United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
West Virginia Agricultural
and Forestry Experiment
Station

Soil Survey of Lewis County, West Virginia

How To Use This Soil Survey

General Soil Map

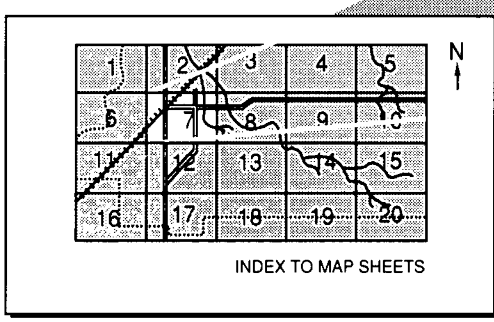
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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.

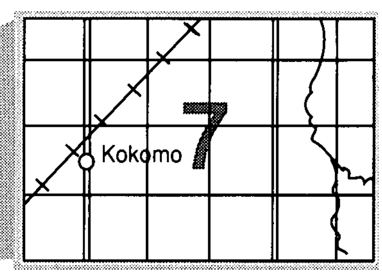
Detailed Soil Maps

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.

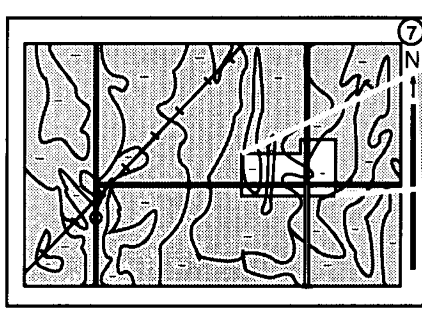


INDEX TO MAP SHEETS

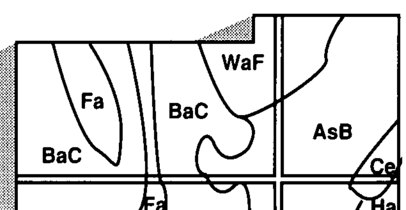


MAP SHEET

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 West Fork 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: The dining hall of the State 4-H Camp at Jackson's Mill, in an area of Monongahela silt loam, 3 to 8 percent slopes.

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Issued October 1995

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Foreword

This soil survey contains information that can be used in land-planning programs in Lewis 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
Natural Resources Conservation Service

Soil Survey of Lewis County, West Virginia

By Roy E. Pyle, Natural Resources Conservation Service

Soils surveyed by Roy E. Pyle and George A. Honchar, 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

LEWIS COUNTY is in the north-central part of West Virginia (fig. 1). It has an area of 249,400 acres, or approximately 390 square miles. In 1980, it had a population of 18,813. Weston, which is along the West Fork River, at the confluence of Stonecoal and Polk Creeks, is the county seat and the largest city in the county.

The first survey of Lewis County was published in 1919 *(4)*. The present survey updates the older one. It provides more information and has larger maps, which show the soils in greater detail.

General Nature of the County

This section provides general information about Lewis County. It describes settlement, farming, transportation facilities and economic enterprises, elevation and drainage, geology, and climate.

Settlement

The first permanent settlement in Lewis County was established in 1769, when John Hacker cleared land and built a cabin near the present village of Berlin. Many of the subsequent settlers came from Virginia, Maryland, and Pennsylvania *(4)*.

On December 18, 1816, Lewis County was established by an act of the Virginia Assembly, 47 years before West Virginia became a state. The county was named in memory of Colonel Charles Lewis. The present boundaries of the county were finalized in 1851.

Farming

In 1982, Lewis County had 346 farms, which made up a total of 85,120 acres *(10)*. Between 1978 and 1982, the number of farms decreased from 379 to 346 and the average size of the farms decreased from 252 to 246 acres. Most of the farms are of the general type. The raising of beef cattle is the most common farming enterprise. Twenty-four farms produce dairy products. Off-farm employment is common. On most of the farms, the narrow flood plains are used for corn or hay, the adjacent hillsides for pasture, and the ridgetops and benches for hay or pasture.

