Skidmore soils; the slope, low strength, high shrink-swell potential, moderately slow or slow permeability, and hazard of slippage in areas of the included Vandalia soils; and the seasonal high water table, low strength, very slow permeability, and potential for frost action in the included Otwell soils.

The capability subclass is VIIe.

GrF—Gilpin-Rock outcrop complex, very steep. This map unit consists of a moderately deep, well drained Gilpin soil and areas of Rock outcrop (fig. 6). It is along the Ohio River and its major tributaries. The landscape is characterized by series of narrow, contour benches on hillsides. Land slips are common. The Gilpin soil is moderately eroded. The Gilpin soil and the Rock outcrop occur as long, very narrow, contour areas in a repeating, alternating pattern. Consequently, it was not practical to map them separately at the scale selected for mapping. This unit is about 35 percent Rock outcrop, 40 percent Gilpin soil, and 25 percent other soils. Slopes range from 35 to 70 percent in areas on the Gilpin soil, and the escarpments of Rock outcrop are vertical.

Typically, the surface layer of the Gilpin soil is dark yellowish brown silt loam about 2 inches thick. The subsoil is about 27 inches thick. The upper 8 inches is yellowish brown channery silt loam. The next 14 inches is yellowish brown channery silty clay loam. The lower 5 inches is yellowish brown very channery silt loam. Bedrock is at a depth of about 29 inches.

The Rock outcrop occurs as vertical escarpments of sandstone and shale that follow the contour of the land. Boulders are on some benches and at the base of some slopes.

Included in this unit in mapping are small areas of the well drained Vandalia and Peabody soils. Also included are small areas of soils that are shallower over bedrock than the Gilpin soil, a few small areas where stones cover 3 to 15 percent of the surface, a few areas where slopes are 25 to 35 percent, areas where erosion has removed much of the original surface layer and has exposed the subsoil in places, and soils that have more than 35 percent rock fragments in the subsoil.

The available water capacity of the Gilpin soil is low or moderate. Permeability is moderate in the subsoil. Runoff is very rapid. Natural fertility is low or medium. In unlimed areas reaction is strongly acid or very strongly acid. The root zone of some plants is restricted

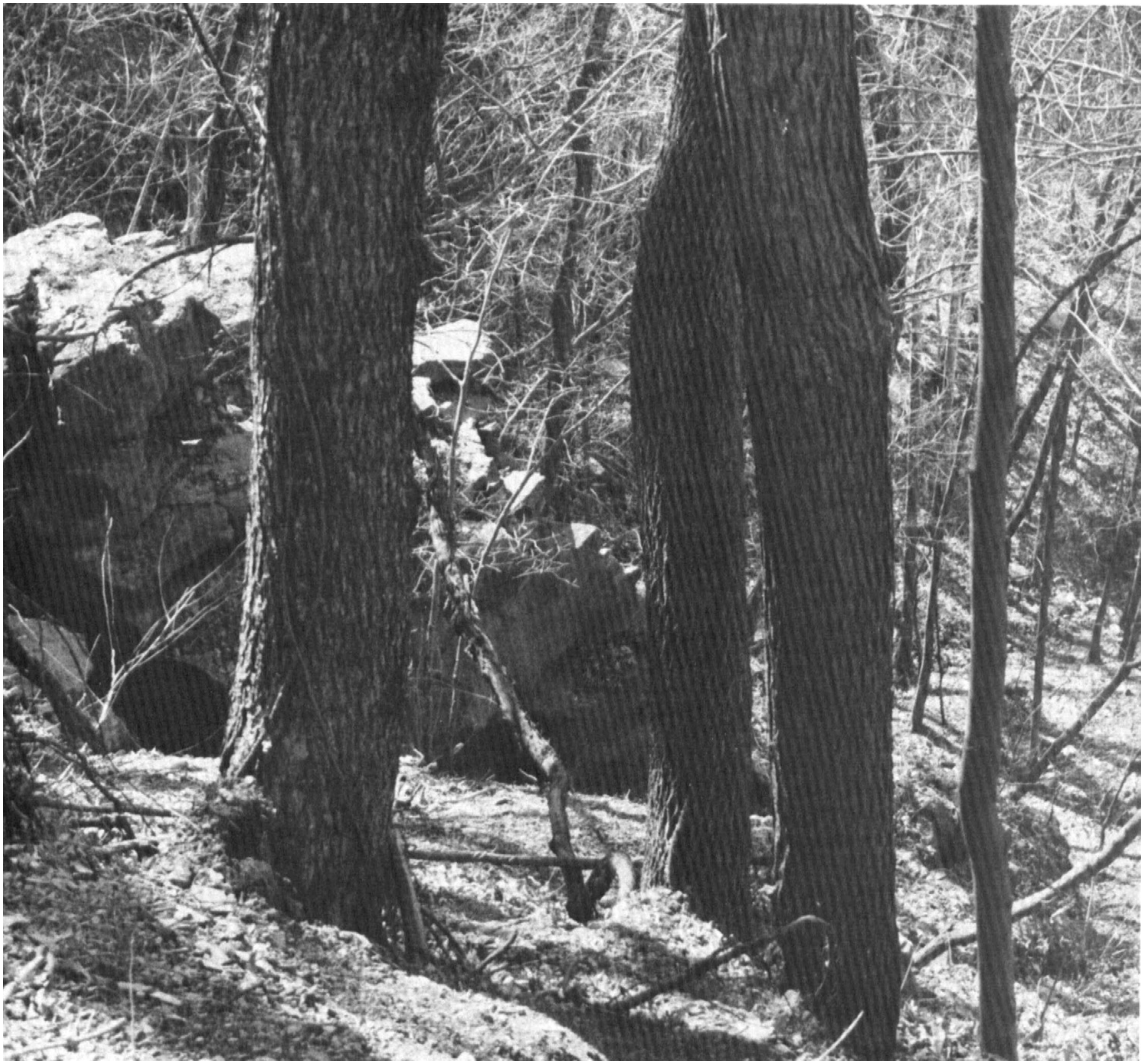

Figure 6.—Rock outcrop in a wooded area of Gilpin-Rock outcrop complex, very steep.

by bedrock at a depth of 20 to 40 inches.

About 95 percent of the acreage is wooded. The Gilpin soil is not suited to cultivated crops, hay, or pasture. It has moderately high potential productivity for trees. The erosion hazard is very severe in unvegetated areas. Managing this unit is very difficult. In many areas trees must be harvested by special equipment because of the slope and the bedrock escarpments. If logging roads and skid trails are needed, constructing them on the contour helps to control erosion.

Because of the slope and depth to bedrock in areas of the Gilpin soil and the vertical escarpments of Rock outcrop, this map unit is not suited to urban uses. It is better suited to woodland and wildlife habitat.

The slope limits the use of all the included soils for urban development. Also, the hazard of slippage, low strength, high shrink-swell potential, and slow permeability in areas of the included Peabody and Vandalia soils limit most urban uses.

The capability subclass is VIIs.

GsB—Glenford silt loam, 3 to 8 percent slopes. This soil is very deep and moderately well drained. It is on stream terraces along Fishing Creek, near its confluence with the Ohio River.

Typically, the surface layer is very dark grayish brown silt loam about 2 inches thick. The subsoil extends to a depth of about 53 inches. In sequence downward, it is 7 inches of yellowish brown silt loam; 8 inches of yellowish brown silty clay loam mottled with strong brown; 14 inches of yellowish brown silty clay loam mottled with light brownish gray, grayish brown, and strong brown; 7 inches of yellowish brown silt loam mottled with grayish brown and brown; and 15 inches of brown silt loam mottled with grayish brown and strong brown. The substratum to a depth of at least 65 inches is brown silt loam that has grayish brown and strong brown mottles.

Included with this soil in mapping are a few small areas of the well drained Vandalia, Elk, and Nolin soils. Also included are somewhat poorly drained or poorly drained soils in small depressions and a few small areas where slopes are less than 3 percent or are 8 to 15 percent. Included soils make up about 25 percent of this map unit.

The available water capacity of the Glenford soil is high. Permeability is moderately slow in the subsoil. Runoff is medium. Natural fertility also is medium. In unlimed areas reaction is very strongly acid to moderately acid in the upper part of the solum and moderately acid to neutral in the lower part. The substratum is moderately acid to mildly alkaline. A seasonal high water table is about 2.0 to 3.5 feet below the surface. It restricts the root zone of some plants. The depth to bedrock is more than 60 inches.

Most areas are used as woodland. Some areas are used for hay or pasture. Erosion is a moderate hazard in unvegetated areas. Applying a system of conservation tillage, farming on the contour, including hay in the cropping sequence, and returning crop residue to the soil help to control erosion and maintain fertility and tilth. The main management needs in pastured areas are proper stocking rates, a rotational grazing system, and deferment of grazing in spring until the soil is reasonably firm.

This soil has moderately high potential productivity for trees. Few limitations affect woodland management, but most woodlots are too small for commercial wood production.

The seasonal high water table, low strength, the potential for frost action, and the moderately slow permeability are the main limitations affecting most urban uses. The seasonal high water table is the main limitation on sites for dwellings with basements. Installing foundation drains and sealing foundations can help to prevent wetness in basements. Constructing dwellings without basements may be a better alternative.

The seasonal high water table and the moderately slow permeability severely limit the use of this soil as a site for septic tank absorption fields. Lengthening the absorption field and establishing a wide, deep trench below the distribution lines can help to overcome these limitations. Selecting a better suited soil may be a better alternative.

Low strength and the potential for frost action are the main limitations affecting the use of this soil as a site for local roads and streets. The soil is soft when wet. As a result, the pavement can crack when the roads and streets are subject to heavy traffic. Providing coarse grained base material helps to prevent the damage to pavement caused by frost action and low strength.

The limitations affecting the use of the included soils for most kinds of urban development are the slope, the seasonal high water table, a high shrink-swell potential, and the hazard of slippage. Also, low strength is a limitation in areas of the included Vandalia soils.

The capability subclass is IIe.

Hn—Huntington silt loam. This soil is very deep and well drained. It is on flood plains along the Ohio River. It is occasionally flooded, generally during late winter and early spring, before crops are planted. Slopes range from 0 to 3 percent.

Typically, the surface layer is very dark grayish brown and dark brown silt loam about 14 inches thick. The subsoil to a depth of at least 65 inches is dark brown and dark yellowish brown silt loam.

Included with this soil in mapping are a few small areas of Wheeling and Nolin soils, small areas of soils that are poorly drained to moderately well drained, small areas of Huntington soils that have slopes of 8 to 15 percent, and areas of soils that are similar to this Huntington soil but have a surface layer that is less than 10 inches thick. Also included are small areas of frequently flooded soils upstream from the Hannibal Locks and Dam. Included soils make up about 25 percent of this map unit.

The available water capacity of the Huntington soil is high. Permeability is moderate in the subsoil. Runoff is slow. Natural fertility is high. In unlimed areas reaction is moderately acid to neutral. The depth to bedrock is more than 60 inches.

Most areas are used for corn. Some areas are used for hay or pasture. The flooding in late winter and early spring does not affect crop production. Cultivated crops can be grown year after year, but cover crops are needed to control erosion. Working the residue from the cover crops into the soil helps to maintain fertility and tilth. The main management needs in pastured areas are proper stocking rates, which help to maintain desirable grasses and legumes; a rotational grazing system; and deferment of grazing in spring until the soil is reasonably firm.

Only a small acreage is wooded. This soil has moderately high potential productivity for trees. Few limitations affect woodland management. Most of the trees are along the banks of the Ohio River and in small woodlots. The wooded areas are not large enough for commercial wood production.

The flooding and the potential for frost action are the main limitations affecting most urban uses. The flooding limits the use of this soil as a site for dwellings and septic tank absorption fields. Alternative sites should be selected.

The flooding and the potential for frost action limit the use of this soil as a site for local roads and streets. Constructing the roads and streets on raised fill, over coarse grained base material, can minimize the damage caused by flooding and frost action.

Occasional flooding on the included Nolin soils limits most urban uses.

The capability class is I.

Hu—Huntington-Urban land complex. This map unit consists of a very deep, well drained Huntington soil and areas of Urban land. It is on nearly level flood plains in urban and industrial areas along the Ohio River. The Huntington soil is occasionally flooded, generally in late winter and early spring. The Huntington soil and the Urban land occur as areas so intricately intermingled that it was not practical to map them separately at the scale selected for mapping. This unit is about 35 percent Urban land, 35 percent Huntington soil, and 30 percent other soils, some of which are sites for industrial uses.

Typically, the surface layer of the Huntington soil is very dark grayish brown and dark brown silt loam about 14 inches thick. The subsoil to a depth of at least 65 inches is dark brown and dark yellowish brown silt loam.

Urban land consists of areas that are covered by streets, parking lots, buildings, and other urban structures.

Included in this unit in mapping are a few small areas of the well drained Wheeling and Nolin soils. Also included are small areas of soils that are poorly drained to moderately well drained, small areas of Huntington soils that have slopes of 8 to 15 percent, small areas of the frequently flooded Huntington soils upstream from the Hannibal Locks and Dam, and industrial dump sites and their associated water impoundments.

The available water capacity of the Huntington soil is high. Permeability is moderate in the subsoil. Runoff is slow. Natural fertility is high. In unlimed areas reaction is moderately acid to neutral. The depth to bedrock is more than 60 inches.

Most areas are used for urban development. Most open areas are used for lawns or gardens. The Huntington soil is not used for cultivated crops, hay, pasture, or woodland.

The flooding and the potential for frost action are the main limitations affecting the use of the Huntington soil for urban development. The flooding limits the use of this soil as a site for dwellings and septic tank absorption fields. Alternative sites should be selected.

The flooding and the potential for frost action limit the use of the Huntington soil as a site for local roads and streets. Constructing the roads and streets on raised fill, over coarse grained base material, can minimize the damage caused by flooding and frost action.

Occasional flooding on the included Nolin soils limits most urban uses.

No capability classification is assigned.

No—Nolin loam. This soil is very deep and well drained. It is on flood plains along streams throughout the survey area. It is occasionally flooded. The flooding occurs mainly in late winter and early spring. In some areas, however, it damages crops during the growing season. Slopes range from 0 to 3 percent.

Typically, the surface layer is dark brown loam about 10 inches thick. The subsoil is dark brown silt loam about 37 inches thick. The substratum to a depth of at least 65 inches is dark yellowish brown loam and sandy loam.

Included with this soil in mapping are a few small areas of the well drained Elk, Gilpin, Huntington, Peabody, Skidmore, Vandalia, and Wheeling soils. Also included are small areas of soils that are moderately well drained to poorly drained, a few small areas where slopes are 3 to 8 percent, areas where the surface layer is fine sandy loam, some areas where the subsoil is strongly acid, and a few small areas of frequently flooded soils. Included soils make up about 20 percent of this map unit.

The available water capacity of the Nolin soil is high. Permeability is moderate in the subsoil. Runoff is slow.

Natural fertility is high. In unlimed areas reaction is moderately acid to neutral. The depth to bedrock is more than 60 inches.

Most areas are used for hay or pasture. Some areas are used for cultivated crops. The cultivated crops can be grown year after year, but cover crops are needed to control erosion. Working the residue from the cover crops into the soil helps to maintain fertility and tilth. The main management needs in pastured areas are proper stocking rates, which help to maintain desirable grasses and legumes; a rotational grazing system; and deferment of grazing in spring until the soil is reasonably firm.

Only a small acreage is wooded. This soil has moderately high potential productivity for trees.

The flooding and low strength are the main limitations affecting most urban uses. The flooding limits the use of this soil as a site for dwellings and septic tank absorption fields. Alternative sites should be selected.

The flooding and low strength limit the use of this soil as a site for local roads and streets. Constructing the roads and streets on raised fill, over coarse grained base material, can minimize the damage caused by flooding and low strength.

Most urban uses are limited by rare flooding on the included Elk soils; occasional flooding on the included Skidmore soils; the depth to bedrock in the included Gilpin soils; and a high shrink-swell potential, the hazard of slippage, and low strength in areas of the included Peabody soils.

The capability subclass is IIw.

OtB—Otwell silt loam, 3 to 8 percent slopes. This soil is very deep and moderately well drained. It is on stream terraces along Fishing Creek and its major tributaries.

Typically, the surface layer is dark brown and dark yellowish brown silt loam about 10 inches thick. The subsoil extends to a depth of about 51 inches. The upper 17 inches is yellowish brown silt loam. The lower 24 inches is a very firm, brittle fragipan of yellowish brown silt loam mottled with light brownish gray and strong brown. The substratum to a depth of at least 65 inches is strong brown silt loam mottled with light brownish gray and strong brown.

Included with this soil in mapping are small areas of the well drained Gilpin, Peabody, and Vandalia soils. Also included are small areas of soils that are somewhat poorly drained, small areas where slopes are less than 3 percent, and areas where slopes are 8 to 15 percent. Included soils make up about 25 percent of this map unit.

The available water capacity of the Otwell soil is moderate. Permeability is slow above the fragipan and very slow in the fragipan. Runoff is medium. Natural fertility is low or medium. In unlimed areas reaction is very strongly acid to moderately acid. The seasonal high water table is about 2.0 to 3.5 feet below the surface. The water table and the fragipan restrict the root zone of deep-rooted plants. The depth to bedrock is more than 60 inches.

About one-half of the acreage is used for hay or pasture. This soil is suited to cultivated crops. The hazard of erosion is moderate in unvegetated areas. Applying a system of conservation tillage, farming on the contour, including hay in the cropping sequence, and returning crop residue to the soil help to control erosion and maintain fertility and tilth. The main management needs in pastured areas are proper stocking rates, which help to maintain desirable grasses and legumes; a rotational grazing system; and deferment of grazing in spring until the soil is reasonably firm.

Approximately one-half of the acreage is wooded. This soil has moderate potential productivity for trees. Few limitations affect woodland management.

The seasonal high water table, low strength, the very slow permeability, and the potential for frost action are the main limitations affecting most urban uses. The seasonal high water table limits the use of this soil as a site for dwellings. Installing foundation drains and sealing foundations can help to prevent the wetness in basements caused by the seasonal high water table. Erosion is a hazard in areas that have been cleared for construction. It can be controlled by revegetating during or soon after construction.

The seasonal high water table and the very slow permeability in the subsoil severely limit the use of this soil as a site for septic tank absorption fields. Lengthening the absorption field and establishing a wide, deep trench below the distribution lines can help to overcome these limitations.

Low strength and the potential for frost action limit the use of this soil as a site for local roads and streets. The soil is soft when wet. As a result, the pavement can crack when the roads and streets are subject to heavy traffic. Providing coarse grained base material helps to prevent the damage caused by low strength and frost action. Installing a subsurface drainage system helps to prevent the damage caused by the seasonal high water table.

Low strength, a high shrink-swell potential, and slow permeability in the subsoil limit development of the included Vandalia soils for most urban uses.

The capability subclass is IIe.

Sk—Skidmore gravelly loam. This soil is very deep and well drained. It is on flood plains and alluvial fans along small streams throughout the survey area. It is occasionally flooded. The flooding occurs mainly in late winter and early spring. In some areas, however, it damages crops during the growing season. Slopes range from 0 to 3 percent.

Typically, the surface layer is dark brown gravelly loam about 6 inches thick. The subsoil is about 15 inches thick. It is dark brown and dark yellowish brown. The upper 9 inches is gravelly loam, and the lower 6 inches is very gravelly sandy loam. The substratum to a depth of at least 65 inches is dark yellowish brown extremely gravelly sandy loam.

Included with this soil in mapping are small areas of the well drained Elk, Gilpin, Nolin, Peabody, and Vandalia soils; small areas of soils that are poorly drained to moderately well drained; and, on alluvial fans at the mouth of hollows, small areas of soils that have slopes of 3 to 8 percent and are subject to rare flooding. Also included are a few areas of frequently flooded soils. Included soils make up about 25 percent of this map unit.

The available water capacity of the Skidmore soil is very low to moderate. Permeability is moderately rapid in the subsoil. Runoff is slow. Natural fertility is high. In unlimed areas reaction is moderately acid to neutral. The depth to bedrock is more than 60 inches.

Most areas are used for hay (fig. 7) or pasture. Some areas are used for cultivated crops. The cultivated crops can be grown year after year, but cover crops are needed to control erosion. Working the residue from the cover crops into the soil helps to maintain fertility and tilth. The main management needs in pastured areas are proper stocking rates, which help to maintain desirable grasses and legumes; a rotational grazing system; and deferment of grazing in spring until the soil is reasonably firm.

Only a small acreage is wooded. This soil has moderately high potential productivity for trees. Restricting the use of heavy equipment to dry periods is the main management need.

The flooding is the main hazard affecting most urban uses. It limits the use of this soil as a site for dwellings and septic tank absorption fields. Alternative sites should be selected.

The flooding limits the use of this soil as a site for local roads and streets. Constructing the roads and streets on raised fill, over coarse grained base material, can minimize the hazard of flooding.

Most urban uses are limited by the depth to bedrock in the included Gilpin soils; rare flooding on the included Elk soils; occasional flooding on the included Nolin soils; and a high shrink-swell potential, the hazard of slippage, and low strength in areas of the included Vandalia and Peabody soils.

The capability subclass is IIw.

Us—Udorthents, smoothed. These nearly level to very steep, well drained soils are in areas that have been disturbed by road construction and by industrial and urban development. They are mainly along West Virginia Routes 2, 7, and 20; in New Martinsville and Paden City; and along the Ohio River. Slopes are generally less than 15 percent but range from 0 to 70 percent.

In a representative profile, the surface layer is dark brown channery silt loam about 5 inches thick. The substratum extends to a depth of at least 65 inches. The upper 16 inches is dark brown very channery silt loam. The next 14 inches is dark grayish brown very channery silt loam. The lower 30 inches is reddish brown very channery silty clay.

Included with these soils in mapping are small areas of Elk, Gilpin, Huntington, Nolin, Peabody, Skidmore, Vandalia, and Wheeling soils. Also included are quarries and dumps, storage and processing areas related to logging and oil and gas industries, and fly ash disposal areas. Included areas make up about 40 percent of this map unit.

Estimating the physical and chemical properties of the Udorthents is impractical because the soils are disturbed and vary significantly. In most fill areas the depth to bedrock is more than 60 inches. Runoff ranges from medium in the nearly level areas to very rapid in the very steep areas. Natural fertility ranges from low to high.

Most areas are idle or are used as industrial dump sites, storage areas, or sites for processing facilities. These soils are not used for cultivated crops, hay, pasture, or woodland. Because of the extreme variability, onsite investigation is necessary to determine the suitability of these soils for any proposed use.

No capability classification is assigned.

VaD—Vandalia silty clay loam, 15 to 25 percent slopes. This soil is very deep and well drained. It is on foot slopes and around the head of drainageways at the base of steep areas of Gilpin and Peabody soils. It is throughout the survey area. Some areas are dissected by drainageways. Land slips (fig. 8) and water seeps are common in some areas. The soil is moderately eroded.

Typically, the surface layer is reddish brown silty clay loam about 7 inches thick. The subsoil to a depth of at least 65 inches is reddish brown silty clay loam and channery silty clay loam.

Figure 7.—An area of Skidmore gravelly loam used for hay.

Included with this soil in mapping are a few small areas of the well drained Gilpin, Nolin, Peabody, and Skidmore soils and the moderately well drained Otwell and Glenford soils. Also included are soils that are similar to the Vandalia soil but contain less clay in the subsoil, soils that are less than 60 inches deep over bedrock, small areas where slopes are less than 15 percent, areas where slopes are more than 25 percent, a few areas where stones cover as much as 15 percent of the surface, and areas where erosion has removed much of the surface layer and has exposed the subsoil in places. Included soils make up about 30 percent of this map unit.

The available water capacity of the Vandalia soil is moderate. Permeability is moderately slow or slow in the subsoil. Runoff is rapid. Natural fertility is medium or high. In unlimed areas reaction is strongly acid or moderately acid in the upper part of the solum and strongly acid to neutral in the lower part and in the substratum. The depth to bedrock is more than 60 inches. The shrink-swell potential is high in the subsoil. Slippage is a hazard.

About one-third of the acreage is used for hay or pasture. The hazard of erosion is severe in unvegetated areas. If the soil is cultivated, applying a system of conservation tillage, growing crops in contour strips, including hay in the cropping sequence, maintaining shallow drainageways in sod, and returning crop residue to the soil help to control erosion and maintain fertility and good tilth. The main management needs in pastured areas are proper stocking rates, which help to maintain desirable grasses and legumes; a rotational grazing system; and deferment of grazing in spring until the soil is reasonably firm.

About two-thirds of the acreage is wooded. This soil has moderately high potential productivity for trees. The hazard of erosion in unvegetated areas and an equipment limitation caused by the slope are the main concerns in managing woodland. The use of equipment is further restricted during wet periods because of poor traction and low strength. Timber should be harvested during dry periods. Constructing logging roads and skid trails on the contour helps to control erosion.

The slope, the high shrink-swell potential, the moderately slow or slow permeability, low strength, and the hazard of slippage are the main limitations affecting

Figure 8.—An area of Vandalia silty clay loam, 15 to 25 percent slopes. As evidenced by the fence line, this soil is subject to slippage.

the use of this soil for most kinds of urban development. The slope, the high shrink-swell potential, the moderately slow or slow permeability, and the hazard of slippage are severe limitations on sites for dwellings, septic tank absorption fields, and local roads and streets. Water seeps and land slips are common, and land disturbance increases the hazard of slippage.

Most urban uses are limited by the depth to bedrock in the included Gilpin soils; occasional flooding on the included Skidmore and Nolin soils; the seasonal high water table in the included Glenford and Otwell soils; moderately slow or slow permeability, low strength, a high shrink-swell potential, and the hazard of slippage in areas of the included Peabody soils; and the slope of the included Peabody and Gilpin soils and the steeper Vandalia soils.

The capability subclass is IVe.

VaE—Vandalia silty clay loam, 25 to 35 percent slopes. This soil is very deep and well drained. It is on foot slopes and around the head of drainageways at the base of steep areas of Gilpin and Peabody soils. It is throughout the survey area. Some areas are dissected by drainageways. Land slips and water seeps are common in some areas. The soil is moderately eroded.

Typically, the surface layer is reddish brown silty clay loam about 7 inches thick. The subsoil to a depth of at least 65 inches is reddish brown silty clay loam and channery silty clay loam.

Included with this soil in mapping are a few small areas of the well drained Gilpin, Nolin, Peabody, and Skidmore soils and the moderately well drained Otwell and Glenford soils. Also included are soils that are similar to the Vandalia soil but contain less clay in the subsoil, soils that are less than 60 inches deep over bedrock, small areas where slopes are less than 25 percent, areas where slopes are more than 35 percent, a few areas where stones cover as much as 15 percent of the surface, and areas where erosion has removed much of the surface layer and has exposed the subsoil in places. Included soils make up about 30 percent of this map unit.

The available water capacity of the Vandalia soil is moderate. Permeability is moderately slow or slow in the subsoil. Runoff is rapid. Natural fertility is medium or high. In unlimed areas reaction is strongly acid or moderately acid in the upper part of the solum and moderately acid to neutral in the lower part and in the substratum. The depth to bedrock is more than 60 inches. The shrink-swell potential is high in the subsoil. Slippage is a hazard.

About one-third of the acreage is used for hay or pasture. This soil is not suited to cultivated crops or hay. The hazard of erosion is severe in unvegetated areas. The main management needs in pastured areas are proper stocking rates, which help to maintain desirable grasses and legumes; a rotational grazing system; and deferment of grazing in spring until the soil is reasonably firm.

About two-thirds of the acreage is wooded. This soil has moderately high potential productivity for trees. The hazard of erosion in unvegetated areas and an equipment limitation caused by the slope are the main concerns in managing woodland. The use of equipment is further restricted during wet periods because of poor traction and low strength. Timber should be harvested during dry periods. Constructing logging roads and skid trails on the contour helps to control erosion.

The slope, the high shrink-swell potential, the moderately slow or slow permeability, low strength, and the hazard of slippage are the main limitations affecting the use of this soil as a site for most kinds of urban development. The slope, the high shrink-swell potential, the moderately slow or slow permeability, and the hazard of slippage are severe limitations on sites for dwellings, septic tank absorption fields, and local roads and streets. Water seeps and land slips are common, and land disturbance increases the hazard of slippage.

Most urban uses are limited by the depth to bedrock in the included Gilpin soils; occasional flooding on the included Skidmore and Nolin soils; the seasonal high water table in the included Glenford and Otwell soils; moderately slow or slow permeability, low strength, a high shrink-swell potential, and the hazard of slippage in areas of the included Peabody soils; and the slope of the included Peabody and Gilpin soils and the steeper Vandalia soils.

The capability subclass is VIe.

VbD—Vandalia silty clay loam, 15 to 25 percent slopes, extremely stony. This soil is very deep and well drained. It is on foot slopes and around the head of drainageways at the base of steep areas of Gilpin and Peabody soils. It is throughout the survey area. Stones cover 3 to 15 percent of the surface. They are commonly 1 to 2 feet in diameter. Wet spots and land slips are common in some areas. The soil is moderately eroded.

Typically, the surface layer is reddish brown silty clay loam about 7 inches thick. The subsoil to a depth of at least 65 inches is reddish brown silty clay loam and channery silty clay loam.

Included with this soil in mapping are a few small areas of the well drained Gilpin, Nolin, Peabody, and Skidmore soils. Also included are soils that are similar to the Vandalia soil but contain less clay in the subsoil, soils that are less than 60 inches deep over bedrock, small areas where slopes are less than 15 percent, areas where slopes are more than 25 percent, a few areas where stones cover as much as 3 percent of the surface, and areas where erosion has removed much of the surface layer and has exposed the subsoil in places. Included soils make up about 30 percent of this map unit.

The available water capacity of the Vandalia soil is moderate. Permeability is moderately slow or slow in the subsoil. Runoff is rapid. Natural fertility is medium or high. In unlimed areas reaction is strongly acid or moderately acid in the upper part of the solum and moderately acid to neutral in the lower part and in the substratum. The depth to bedrock is more than 60 inches. The shrink-swell potential is high in the subsoil. Slippage is a hazard.

About three-fourths of the acreage is used as woodland, and one-fourth is used as pasture. Because of the stones on the surface, this soil is generally unsuitable for cultivated crops, hay, and pasture. It is suited to pasture if the surface stones are removed.

This soil has moderately high potential productivity for trees. The hazard of erosion in unvegetated areas and an equipment limitation caused by the slope are the main concerns in managing woodland. The use of equipment is further restricted during wet periods because of poor traction and low strength. Timber should be harvested during dry periods. Constructing logging roads and skid trails on the contour helps to control erosion.

The slope, low strength, the high shrink-swell potential, the hazard of slippage, the moderately slow or slow permeability, and the surface stones are the main limitations affecting the use of this soil as a site for dwellings, septic tank absorption fields, and local roads and streets. Water seeps and land slips are common, and land disturbance increases the hazard of slippage.

Most urban uses are limited by the depth to bedrock in the included Gilpin soils; occasional flooding on the included Skidmore and Nolin soils; moderately slow or slow permeability, low strength, a high shrink-swell potential, and the hazard of slippage in areas of the included Peabody soils; and the slope of the included Gilpin and Peabody soils and the steeper Vandalia soils.

The capability subclass is VIIs.

VuD—Vandalia-Urban land complex, 15 to 25 percent slopes. This map unit consists of a very deep, well drained Vandalia soil and areas of Urban land. It is on foot slopes at the base of steep areas of Gilpin and Peabody soils, dominantly along the Ohio River. The Vandalia soil and the Urban land occur as areas so intricately intermingled that it was not practical to map them separately at the scale selected for mapping. This unit is about 30 percent Urban land, 40 percent Vandalia soil, and 30 percent other soils.

Typically, the surface layer of the Vandalia soil is reddish brown silty clay loam about 7 inches thick. The subsoil to a depth of at least 65 inches is reddish brown silty clay loam and channery silty clay loam.

Urban land consists of areas that are covered by streets, parking lots, buildings, and other urban structures.

Included in this unit in mapping are small areas of Gilpin and Peabody soils. Also included are soils that are similar to the Vandalia soil but contain less clay in the subsoil, soils that are less than 60 inches deep over bedrock, small areas where slopes are less than 15 percent, areas where slopes are more than 35 percent, and a few areas where stones cover as much as 15 percent of the surface.

The available water capacity of the Vandalia soil is moderate. Permeability is moderately slow or slow in the subsoil. Runoff is rapid. Natural fertility is medium or high. In unlimed areas reaction is moderately acid or strongly acid in the upper part of the solum and moderately acid to neutral in the lower part and in the substratum. The depth to bedrock is more than 60 inches. The shrink-swell potential is high in the subsoil. Slippage is a hazard.

Most areas are used for urban development. Most open areas are used for lawns or gardens. The Vandalia soil is not used for cultivated crops, hay, woodland, or pasture.

The Vandalia soil is severely limited as a site for most urban uses. The slope, the high shrink-swell potential, the moderately slow or slow permeability, and the hazard of slippage are severe limitations on sites for dwellings, septic tank absorption fields, and local roads and streets. Water seeps and land slips are common, and land disturbance increases the hazard of slippage.

Most urban uses are limited by the depth to bedrock in the included Gilpin soils; moderately slow or slow permeability, low strength, a high shrink-swell potential, and the hazard of slippage in areas of the included Peabody soils; and the slope of the included Gilpin and Peabody soils and the steeper Vandalia soils.

No capability classification is assigned.

WnB—Wheeling-Urban land complex, 0 to 8 percent slopes. This map unit consists of a very deep, well drained Wheeling soil and areas of Urban land. It is on stream terraces in urban and industrial areas along the Ohio River. The Wheeling soil and the Urban land occur as areas so intricately intermingled that it was not practical to map them separately at the scale selected for mapping. This unit is about 30 percent Urban land, 40 percent Wheeling soil, and 30 percent other soils, some of which are sites for industrial uses.

Typically, the surface layer of the Wheeling soil is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of about 40 inches. It is dark yellowish brown silt loam. The substratum to a depth of at least 65 inches is dark yellowish brown loam and fine sandy loam.

Urban land consists of areas that are covered by streets, parking lots, buildings, and other urban structures.

Included in this unit in mapping are small areas of Nolin and Huntington soils. Also included are small areas of somewhat poorly drained or moderately well drained soils; small areas of soils that have a very gravelly surface layer or subsoil; areas where slopes are 8 to 15 percent; industrial dump sites and their associated water impoundments; some extensively disturbed areas, such as quarries; and sand and gravel storage sites.

The available water capacity of the Wheeling soil is moderate or high. Runoff is medium. Permeability is moderate in the subsoil. In unlimed areas reaction is strongly acid or moderately acid. The depth to bedrock is more than 60 inches.

Most areas are used for urban development. Most open areas are used for lawns or gardens. The Wheeling soil is not used for cultivated crops, hay, pasture, or woodland.

Few limitations affect the use of the Wheeling soil as a site for dwellings. The rapid permeability in the substratum is the main limitation on sites for septic tank absorption fields. Low strength and the potential for frost action are the main limitations on sites for local roads and streets. Providing coarse grained base material helps to prevent the damage to local roads and streets caused by frost action and low strength.

Most urban uses are limited by occasional flooding on the included Huntington soils.

No capability classification is assigned.

Prime Farmland

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

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

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

About 3,740 acres in Wetzel County, or 1.6 percent of the total acreage, meets the soil requirements for prime farmland. The map units that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

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 to prevent soil-related failures in land uses.

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

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational 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

Dixie L. Shreve, resource conservationist, Natural Resources 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 Natural Resources 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 the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Some general principles of management apply to all of the soils suitable for farm crops and pasture throughout the county, although individual soils or groups of soils require different kinds of management. The general principles are described in the following paragraphs.

Most of the soils in the county have a moderate or low supply of basic plant nutrients. As a result, applications of lime and fertilizer are necessary. The amounts to be applied depend on the type of soil, the cropping history, the type of crop to be grown, and the level of desired yields and should be determined by the results of tests and analyses of soil samples and plants.

The content of organic matter is low in most of the soils in the county. Increasing the content is not feasible. The content can be maintained, however, by adding farm manure, by returning crop residue to the soil, and by growing sod crops, cover crops, and green manure crops.

Tillage tends to break down soil structure and should be kept to the minimum necessary to prepare a seedbed and control weeds. Maintaining the content of organic matter in the plow layer also helps to maintain soil structure.

Runoff and erosion occur mainly while a cultivated crop is growing or soon after it has been harvested. If cultivated, all of the gently sloping and steeper soils are subject to erosion. A suitable cropping system that helps to control erosion is needed on these soils. In areas where such a system is applied, the main management needs are the proper crop rotation, conservation tillage, mulch planting, crop residue management, cover crops and green manure crops, and applications of lime and fertilizer. Other major erosion-control measures are contour farming, contour stripcropping, diversions, and grassed waterways. The effectiveness of a particular combination of these measures differs from one soil to another. Different combinations can be equally effective on the same soil.

Using the soils for pasture is effective in controlling erosion in most areas of the county. A high level of pasture management, including applications of fertilizer, controlled grazing, and careful selection of forage species, is needed to prevent excessive erosion on some soils. Grazing is controlled by rotating livestock from one pasture to another and by providing rest periods, which allow the plants to recover. On some soils the pasture species that require the least renovation are needed to maintain a good ground cover and to provide forage for grazing.

Yields per Acre

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

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

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

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

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

Land Capability Classification

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

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit *(7)*. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

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

Woodland Management and Productivity

Charles L. Rowan, forester, Natural Resources Conservation Service, helped prepare this section.

Nearly 180,000 acres in Wetzel County, or about 78 percent of the total acreage, is used as woodland. The wooded areas range from small woodlots on farms to large tracts owned by corporations.

The common forest types, or natural associations of tree species, and their percentages in the wooded tracts, are the oak-hickory type, about 66 percent; the maple-beech-birch type, 15 percent; other hardwoods, 16 percent; and the Virginia pine and pitch pine types, about 3 percent *(3)*.

The aspect of some soils, generally those that have slopes of more than 15 percent, affects potential productivity. North aspects face in any compass direction from 315 to 135 degrees. South aspects face in any compass direction from 135 to 315 degrees. Generally, the soils on north aspects are moister than the soils on south aspects and have a higher site index. Aspect also affects the composition of tree species and the severity of the limitations that affect woodland management.

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

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

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

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope and the erosion factor K shown in table 16. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities. The proper construction and maintenance of roads, trails, landings, and fire lanes can reduce the hazard of erosion.

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

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

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied. Adequate site preparation before the new crop is planted can help to control plant competition.

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.

Average annual growth of some of the common trees is expressed as cubic feet, board feet, and cords per acre *(5)*.

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

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, 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 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

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

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

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

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

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

Wildlife Habitat

Gary A. Gwinn, biologist, Natural Resources Conservation Service, helped prepare this section.

The wildlife habitat in Wetzel County is best suited to woodland wildlife. Almost 80 percent of the acreage in the county is forested. Openland wildlife species, such as bobwhite quail, cottontail rabbit, and meadowlark, are scarce in most areas.

The game species throughout the county include whitetail deer, wild turkey, ruffed grouse, and gray squirrel. Because of its proximity to the Ohio River, the county supports a relatively large population of waterfowl. It also has a large population of the songbirds, raptors, reptiles, and amphibians commonly associated with West Virginia.

The larger streams in the county support a variety of game fish, including smallmouth bass, largemouth bass, and assorted sunfish. The Ohio River, which forms the western boundary of the county, is considered one of the best fishing streams in the State.

Good management can increase the carrying capacity of wildlife habitat for specific species. Unless major land use changes are made, openland species are not expected to become predominant in the county. Local populations of such species can be increased, however, through careful planning.

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 10, 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 flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

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

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

Hardwood trees and woody shrubs produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, birch, cherry, maple, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are gray dogwood and crabapple.

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

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, arrowhead, bur reed, pickerelweed, cordgrass, rushes, and sedges.

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, swamps, 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. Wildlife attracted to these areas include bobwhite quail, meadow vole, meadowlark, field sparrow, cottontail, and red fox.

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

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

Engineering

Michael M. Blaine, conservation engineer, Natural Resources Conservation Service, helped prepare this section.

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

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

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, soil density, shear strength, bearing strength, and consolidation. 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 evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, and agricultural waste storage structures; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

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

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. 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, and the available water capacity in the upper 40 inches 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 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

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

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

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

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

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

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

The ratings in table 12 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 landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of 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. They are used in many kinds of construction. Specifications for each use vary widely. In table 13, 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 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 or stones, 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 or stones, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

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

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. 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 or of organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as 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 control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of 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 low available water capacity, a restricted rooting depth, toxic substances, 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.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 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 the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(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, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 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, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of water movement 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 and septic tank absorption fields.

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 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.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps, marshes, or closed depressions.

Table 17 gives the estimated frequency of flooding. The frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year).

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 little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17. Only saturated zones within a depth of about 6 feet are indicated.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. 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 *(8)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Ultisol.

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 Udult (*Ud*, meaning humid, plus *ult*, from Ultisol).

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 Hapludults (*Hapl*, meaning minimal horizonation, plus *udult*, the suborder of the Ultisols that has 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 Hapludults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludults.

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

Dr. John Sencindiver, professor of agronomy, West Virginia Agricultural and Forestry Experiment Station, helped prepare this section.

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 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" *(9)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(8)*. 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."

Elk Series

The Elk series consists of very deep, well drained soils that formed in mixed alluvial material washed from soils on uplands. The Elk soils are on low stream terraces and high flood plains along the major streams in the survey area. They are subject to rare flooding. Slope ranges from 3 to 8 percent.

Elk soils are near Nolin and Skidmore soils. They are flooded less frequently than Nolin and Skidmore soils. They have an argillic horizon, which is not characteristic of the Nolin or Skidmore soils. Unlike Elk soils, Skidmore soils are loamy-skeletal. They have a gravelly surface layer, subsoil, and substratum.

Typical pedon of Elk silt loam, 3 to 8 percent slopes, in a meadow along the North Fork of Fishing Creek, about 0.75 mile southwest of the intersection of North Fork Run Road and Barker Run Road, near Barker:

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; weak fine and medium granular structure; friable, slightly sticky and slightly plastic; common very fine and fine roots; moderately acid; abrupt smooth boundary.

Bt1—9 to 21 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; few very fine roots; common distinct clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—21 to 43 inches; dark brown (7.5YR 4/4) silty clay loam; weak medium prismatic structure parting to moderate medium and coarse subangular blocky; firm, slightly sticky and slightly plastic; many prominent clay films on faces of peds; strongly acid; clear wavy boundary.

C—43 to 65 inches; dark brown (7.5YR 4/4) silt loam; massive; friable, nonsticky and slightly plastic; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock is more than 60 inches. In some pedons the content of rock fragments is as much as 5 percent, by volume, in individual subhorizons of the B horizon. The content of gravel ranges from 0 to 35 percent, by volume, in the C horizon. In unlimed areas reaction is very strongly acid to slightly acid in the solum and strongly acid to slightly acid in the C horizon.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The Bt and C horizons have hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. In the fine-earth fraction, they are dominantly silt loam or silty clay loam. In some pedons, however, the C horizon has strata of loam, fine sandy loam, or clay loam.

Gilpin Series

The Gilpin series consists of moderately deep, well drained soils that formed in material weathered from shale, siltstone, and sandstone. These soils are on ridgetops, benches, and hillsides throughout the survey area. Slope ranges from 15 to 70 percent.

Gilpin soils are near Nolin, Otwell, Peabody, Skidmore, and Vandalia soils. Unlike Gilpin soils, Peabody and Vandalia soils are fine textured, Nolin soils are fine-silty, Skidmore soils are loamy-skeletal, and Nolin and Skidmore soils are subject to flooding.

Typical pedon of Gilpin silt loam, in a wooded area of Gilpin-Peabody complex, 35 to 70 percent slopes, about 0.80 mile northwest of the junction of American Ridge Road and Schupbach Ridge Road:

Oi—2 inches to 1 inch; hardwood leaf litter and slightly decomposed organic material.

Oe—1 inch to 0; moderately decomposed organic material.

A—0 to 3 inches; dark yellowish brown (10YR 4/4) silt loam; weak very fine and fine granular structure; very friable, slightly sticky and slightly plastic; many fine and medium roots; about 5 percent fragments of fine grained sandstone and siltstone; strongly acid; abrupt wavy boundary.

Bt1—3 to 12 inches; yellowish brown (10YR 5/4) channery silt loam; moderate fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; few distinct clay films on faces of peds; about 15 percent fragments of fine grained sandstone and siltstone; strongly acid; clear wavy boundary.

Bt2—12 to 27 inches; yellowish brown (10YR 5/6) channery silty clay loam; moderate fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; common distinct clay films on faces of peds; about 30 percent fragments of fine grained sandstone and siltstone; very strongly acid; clear wavy boundary.

Bt3—27 to 33 inches; yellowish brown (10YR 5/6) very channery silt loam; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; common distinct clay films on faces of peds; about 40 percent fragments of fine grained sandstone and siltstone; very strongly acid; clear wavy boundary.

Cr—33 inches; fine grained sandstone and siltstone bedrock.

The thickness of the solum ranges from 18 to 36 inches. The depth to bedrock ranges from 20 to 40 inches. The content of sandstone, siltstone, and shale fragments ranges, by volume, from 5 to 40 percent in the solum and from 30 to 70 percent in the C horizon. In unlimed areas reaction is very strongly acid or strongly acid.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. The Bt horizon has hue of 10YR or

7.5YR, value of 5, and chroma of 4 to 8. In the fine-earth fraction, it is silt loam or silty clay loam. The C horizon, if it occurs, has hue of 7.5YR or 10YR, value of 5, and chroma of 4 to 6. In the fine-earth fraction, it is silt loam or loam.

Glenford Series

The Glenford series consists of very deep, moderately well drained soils that formed in stratified, silty glaciolacustrine material. These soils are on terraces along Fishing Creek, near its junction with Little Fishing Creek. Slope ranges from 3 to 8 percent.

Glenford soils are near Vandalia soils. Unlike Glenford soils, Vandalia soils are fine textured and well drained.

Typical pedon of Glenford silt loam, 3 to 8 percent slopes, in a wooded area about 0.78 mile northwest of the junction of Little Fishing Creek and Fishing Creek, near the Wetzel County 4-H camp:

Oi—1 inch to 0; slightly decomposed organic material and leaf litter.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine and medium granular structure; friable, slightly sticky and nonplastic; common fine and medium roots; moderately acid; clear wavy boundary.

BA—2 to 9 inches; yellowish brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; friable, slightly sticky and nonplastic; many fine and medium roots; moderately acid; clear wavy boundary.

Bt1—9 to 17 inches; yellowish brown (10YR 5/6) silty clay loam; common fine strong brown (7.5YR 5/6) mottles; moderate medium and coarse subangular blocky structure; friable, slightly sticky and slightly plastic; few fine and medium roots; few distinct clay films on faces of peds; moderately acid; clear wavy boundary.

Bt2—17 to 31 inches; yellowish brown (10YR 5/4) silty clay loam; many fine light brownish gray (10YR 6/2), grayish brown (10YR 5/2), and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm, slightly sticky and slightly plastic; few fine and very fine roots; common distinct clay films on faces of peds; slightly acid; clear wavy boundary.

Bt3—31 to 38 inches; yellowish brown (10YR 5/4) silt loam; common fine grayish brown (10YR 5/2) and few fine brown (7.5YR 5/4) mottles; moderate medium prismatic structure parting to weak thick platy; firm, slightly sticky and slightly plastic; few fine roots; few distinct clay films on faces of peds; neutral; clear wavy boundary.

BC—38 to 53 inches; brown (10YR 5/3) silt loam; common fine grayish brown (10YR 5/2), brown (7.5YR 5/4), and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to weak thick and very thick platy; friable, slightly sticky and nonplastic; neutral; clear wavy boundary.

C—53 to 65 inches; brown (10YR 5/3) silt loam; common fine grayish brown (10YR 5/2), brown (7.5YR 5/4), and strong brown (7.5YR 5/6) mottles; massive; friable, slightly sticky and nonplastic; neutral.

The thickness of the solum ranges from 30 to 60 inches. The depth to bedrock is more than 60 inches. In unlimed areas reaction is very strongly acid to moderately acid in the upper part of the solum and moderately acid to neutral in the lower part. The substratum is moderately acid to mildly alkaline.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The BA horizon has hue of 10YR, value of 5, and chroma of 4 to 6.

The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. In the fine-earth fraction, it is silt loam or silty clay loam.

The BC and C horizons have hue of 10YR, value of 4 or 5, and chroma of 3 to 6. In the fine-earth fraction, the BC horizon is silt loam or silty clay loam and the C horizon is silt loam, silty clay loam, or loam.

Huntington Series

The Huntington series consists of very deep, well drained soils that formed in alluvial material washed from soils on uplands. The Huntington soils are on flood plains along the Ohio River. They are occasionally flooded in late winter and early spring, before crops are planted. Flood-control structures in areas of the Ohio River have reduced the frequency of flooding on these soils. Slope ranges from 0 to 3 percent.

Huntington soils are near Nolin and Wheeling soils. Unlike Huntington soils, Wheeling soils are fine-loamy and Nolin and Wheeling soils do not have a mollic epipedon.

Typical pedon of Huntington silt loam, in a field of hay about 0.34 mile northwest of the intersection of West Virginia Routes 89 and 2, at Proctor:

Ap1—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak medium granular structure; friable, nonsticky and nonplastic; many fine roots; neutral; clear smooth boundary.

Ap2—7 to 14 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; friable, nonsticky and nonplastic;

common fine roots; slightly acid; clear smooth boundary.

Bw1—14 to 32 inches; dark brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable, slightly sticky and nonplastic; few fine roots; moderately acid; clear wavy boundary.

Bw2—32 to 65 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine and medium subangular blocky structure; friable, slightly sticky and nonplastic; moderately acid.

The thickness of the solum ranges from 50 to 70 inches. The depth to bedrock is more than 60 inches. In some pedons the content of rock fragments is as much as 3 percent, by volume, in individual horizons. In unlimed areas reaction is moderately acid to neutral.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3. The Bw horizon and the C horizon, if it occurs, have hue of 10YR, value of 4 or 5, and chroma of 3 or 4. In the fine-earth fraction, the C horizon is silt loam, loam, or sandy loam. It is stratified in some pedons.

Nolin Series

The Nolin series consists of very deep, well drained soils that formed in alluvial material that washed from soils on uplands. The Nolin soils are on flood plains along streams throughout the survey area. They are occasionally flooded in winter and spring, before crops are planted. Slope ranges from 0 to 3 percent.

Nolin soils are near Elk, Gilpin, Huntington, Peabody, Skidmore, Vandalia, and Wheeling soils. Gilpin, Peabody, Vandalia, and Wheeling soils are not subject to flooding, and Elk soils are flooded less frequently than Nolin soils. Unlike Nolin soils, Skidmore soils are loamy-skeletal, Gilpin soils are fine-loamy, Peabody and Vandalia soils are fine textured, and Huntington soils have a mollic epipedon.

Typical pedon of Nolin loam, in a field along Fishing Creek, about 1.5 miles south of the junction of West Virginia Routes 7 and 20:

Ap—0 to 10 inches; dark brown (10YR 4/3) loam; weak fine and medium granular structure; friable; common very fine and fine roots; moderately acid; abrupt smooth boundary.

Bw—10 to 47 inches; dark brown (10YR 4/3) silt loam; weak fine and medium subangular blocky structure; friable; few very fine roots; moderately acid; gradual smooth boundary.

C1—47 to 57 inches; dark yellowish brown (10YR 4/4) loam; massive; very friable; slightly acid; gradual smooth boundary.

C2—57 to 65 inches; dark yellowish brown (10YR 4/4) sandy loam; single grain; loose; slightly acid.

The thickness of the solum ranges from 40 to 50 inches. The depth to bedrock is more than 60 inches. In some pedons the content of rock fragments is, by volume, as much as 5 percent in the solum and as much as 35 percent in the C horizon. In unlimed areas reaction is moderately acid to neutral.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. The Bw and C horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. In the fine-earth fraction, the C horizon is loam, silt loam, or sandy loam.

Otwell Series

The Otwell series consists of very deep, moderately well drained soils that formed in 20 to 30 inches of loess and mixed alluvium eroded from upland soils underlain by shale, siltstone, and sandstone. The Otwell soils are on terraces along the major streams throughout the survey area. Slope ranges from 3 to 8 percent.

Otwell soils are near Gilpin, Peabody, and Vandalia soils. Unlike Otwell soils, Gilpin, Peabody, and Vandalia soils are well drained and do not have a fragipan, Peabody and Vandalia soils are fine textured, and Gilpin soils are fine-loamy.

Typical pedon of Otwell silt loam, 3 to 8 percent slopes, in a field about 0.47 mile southwest of the intersection of North Fork Road and Barker Run Road, near Barker:

Ap1—0 to 3 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable, slightly sticky and slightly plastic; many very fine roots; strongly acid; abrupt smooth boundary.

Ap2—3 to 10 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; many very fine roots; strongly acid; abrupt smooth boundary.

Bt—10 to 27 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; few very fine roots; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.

Btx1—27 to 40 inches; yellowish brown (10YR 5/6) silt loam; common fine light brownish gray (10YR 6/2) and few fine strong brown (7.5YR 5/8) mottles; moderate very coarse prismatic structure parting to weak thick platy; very firm and brittle, slightly sticky and slightly plastic; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.

Btx2—40 to 51 inches; yellowish brown (10YR 5/8) silt loam; many medium light brownish gray (10YR 6/2) and few fine strong brown (7.5YR 5/8) mottles; moderate very coarse prismatic structure parting to moderate coarse subangular blocky; very firm and brittle, slightly sticky and slightly plastic; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.

C—51 to 65 inches; strong brown (7.5YR 5/6) silt loam; many medium light brownish gray (10YR 6/2) and many fine strong brown (7.5YR 5/8) mottles; massive; friable, slightly sticky and slightly plastic; about 10 percent sandstone fragments; moderately acid.

The thickness of the solum ranges from 40 to 80 inches. The depth to bedrock is more than 60 inches. Depth to the fragipan ranges from 24 to 36 inches. In some pedons the content of rock fragments is, by volume, as much as 5 percent in the fragipan and the BC horizon and as much as 15 percent in the C horizon. In unlimed areas reaction is very strongly acid to moderately acid.

The Ap horizon has hue of 10YR, value of 4 or 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. In the fine-earth fraction, it is silt loam or silty clay loam. The Btx and C horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. In the fine-earth fraction, they are silt loam, silty clay loam, loam, or clay loam.

Peabody Series

The Peabody series consists of moderately deep, well drained soils that formed in material weathered from siltstone and shale. These soils are on ridgetops, benches, and hillsides throughout the survey area. Slope ranges from 15 to 70 percent.

Peabody soils are near Gilpin, Nolin, Otwell, Skidmore, and Vandalia soils. Unlike Peabody soils, Skidmore soils are loamy-skeletal, Gilpin soils are fine-loamy, Nolin and Otwell soils are fine-silty, and Vandalia soils are very deep.

Typical pedon of Peabody silty clay loam, in a wooded area of Gilpin-Peabody complex, 35 to 70 percent slopes, about 100 yards northwest of the intersection of Lowman Ridge Road and the north fork of Richwood Run Road, near Chutes Cemetery, about 1.25 miles south of Kingston:

Oi—1 inch to 0; slightly decomposed organic material.

A—0 to 2 inches; dark brown (7.5YR 4/4) silty clay loam; weak fine granular structure; very friable, slightly sticky and nonplastic; many very fine and fine roots; very strongly acid; clear wavy boundary.

Bt1—2 to 10 inches; reddish brown (5YR 4/4) silty clay loam; moderate medium and coarse subangular blocky structure; friable, sticky and plastic; many fine and medium roots; common distinct clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—10 to 22 inches; dark reddish brown (2.5YR 3/4) silty clay; moderate medium and coarse subangular blocky structure; friable, sticky and plastic; few fine roots; common distinct clay films on faces of peds; very strongly acid; clear wavy boundary.

C—22 to 27 inches; dark reddish brown (2.5YR 3/4) channery silty clay; massive; firm, slightly sticky and slightly plastic; about 30 percent shale and siltstone fragments; very strongly acid; clear wavy boundary.

Cr—27 inches; weathered, red clay shale and siltstone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of weathered siltstone and shale fragments ranges, by volume, from 0 to 15 percent in the A, BE, and Bt1 horizons, from 0 to 25 percent in the Bt2 horizon, and from 15 to 70 percent in the C horizon. In unlimed areas reaction is very strongly acid to slightly acid in the solum and very strongly acid to neutral in the substratum.

The A horizon has hue of 10YR, 7.5YR, or 5YR and value and chroma of 2 to 4. The Bt and C horizons have hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 3 to 6. In the fine-earth fraction, the Bt horizon is silty clay loam, silty clay, or clay and the C horizon is silty clay loam or silty clay.

Skidmore Series

The Skidmore series consists of very deep, well drained soils that formed in mixed alluvial material washed from soils on uplands. The Skidmore soils are on narrow flood plains and on alluvial fans at the mouth of hollows throughout the survey area. They are occasionally flooded on the narrow flood plains and rarely flooded on the alluvial fans. Slope ranges from 0 to 3 percent.

Skidmore soils are near Elk, Gilpin, Nolin, Peabody, and Vandalia soils. Unlike Skidmore soils, Elk and Nolin soils are fine-silty, Peabody and Vandalia soils are fine textured, and Gilpin soils are fine-loamy.

Typical pedon of Skidmore gravelly loam, in a meadow about 100 feet east of State Run, about 0.83 mile south of the junction of Fishing Creek and State Run, near Porters Falls:

Ap—0 to 6 inches; dark brown (10YR 4/3) gravelly loam; weak coarse granular structure; friable, slightly sticky and nonplastic; common fine roots;

about 15 percent sandstone fragments; moderately acid; clear wavy boundary.

Bw—6 to 15 inches; dark brown (10YR 4/3) gravelly loam; moderate medium subangular blocky structure; friable, slightly sticky and nonplastic; common fine roots; about 20 percent sandstone fragments; slightly acid; clear wavy boundary.

BC—15 to 21 inches; dark yellowish brown (10YR 4/4) very gravelly sandy loam; weak very fine subangular blocky structure; very friable, nonsticky and nonplastic; many very fine roots; about 50 percent sandstone fragments; slightly acid; gradual wavy boundary.

C1—21 to 34 inches; dark yellowish brown (10YR 4/4) extremely gravelly sandy loam; massive; very friable, nonsticky and nonplastic; few fine roots; about 65 percent sandstone fragments; slightly acid; gradual wavy boundary.

C2—34 to 65 inches; dark yellowish brown (10YR 4/4) extremely gravelly sandy loam; massive; very friable, nonsticky and nonplastic; about 85 percent sandstone fragments; slightly acid.

The thickness of the solum ranges from 20 to 32 inches. The depth to bedrock is more than 60 inches. The content of sandstone and shale fragments ranges, by volume, from 15 to 25 percent in the A horizon, from 5 to 50 percent in the Bw horizon, and from 35 to 85 percent in the BC and C horizons. By weighted average, the content of rock fragments ranges from 35 to about 60 percent in the control section. In unlimed areas reaction is moderately acid to neutral.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. The Bw horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 to 6. In the fine-earth fraction, it is loam or fine sandy loam. The BC and C horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. In the fine-earth fraction, the BC horizon is sandy loam, loam, or fine sandy loam and the C horizon is loam, fine sandy loam, sandy loam, or clay loam.

Udorthents

Udorthents are deep and very deep, well drained soils in areas that have been disturbed by human activities, mainly along West Virginia Routes 2, 7, and 20; in New Martinsville and Paden City; and along the Ohio River. These soils formed in a mixture of soil material and rock fragments resulting from excavation, filling, or other kinds of earthmoving in areas where roads have been constructed and in urban and industrial areas. Bedrock is exposed in cut areas. Slope ranges from 0 to 70 percent.

A typical pedon of Udorthents is not given because of the variability of these soils. The depth to bedrock is more than 40 inches. Rock fragments vary in kind, size, and amount. The soils have hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 8. In the fine-earth fraction, they are silt loam, loam, silty clay loam, silty clay, or sandy loam. Reaction ranges from extremely acid to slightly acid.

Vandalia Series

The Vandalia series consists of very deep, well drained soils that formed in colluvial material derived from upland soils underlain by shale, siltstone, and sandstone. The Vandalia soils are on colluvial foot slopes and fans. Slope ranges from 15 to 35 percent.

Vandalia soils are near Gilpin, Glenford, Nolin, Otwell, Skidmore, and Peabody soils. Unlike Vandalia soils, Gilpin soils are fine-loamy, Skidmore soils are loamy-skeletal, Otwell, Nolin, and Glenford soils are fine-silty, Skidmore and Nolin soils are subject to flooding, and Peabody soils are moderately deep.

Typical pedon of Vandalia silty clay loam, 15 to 25 percent slopes, in a pasture along Little Fishing Creek, about 125 yards southeast of the junction of West Virginia Route 7 and Steel Run:

Ap—0 to 7 inches; reddish brown (5YR 4/3) silty clay loam; weak fine granular structure; friable, slightly sticky and slightly plastic; many very fine and fine roots; about 5 percent fragments of fine grained sandstone; moderately acid; clear wavy boundary.

Bt1—7 to 14 inches; reddish brown (5YR 4/3) silty clay loam; weak very fine and fine subangular blocky structure; friable, sticky and plastic; many very fine roots; few faint clay films on faces of peds; about 5 percent fragments of fine grained sandstone; moderately acid; clear wavy boundary.

Bt2—14 to 29 inches; reddish brown (5YR 4/3) silty clay loam; moderate medium and coarse subangular blocky structure; firm, sticky and plastic; common very fine roots; common distinct clay films on faces of peds; few black concretions; about 10 percent fragments of fine grained sandstone; moderately acid; gradual wavy boundary.

Bt3—29 to 50 inches; reddish brown (5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm, sticky and plastic; few very fine roots; common distinct clay films on faces of peds; few black concretions; about 10 percent fragments of fine grained sandstone; strongly acid; gradual wavy boundary.

Bt4—50 to 65 inches; reddish brown (5YR 4/4) channery silty clay loam; moderate medium and coarse subangular blocky structure; sticky and plastic; many distinct clay films on faces of peds; few black concretions; about 20 percent fragments of fine grained sandstone; strongly acid.

The thickness of the solum ranges from 40 to 80 inches. The depth to bedrock is more than 60 inches. The content of sandstone, siltstone, and shale fragments ranges, by volume, from 5 to 15 percent in the A horizon, from 5 to 40 percent in individual subhorizons of the B horizon, and from 5 to 50 percent in the C horizon. In unlimed areas reaction is strongly acid to moderately acid in the upper part of the solum and strongly acid to neutral in the lower part and in the substratum.

The Ap horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 2 to 4. The A horizon has hue of 10YR or 7.5YR, value of 3, and chroma of 2. In the fine-earth fraction, it is silty clay loam.

The upper part of the Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The lower part has hue of 5YR, value of 4, and chroma of 3 to 6. In some pedons it has pockets with mottles that have chroma of 2 or less. In the fine-earth fraction, the Bt horizon is silty clay loam or silty clay.

The C horizon, if it occurs, has hue of 5YR, value of 4 to 6, and chroma of 3 to 6. In the fine-earth fraction, it is silty clay loam or silty clay.

Wheeling Series

The Wheeling series consists of very deep, well drained soils that formed in silty or loamy alluvial material and are underlain by sand or sand and gravel below a depth of 40 inches. These soils are on terraces along the Ohio River. Slope ranges from 0 to 8 percent.

Wheeling soils are near Huntington and Nolin soils. Unlike Wheeling soils, Huntington and Nolin soils are subject to flooding.

Typical pedon of Wheeling silt loam, in an area of Wheeling-Urban land complex, 0 to 8 percent slopes, in a field about 300 feet west of West Virginia Route 2, about 1.75 miles north of the junction of West Virginia Route 2 and Williams Run, in New Martinsville:

Ap1—0 to 4 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable, nonsticky and nonplastic; many very fine and fine roots; strongly acid; abrupt smooth boundary.

Ap2—4 to 9 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable, nonsticky and nonplastic; many very fine and fine roots; moderately acid; abrupt smooth boundary.

Bt1—9 to 24 inches; dark yellowish brown (10YR 4/6) silt loam; moderate fine and medium subangular blocky structure; friable, slightly sticky and nonplastic; few fine roots; few distinct clay films on faces of peds; moderately acid; clear wavy boundary.

Bt2—24 to 40 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable, slightly sticky and nonplastic; few fine roots; few distinct clay films on faces of peds; moderately acid; clear wavy boundary.

C1—40 to 54 inches; dark yellowish brown (10YR 4/4) loam; common fine yellowish brown (10YR 5/4) and yellowish red (5YR 5/8) mottles; massive; very friable, nonsticky and nonplastic; strongly acid; clear wavy boundary.

C2—54 to 65 inches; dark yellowish brown (10YR 4/4) fine sandy loam; many fine yellowish brown (10YR 5/4 and 5/6) mottles; massive; very friable, nonsticky and nonplastic; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock is more than 60 inches. The content of rock fragments ranges, by volume, from 0 to 25 percent in the upper 40 inches. In some pedons the substratum has layers of sand and gravel below a depth of 40 inches. These layers have as much as 60 percent gravel, by volume. In unlimed areas reaction is strongly acid to moderately acid.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 3. The Bt and C horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. In the fine-earth fraction, the C horizon is loam, fine sandy loam, loamy sand, or sand. It is stratified in some pedons.

Formation of the Soils

The origin and development of the soils in Wetzel County are explained in this section. The five major factors of soil formation are identified, and their influence on the soils in the county is described. Also, the morphology of the soils is related to horizon nomenclature and the processes of horizon development.

Factors of Soil Formation

The soils in Wetzel County formed as a result of the interaction of five major factors of soil formation—parent material, time, climate, living organisms, and topography. Each factor modifies the effect of the others. Parent material, topography, and time have resulted in the major differences among the soils in the county. Climate and living organisms generally influence soil formation uniformly throughout broad areas.

Parent Material, Time, and Climate

The character of the parent material strongly influences the time required for soil formation and the nature of the soil that forms. The soils in Wetzel County formed in residual, colluvial, and alluvial material. Most formed in material weathered from rocks of the Dunkard Group. Gilpin soils, for example, formed in material weathered from shale, siltstone, and sandstone, and Peabody soils formed in material weathered from siltstone and red clay shale.

The residuum is the oldest parent material in the county. Soil formation has been retarded by clayey material, resistant rock, the slope, and constant erosion. Consequently, the profile of some of the soils that formed in residual material is less well developed than that of some of the soils that formed in younger material.

Colluvial material is along foot slopes and at the head of drainageways. This material moved downslope from areas of acid and limy residual soils. Vandalia soils formed in colluvium below areas of Gilpin and Peabody soils.

The parent material on terraces and flood plains was washed from areas of acid and limy soils on uplands. The soil-forming processes have had considerable time to act on the material on terraces. Many additions, losses, and alterations have taken place. The resulting Glenford, Wheeling, and Otwell soils have a moderately well developed profile.

The alluvium on flood plains is the youngest parent material in the county. Most of this material is well suited to soil formation, but the soil-forming processes have had little time to act. The soils on flood plains generally have a weakly developed profile. Huntington, Nolin, and Skidmore soils are examples.

Climate generally is relatively uniform throughout the county. As a result, it is not responsible for any major differences among the soils in the county. It is a major factor, however, in the development of soil horizons. A detailed description of the climate is given in the section "General Nature of the County."

Living Organisms

Living organisms, including plants, animals, bacteria, and fungi, affect soil formation. The kind and amount of vegetation are generally responsible for the content of organic matter and color of the surface layer and are partly responsible for the content of nutrients. Earthworms and burrowing animals help to keep the soil open and porous. They mix organic material with mineral material by moving soil to the surface. Bacteria and fungi decompose organic matter, thus releasing plant nutrients. They somewhat influence the weathering and decomposition of minerals.

Topography

Topography affects soil formation through its effect on the amount of water moving through the soil, the amount and rate of runoff, and the rate of erosion. Large amounts of water have moved through gently sloping and strongly sloping soils. This movement favors the formation of deep soils that have a moderately well developed or well developed profile. On steep and very steep hillsides, less water moves through the soils and more water runs off the surface. The soil material is washed away almost as rapidly as a soil forms. As a result, the soils on many of the steeper hillsides are shallower over bedrock than the soils on the more gentle slopes.

The topography in Wetzel County favors the formation of soils on flood plains and terraces, and formation is progressing at a rapid rate. The soils on flood plains are weakly developed, however, mainly because too little time has elapsed since the parent material was deposited.

Morphology of the Soils

The results of the soil-forming processes are evident in the different layers, or horizons, in the soil profile. The profile extends from the surface downward to material that has been little changed by the soil-forming processes. Most soils have three major horizons, called the A, B, and C horizons. Subdivisions of these horizons are indicated by numbers and lowercase letters in the horizon designators.

The A horizon is the surface layer. It is the layer that has the maximum accumulation of organic matter.

The B horizon underlies the A horizon and is commonly called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay, iron, aluminum, or other compounds leached from the surface layer. It commonly has blocky structure and generally is firmer and lighter in color than the A horizon.

The C horizon is below the A and B horizons. It consists of material that has been modified by weathering but is little altered by the soil-forming processes.

Many processes have influenced the formation of horizons in the soils of Wetzel County. The more important of these are the accumulation of organic matter, the reduction and transfer of iron, the formation and translocation of clay minerals, and the formation of soil structure. These processes are continuous and have been taking place for thousands of years.

In most of the soils on uplands in the county, the B horizon is yellowish brown, reddish brown, or dark reddish brown, mainly because of iron oxides. The B horizon has blocky structure and translocated clay minerals.

A fragipan has formed in the B horizon of the moderately well drained Otwell soils on terraces. This layer is dense and brittle, is mottled, and is slowly permeable or very slowly permeable. Most fragipans are grayish or are mottled with gray.

Moderately well drained to poorly drained soils commonly have gray colors. These colors are the result of gleying, or the reduction of iron, during soil formation.

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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.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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 40-inch profile or to a limiting layer is expressed as:

Very low	0 to 2.4
Low	2.4 to 3.2
Moderate	3.2 to 5.2
High	more than 5.2

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.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

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 channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

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, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

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.

Forb. Any herbaceous plant not a grass or a sedge.

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.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 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 the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

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 three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

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 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, for example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately 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.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 drawbar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

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). A layer of otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Middlebourne, West Virginia)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	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-----	39.1	19.3	29.2	68	-12	38	3.10	1.78	4.27	9	9.6
February----	42.7	20.8	31.8	70	-10	47	2.83	1.59	3.91	8	6.7
March-------	53.1	29.0	41.1	81	6	157	3.52	2.07	4.81	9	3.4
April-------	65.3	38.0	51.7	87	19	351	3.81	2.66	4.86	10	.3
May---------	74.7	47.2	61.0	90	27	651	4.43	2.67	5.99	10	.0
June--------	82.0	56.4	69.2	94	39	876	3.92	2.13	5.48	8	.0
July--------	84.8	61.1	73.0	95	46	1,023	4.74	2.98	6.32	9	.0
August------	83.8	60.0	71.9	94	44	989	4.74	2.37	6.79	8	.0
September---	78.4	53.1	65.8	93	32	774	3.46	1.84	4.87	7	.0
October-----	67.2	40.0	53.6	85	19	422	2.85	1.42	4.08	7	.0
November----	54.2	31.2	42.7	77	10	136	2.73	1.68	3.66	7	1.4
December----	43.2	23.8	33.5	71	-4	63	3.02	1.76	4.14	9	4.2
Yearly:											
Average---	64.0	40.0	52.0	---	---	---	---	---	---	---	---
Extreme---	---	---	---	97	-14	---	---	---	---	---	---
Total-----	---	---	---	---	---	5,527	43.15	37.79	48.21	101	25.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Middlebourne, West Virginia)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 25	May 8	May 28
2 years in 10 later than--	Apr. 20	May 3	May 21
5 years in 10 later than--	Apr. 10	Apr. 25	May 8
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 19	Oct. 8	Sept. 18
2 years in 10 earlier than--	Oct. 23	Oct. 12	Sept. 25
5 years in 10 earlier than--	Oct. 30	Oct. 21	Oct. 7

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Middlebourne, West Virginia)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	184	161	125
8 years in 10	191	167	134
5 years in 10	202	178	150
2 years in 10	214	188	167
1 year in 10	220	194	175

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
EkB	Elk silt loam, 3 to 8 percent slopes	435	0.2
GpD	Gilpin-Peabody complex, 15 to 25 percent slopes	35,920	15.5
GpE	Gilpin-Peabody complex, 25 to 35 percent slopes	13,450	5.8
GpF	Gilpin-Peabody complex, 35 to 70 percent slopes	151,835	65.7
GrF	Gilpin-Rock outcrop complex, very steep	1,290	0.6
GsB	Glenford silt loam, 3 to 8 percent slopes	105	*
Hn	Huntington silt loam	335	0.1
Hu	Huntington-Urban land complex	320	0.1
No	Nolin loam	2,970	1.3
OtB	Otwell silt loam, 3 to 8 percent slopes	580	0.3
Sk	Skidmore gravelly loam	12,195	5.3
Us	Udorthents, smoothed	715	0.3
VaD	Vandalia silty clay loam, 15 to 25 percent slopes	7,085	3.1
VaE	Vandalia silty clay loam, 25 to 35 percent slopes	1,500	0.6
VbD	Vandalia silty clay loam, 15 to 25 percent slopes, extremely stony	120	0.1
VuD	Vandalia-Urban land complex, 15 to 25 percent slopes	355	0.2
WnB	Wheeling-Urban land complex, 0 to 8 percent slopes	725	0.3
	Water	1,265	0.5
	Total	231,200	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland)

Map symbol	Soil name
EkB	Elk silt loam, 3 to 8 percent slopes
Hn	Huntington silt loam
No	Nolin loam

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Oats	Wheat	Grass-legume hay	Alfalfa hay	Kentucky bluegrass
		Bu	Bu	Bu	Tons	Tons	AUM*
EkB------------- Elk	IIe	125	80	45	4.5	5.0	5.5
GpD**----------- Gilpin-Peabody	IVe	85	60	35	3.0	3.5	4.0
GpE**----------- Gilpin-Peabody	VIe	---	---	---	---	---	3.5
GpF**----------- Gilpin-Peabody	VIIe	---	---	---	---	---	---
GrF**----------- Gilpin-Rock outcrop	VIIs	---	---	---	---	---	---
GsB------------- Glenford	IIe	110	75	40	4.5	4.5	5.0
Hn-------------- Huntington	I	135	80	50	3.5	5.0	5.5
Hu**. Huntington-Urban land							
No-------------- Nolin	IIw	125	75	45	3.5	4.5	5.5
OtB------------- Otwell	IIe	95	60	45	3.0	3.0	4.5
Sk-------------- Skidmore	IIw	70	55	30	3.0	2.5	5.5
Us**. Udorthents							
VaD------------- Vandalia	IVe	90	55	30	2.5	4.0	4.0
VaE------------- Vandalia	VIe	---	---	---	---	---	3.5
VbD------------- Vandalia	VIIs	---	---	---	---	---	---
VuD**. Vandalia-Urban land							
WnB**. Wheeling-Urban land							

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	335	---	---	---
II	16,285	1,015	15,270	---
III	---	---	---	---
IV	43,005	43,005	---	---
V	---	---	---	---
VI	14,950	14,950	---	---
VII	153,245	151,835	---	1,410
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. For map units having slopes of more than 15 percent, site index is given for north aspects. Site index on south aspects will generally be 5 to 10 points lower)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Average annual growth: Cubic feet/ac.	Board feet/ac.	Cords/ac.
EkB------------- Elk	5A	Slight	Slight	Slight	Moderate	Northern red oak----	85	67	285	0.88
						Yellow-poplar-------	91	92	454	1.06
						Cherrybark oak------	95	77	355	1.02
						Pin oak-------------	96	78	362	1.03
						Hackberry-----------	---	---	---	---
						Red maple-----------	---	---	---	---
						American sycamore---	---	---	---	---
						Black walnut--------	---	---	---	---
GpD*:										
Gilpin---------	4R	Moderate	Moderate	Slight	Moderate	Northern red oak----	80	62	250	0.81
						Yellow-poplar-------	95	98	510	1.14
Peabody--------	4R	Moderate	Severe	Slight	Moderate	Northern red oak----	70	52	180	0.67
						White oak-----------	65	48	145	0.60
						Yellow-poplar-------	90	90	440	1.04
GpE*:										
Gilpin---------	4R	Moderate	Moderate	Slight	Moderate	Northern red oak----	80	62	250	0.81
						Yellow-poplar-------	95	98	510	1.14
Peabody--------	4R	Severe	Severe	Slight	Moderate	Northern red oak----	70	52	180	0.67
						White oak-----------	65	48	145	0.60
						Yellow-poplar-------	90	90	440	1.04
GpF*:										
Gilpin---------	4R	Severe	Severe	Slight	Moderate	Northern red oak----	80	62	250	0.81
						Yellow-poplar-------	95	98	510	1.14
Peabody--------	4R	Severe	Severe	Slight	Moderate	Northern red oak----	70	52	180	0.67
						White oak-----------	65	48	145	0.60
						Yellow-poplar-------	90	90	440	1.04
GrF*:										
Gilpin---------	4R	Severe	Severe	Slight	Moderate	Northern red oak----	80	62	250	0.81
						Yellow-poplar-------	95	98	510	1.14
Rock outcrop.										
GsB------------- Glenford	5A	Slight	Slight	Slight	Severe	Northern red oak----	86	68	292	0.89
						Yellow-poplar-------	96	100	524	1.15
						White oak-----------	---	---	---	---
						White ash-----------	---	---	---	---
						Black cherry--------	---	---	---	---
						Sugar maple---------	---	---	---	---
Hn-------------- Huntington	5A	Slight	Slight	Slight	Severe	Northern red oak----	85	67	285	0.88
						Yellow-poplar-------	95	98	510	1.14

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Average annual growth: Cubic feet/ac.	Board feet/ac.	Cords/ac.
No------------- Nolin	5A	Slight	Slight	Slight	Severe	Northern red oak----	85	67	285	0.88
						Yellow-poplar-------	107	119	678	1.36
						Sweetgum------------	92	---	---	---
						Cherrybark oak------	97	79	379	1.05
						Eastern cottonwood--	---	---	---	---
						Black walnut--------	---	---	---	---
						American sycamore---	---	---	---	---
						River birch---------	---	---	---	---
OtB------------ Otwell	3A	Slight	Slight	Slight	Slight	White oak-----------	65	48	145	0.60
						Yellow-poplar-------	---	---	---	---
						Sugar maple---------	---	---	---	---
Sk------------- Skidmore	5F	Slight	Moderate	Moderate	Severe	Northern red oak----	85	67	285	0.88
						Yellow-poplar-------	103	112	622	1.29
						Sweetgum------------	---	---	---	---
						American sycamore---	---	---	---	---
						Cherrybark oak------	---	---	---	---
						River birch---------	---	---	---	---
						Eastern cottonwood--	---	---	---	---
						Blackgum------------	---	---	---	---
						White oak-----------	---	---	---	---
						Black oak-----------	---	---	---	---
						Black walnut--------	---	---	---	---
VaD------------ Vandalia	4R	Severe	Severe	Slight	Severe	Northern red oak----	77	59	236	0.78
						Yellow-poplar-------	90	90	440	1.04
						Virginia pine-------	80	---	---	---
VaE------------ Vandalia	4R	Severe	Severe	Slight	Severe	Northern red oak----	77	59	236	0.78
						Yellow-poplar-------	90	90	440	1.04
						Virginia pine-------	80	---	---	---
VbD------------ Vandalia	4R	Severe	Severe	Slight	Severe	Northern red oak----	77	59	236	0.78
						Yellow-poplar-------	90	90	440	1.04
						Virginia pine-------	80	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--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
EkB: Elk	Severe: flooding.	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
GpD*:					
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Peabody	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
GpE*, GpF*:					
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Peabody	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
GrF*:					
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
GsB: Glenford	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Slight.
Hn: Huntington	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Hu*:					
Huntington	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Urban land	Variable	Variable	Variable	Variable	Variable.
No: Nolin	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
OtB: Otwell	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Sk: Skidmore	Severe: flooding, small stones.	Severe: small stones.	Severe: small stones.	Slight	Severe: small stones.
Us*. Udorthents					
VaD: Vandalia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
VaE------------------- Vandalia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
VbD------------------- Vandalia	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: erodes easily.	Severe: slope.
VuD*:					
Vandalia-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Urban land-----------	Variable--------	Variable--------	Variable--------	Variable--------	Variable.
WnB*:					
Wheeling-------------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Urban land-----------	Variable--------	Variable--------	Variable--------	Variable--------	Variable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
EkB----------------- Elk	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
GpD*:										
Gilpin-------------	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Peabody------------	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
GpE*:										
Gilpin-------------	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Peabody------------	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
GpF*:										
Gilpin-------------	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Peabody------------	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
GrF*:										
Gilpin-------------	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.										
GsB----------------- Glenford	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Hn------------------ Huntington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Hu*:										
Huntington---------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Urban land.										
No------------------ Nolin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OtB----------------- Otwell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Sk------------------ Skidmore	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Us*. Udorthents										

See footnote at end of table.

TABLE 10.--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
VaD----------------- Vandalia	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
VaE----------------- Vandalia	Very poor.	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
VbD----------------- Vandalia	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
VuD*:										
Vandalia-----------	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Urban land.										
WnB*:										
Wheeling-----------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Urban land.										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
EkB: Elk	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Slight.
GpD*, GpE*, GpF*:						
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Peabody	Severe: slope, slippage.	Severe: shrink-swell, slope, slippage.	Severe: slope, shrink-swell, slippage.	Severe: shrink-swell, slope, slippage.	Severe: shrink-swell, slippage, slope, low strength.	Severe: slope.
GrF*:						
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
GsB: Glenford	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.
Hn: Huntington	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Hu*:						
Huntington	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Urban land	Variable	Variable	Variable	Variable	Variable	Variable.
No: Nolin	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
OtB: Otwell	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.
Sk: Skidmore	Moderate: depth to rock, wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: small stones.
Us*. Udorthents						

See footnote at end of table.

TABLE 11.--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
VaD, VaE, VbD----- Vandalia	Severe: slope, slippage.	Severe: shrink-swell, slope, slippage.	Severe: slope, shrink-swell, slippage.	Severe: shrink-swell, slope, slippage.	Severe: low strength, slope, shrink-swell.	Severe: slope.
VuD*:						
Vandalia---------	Severe: slope, slippage.	Severe: shrink-swell, slope, slippage.	Severe: slope, shrink-swell, slippage.	Severe: shrink-swell, slope, slippage.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Urban land-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable.
WnB*:						
Wheeling---------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action, low strength.	Slight.
Urban land-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
EkB: Elk	Moderate: flooding.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
GpD*, GpE*, GpF*:					
Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Peabody	Severe: depth to rock, percs slowly, slope, slippage.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope, slippage.	Poor: depth to rock, too clayey, hard to pack.
GrF*:					
Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Rock outcrop.					
GsB: Glenford	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
Hn: Huntington	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Hu*:					
Huntington	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Urban land	Variable	Variable	Variable	Variable	Variable.
No: Nolin	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey.
OtB: Otwell	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
Sk: Skidmore	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, depth to rock, seepage.	Severe: flooding, seepage, wetness.	Poor: seepage, small stones.
Us*. Udorthents					

See footnote at end of table.

TABLE 12.--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
VaD, VaE, VbD: Vandalia	Severe: slope, percs slowly, slippage.	Severe: slope.	Severe: slope, too clayey, slippage.	Severe: slope, slippage.	Poor: too clayey, hard to pack, slope.
VuD*:					
Vandalia	Severe: slope, percs slowly, slippage.	Severe: slope.	Severe: slope, too clayey, slippage.	Severe: slope, slippage.	Poor: too clayey, hard to pack, slope.
Urban land	Variable	Variable	Variable	Variable	Variable.
WnB*:					
Wheeling	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Slight	Fair: thin layer.
Urban land	Variable	Variable	Variable	Variable	Variable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EkB: Elk	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
GpD*:				
Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Peabody	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope, small stones.
GpE*, GpF*:				
Gilpin	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Peabody	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope, small stones.
GrF*:				
Gilpin	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Rock outcrop.				
GsB: Glenford	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hn: Huntington	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hu*:				
Huntington	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land	Variable	Variable	Variable	Variable.
No: Nolin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
OtB: Otwell	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Sk: Skidmore	Fair: area reclaim.	Improbable: small stones.	Probable	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Us*. Udorthents				
VaD: Vandalia	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, thin layer.
VaE: Vandalia	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, thin layer.
VbD: Vandalia	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, thin layer.
VuD*:				
Vandalia	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, thin layer.
Urban land	Variable	Variable	Variable	Variable.
WnB*:				
Wheeling	Fair: low strength.	Probable	Probable	Fair: small stones.
Urban land	Variable	Variable	Variable	Variable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
EkB: Elk	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
GpD*, GpE*, GpF*:					
Gilpin	Severe: slope.	Severe: thin layer.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Peabody	Severe: slope.	Severe: thin layer.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
GrF*:					
Gilpin	Severe: slope.	Severe: thin layer.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Rock outcrop.					
GsB: Glenford	Moderate: seepage, slope.	Severe: piping.	Frost action, slope.	Erodes easily, wetness.	Erodes easily.
Hn: Huntington	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
Hu*:					
Huntington	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
Urban land	Variable	Variable	Variable	Variable	Variable.
No: Nolin	Severe: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily.
OtB: Otwell	Moderate: slope.	Moderate: thin layer, wetness.	Percs slowly, frost action, slope.	Erodes easily, wetness. slope.	Erodes easily, rooting depth.
Sk: Skidmore	Severe: seepage.	Severe: seepage.	Deep to water	Large stones	Large stones, droughty.
Us*. Udorthents					
VaD, VaE, VbD: Vandalia	Severe: slope, slippage.	Moderate: hard to pack.	Deep to water	Slope, erodes easily.	Slope, erodes easily, percs slowly.
VuD*:					
Vandalia	Severe: slope, slippage.	Moderate: hard to pack.	Deep to water	Slope, erodes easily.	Slope, erodes easily, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
VuD*:					
Urban land	Variable	Variable	Variable	Variable	Variable.
WnB*:					
Wheeling	Moderate: seepage, slope.	Severe: piping.	Deep to water	Favorable	Favorable.
Urban land	Variable	Variable	Variable	Variable	Variable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
EkB-------------- Elk	0-9	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	70-95	25-35	3-10
	9-43	Silty clay loam, silt loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-15
	43-65	Silty clay loam, silt loam, silty clay.	ML, CL, CL-ML, SM-SC	A-4, A-6	0	75-100	50-100	45-100	40-95	25-40	5-15
GpD*, GpE*, GpF*:											
Gilpin----------	0-3	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	3-27	Channery silt loam, channery silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	27-33	Very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Peabody---------	0-2	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	90-100	80-95	35-45	12-20
	2-22	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	75-95	35-55	15-30
	22-27	Extremely channery silty clay loam, very channery silty clay, channery silty clay.	GC, SC	A-6, A-7, A-2	0	50-100	20-45	15-45	15-45	30-55	11-30
	27	Weathered bedrock	---	---	---	---	---	---	---	---	---
GrF*:											
Gilpin----------	0-3	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	3-27	Channery silt loam, channery silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	27-33	Very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
GsB-------------- Glenford	0-9	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	80-100	25-40	4-14
	9-38	Silty clay loam, silt loam.	CL, CL-ML, ML	A-6, A-7, A-4	0	100	100	95-100	80-100	25-45	5-18
	38-65	Silt loam, silty clay loam.	CL, ML, CL-ML	A-6, A-4	0	100	95-100	90-100	75-100	20-40	3-18

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Hn----------------Huntington	0-14	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	14-65	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
Hu*:											
Huntington------	0-14	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	14-65	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
Urban land.											
No----------------Nolin	0-10	Loam-------------	ML	A-4	0	100	95-100	80-95	60-80	<30	NP-7
	10-47	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
	47-65	Loam, silt loam, gravelly loam.	ML, CL, CL-ML, GM	A-4, A-6	0-10	50-100	50-100	40-95	35-95	<30	NP-15
OtB---------------Otwell	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-35	5-15
	10-27	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-40	5-20
	27-65	Silty clay loam, loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	85-100	65-90	35-50	20-30
Sk----------------Skidmore	0-15	Gravelly loam----	GM, SM, ML	A-4, A-2	0-10	60-90	40-85	40-75	25-60	<30	NP-7
	15-65	Gravelly fine sandy loam, very channery sandy loam, very gravelly loam.	GM, GP-GM	A-2, A-1	5-30	35-60	20-50	15-40	10-35	<30	NP-5
Us*. Udorthents											
VaD, VaE---------Vandalia	0-7	Silty clay loam	ML, CL	A-4, A-6, A-7	0-5	80-100	75-100	70-95	50-90	25-45	5-20
	7-50	Silty clay loam, channery silty clay, clay.	CL, CH, ML	A-6, A-7	0-5	75-100	70-95	65-90	60-85	35-55	15-30
	50-65	Silty clay, clay, channery silty clay loam.	CL, CH, ML, MH	A-6, A-7	0-5	70-100	65-100	60-100	55-100	30-55	10-30
VbD---------------Vandalia	0-7	Extremely stony silty clay loam.	ML, CL	A-4, A-6, A-7	15-30	65-95	60-80	55-75	55-65	25-45	5-20
	7-50	Silty clay loam, clay loam, silty clay.	MH, CL, CH, ML	A-6, A-7	0-5	70-100	70-95	65-90	60-85	35-55	15-30
	50-65	Silty clay, clay, silty clay loam.	MH, CH, CL, ML	A-6, A-7	0-5	70-100	65-100	60-100	55-100	30-55	10-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
VuD*:											
Vandalia--------	0-7	Silty clay loam	ML, CL	A-4, A-6, A-7	0-5	80-100	75-100	70-95	50-90	25-45	5-20
	7-50	Silty clay loam, channery silty clay, clay.	CL, CH, ML	A-6, A-7	0-5	75-100	70-95	65-90	60-85	35-55	15-30
	50-65	Silty clay, clay, channery silty clay loam.	CL, CH, ML, MH	A-6, A-7	0-5	70-100	65-100	60-100	55-100	30-55	10-30
Urban land.											
WnB*:											
Wheeling--------	0-40	Silt loam--------	ML, CL, SM, SC	A-4	0	90-100	90-100	85-100	45-90	15-35	NP-10
	40-54	Silty clay loam, loam, gravelly sandy loam.	ML, CL, SM, SC	A-4, A-6	0-5	90-100	70-100	65-100	45-80	20-40	2-20
	54-65	Stratified very fine sand to very gravelly sand.	GM, SM, GP, GW	A-1, A-2, A-3, A-4	10-20	35-90	20-75	10-65	4-45	<20	NP-10
Urban land.											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--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 "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
EkB--------------	0-9	10-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-6.5	Low-----------	0.37	5	.5-3
Elk	9-43	18-34	1.20-1.50	0.6-2.0	0.18-0.22	4.5-6.5	Low-----------	0.28		
	43-65	15-40	1.20-1.50	0.6-2.0	0.14-0.20	5.1-6.5	Low-----------	0.28		
GpD*, GpE*, GpF*:										
Gilpin----------	0-3	15-27	1.20-1.40	0.6-2.0	0.12-0.18	4.5-5.5	Low-----------	0.32	3	.5-4
	3-27	18-35	1.20-1.50	0.6-2.0	0.12-0.16	4.5-5.5	Low-----------	0.24		
	27-33	15-35	1.20-1.50	0.6-2.0	0.08-0.12	4.5-5.5	Low-----------	0.24		
	33	---	---	---	---	---	-------------	----		
Peabody---------	0-2	27-40	1.20-1.50	0.2-0.6	0.12-0.16	4.5-6.5	Moderate-----	0.37	3	.5-3
	2-22	35-50	1.30-1.60	0.06-0.6	0.10-0.14	4.5-6.5	High---------	0.32		
	22-27	27-50	1.30-1.60	0.06-0.6	0.10-0.14	4.5-7.3	High---------	0.32		
	27	---	---	---	---	---	-------------	----		
GrF*:										
Gilpin----------	0-3	15-27	1.20-1.40	0.6-2.0	0.12-0.18	4.5-5.5	Low-----------	0.32	3	.5-4
	3-27	18-35	1.20-1.50	0.6-2.0	0.12-0.16	4.5-5.5	Low-----------	0.24		
	27-33	15-35	1.20-1.50	0.6-2.0	0.08-0.12	4.5-5.5	Low-----------	0.24		
	33	---	---	---	---	---	-------------	----		
Rock outcrop.										
GsB--------------	0-9	15-27	1.30-1.45	0.6-2.0	0.16-0.20	4.5-7.3	Low-----------	0.37	5-4	1-3
Glenford	9-38	18-35	1.45-1.65	0.2-2.0	0.14-0.18	4.5-6.0	Moderate-----	0.43		
	38-65	18-35	1.45-1.65	0.2-0.6	0.13-0.17	5.6-7.8	Low-----------	0.43		
Hn---------------	0-14	18-27	1.10-1.30	0.6-2.0	0.18-0.24	5.6-7.3	Low-----------	0.28	5	3-6
Huntington	14-65	18-30	1.30-1.50	0.6-2.0	0.16-0.22	5.6-7.3	Low-----------	0.32		
Hu*:										
Huntington------	0-14	18-27	1.10-1.30	0.6-2.0	0.18-0.24	5.6-7.3	Low-----------	0.28	5	3-6
	14-65	18-30	1.30-1.50	0.6-2.0	0.16-0.22	5.6-7.3	Low-----------	0.32		
Urban land.										
No---------------	0-10	10-25	1.20-1.40	0.6-2.0	0.14-0.18	5.6-7.3	Low-----------	0.37	5	2-4
Nolin	10-47	18-35	1.25-1.50	0.6-2.0	0.18-0.23	5.6-7.3	Low-----------	0.43		
	47-65	10-30	1.30-1.55	0.6-6.0	0.10-0.23	5.6-7.3	Low-----------	0.43		
OtB--------------	0-10	18-27	1.25-1.40	0.6-2.0	0.22-0.24	4.5-6.0	Low-----------	0.43	4-3	.5-2
Otwell	10-27	22-35	1.30-1.45	0.2-0.6	0.18-0.22	4.5-6.0	Low-----------	0.43		
	27-65	18-30	1.60-1.80	<0.06	0.06-0.08	4.5-6.0	Moderate-----	0.43		
Sk---------------	0-15	7-18	1.20-1.40	2.0-6.0	0.07-0.13	5.6-7.3	Low-----------	0.17	5	<2
Skidmore	15-65	7-18	1.30-1.60	2.0-6.0	0.04-0.10	5.6-7.3	Low-----------	0.17		
Us*.										
Udorthents										
VaD, VaE---------	0-7	27-35	1.20-1.50	0.2-2.0	0.12-0.18	5.1-6.0	Moderate-----	0.37	4	1-3
Vandalia	7-50	35-50	1.30-1.60	0.06-0.6	0.12-0.15	5.1-7.3	High---------	0.32		
	50-65	27-50	1.30-1.60	0.06-0.6	0.08-0.12	5.1-7.3	High---------	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
VbD-------------- Vandalia	0-7	27-35	1.20-1.50	0.2-2.0	0.12-0.18	5.1-6.0	Moderate-----	0.32	4	1-3
	7-50	35-50	1.30-1.60	0.06-0.6	0.12-0.15	5.1-7.3	High---------	0.32		
	50-65	27-50	1.30-1.60	0.06-0.6	0.08-0.12	5.1-7.3	High---------	0.32		
VuD*:										
Vandalia--------	0-7	27-35	1.20-1.50	0.2-2.0	0.12-0.18	5.1-6.0	Moderate-----	0.37	4	1-3
	7-50	35-50	1.30-1.60	0.06-0.6	0.12-0.15	5.1-7.3	High---------	0.32		
	50-65	27-50	1.30-1.60	0.06-0.6	0.08-0.12	5.1-7.3	High---------	0.32		
Urban land.										
WnB*:										
Wheeling--------	0-40	12-20	1.20-1.40	0.6-2.0	0.12-0.18	5.1-6.0	Low----------	0.37	4	1-3
	40-54	18-30	1.30-1.50	0.6-2.0	0.08-0.16	5.1-6.0	Low----------	0.32		
	54-65	8-15	1.30-1.50	6.0-20	0.04-0.08	5.1-6.0	Low----------	0.20		
Urban land.										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding," "water table," and terms such as "rare," "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	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
			Ft			In				
EkB---------------- Elk	B	Rare------------	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
GpD*, GpE*, GpF*:										
Gilpin-----------	C	None------------	>6.0	---	---	20-40	Soft	Moderate	Low------	High.
Peabody----------	D	None------------	>6.0	---	---	20-40	Soft	Moderate	High-----	Moderate.
GrF*:										
Gilpin-----------	C	None------------	>6.0	---	---	20-40	Soft	Moderate	Low------	High.
Rock outcrop.										
GsB--------------- Glenford	C	None------------	2.0-3.5	Perched	Nov-May	>60	---	High-----	Moderate	Moderate.
Hn---------------- Huntington	B	Occasional------	>6.0	---	---	60	---	High-----	Low------	Moderate.
Hu*:										
Huntington-------	B	Occasional------	>6.0	---	---	60	---	High-----	Low------	Moderate.
Urban land.										
No---------------- Nolin	B	Occasional------	3.0-6.0	Apparent	Feb-Mar	>60	---	Moderate	Low------	Moderate.
OtB--------------- Otwell	C	None------------	2.0-3.5	Perched	Jan-Apr	>60	---	High-----	Moderate	High.
Sk---------------- Skidmore	B	Occasional------	3.0-4.0	Apparent	Dec-Mar	>40	Hard	Moderate	Low------	Moderate.
Us*. Udorthents										

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding	High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
			Ft			In				
VaD, VaE, VbD----- Vandalia	D	None------------	4.0-6.0	Perched	Feb-Apr	>60	---	Moderate	High-----	Moderate.
VuD*:										
Vandalia---------	D	None------------	4.0-6.0	Perched	Feb-Apr	>60	---	Moderate	High-----	Moderate.
Urban land.										
WnB*:										
Wheeling---------	B	None------------	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
Urban land.										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Elk	Fine-silty, mixed, mesic Ultic Hapludalfs
Gilpin	Fine-loamy, mixed, mesic Typic Hapludults
Glenford	Fine-silty, mixed, mesic Aquic Hapludalfs
Huntington	Fine-silty, mixed, mesic Fluventic Hapludolls
Nolin	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
Otwell	Fine-silty, mixed, mesic Typic Fragiudalfs
Peabody	Fine, mixed, mesic Ultic Hapludalfs
Skidmore	Loamy-skeletal, mixed, mesic Dystric Fluventic Eutrochrepts
Udorthents	Udorthents
Vandalia	Fine, mixed, mesic Typic Hapludalfs
Wheeling	Fine-loamy, mixed, mesic Ultic Hapludalfs

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