From 1978 to 1982, the acreage used as cropland decreased from 39,378 to 37,236 acres, the acreage used as pasture decreased from 19,423 to 14,058 acres, and the acreage used as woodland decreased from 32,905 to 30,023 acres *(10)*.

Transportation Facilities and Economic Enterprises

Lewis County is served by a network of highways, including Interstate 79; U.S. Routes 19, 33, and 119; and State Routes 1, 4, and 9. Rail service is provided

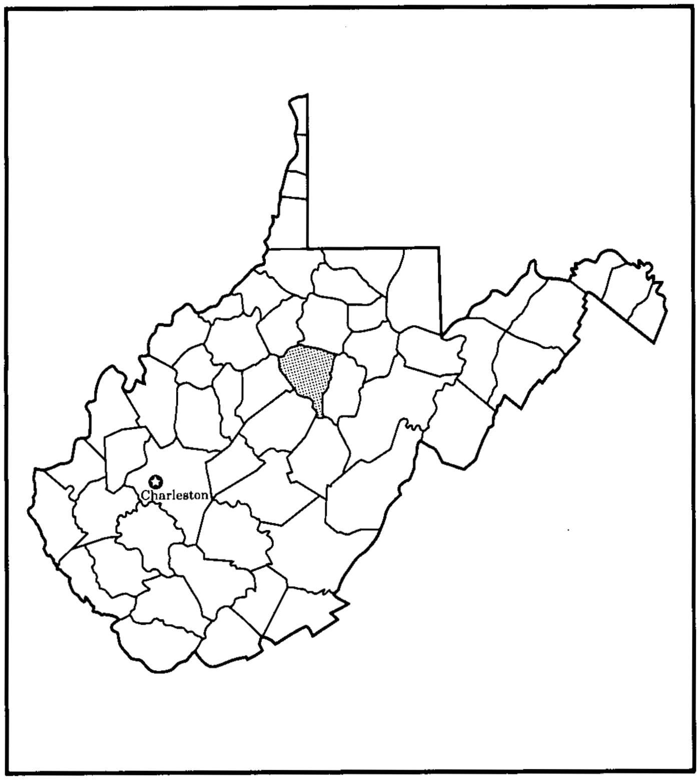

Figure 1.—Location of Lewis County in West Virginia.

by the Chessie System. A small noncommercial airport is directly south of the State 4-H Camp at Jackson's Mill.

The main economic enterprises in the county are farming, coal mining, natural gas and oil production, and timber production.

Elevation and Drainage

Elevation in Lewis County ranges from 760 feet above sea level, in an area where Leading Creek flows into Gilmer County, to 1,950 feet, at the summit of a high knob 1.8 miles northwest of Cleveland, in the southern part of the county. Most of the county is drained by the West Fork River and its tributaries, but the southern part is drained by the Little Kanawha River and its tributaries. The West Fork River flows northward through the center of the county.

Geology

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

All of the surface rocks in Lewis County are sedimentary in origin and consist of sandstone, siltstone, shale, thin layers of limestone, and coal of the Dunkard, Monongahela, and Conemaugh Groups of Pennsylvanian age *(5)*.

A gentle regional dip to the northwest in the county is interrupted by three anticlines and three synclines. The anticlines are Wolf Summit, Chestnut Ridge, and Orlando, and the synclines are Shinnston, Grassland, and Roanoke. The geologic structure results in broad outcrop zones trending from northeast to southwest and accentuated by the larger structures, the Chestnut Ridge Anticline and the Grassland Syncline.

Most of the soils in the county formed in material weathered from rocks of the Dunkard, Monongahela, and Conemaugh Groups. Examples are Gilpin and Upshur soils on ridgetops and side slopes and Vandalia soils on foot slopes. The soils along the West Fork and Little Kanawha Rivers and their tributaries formed in alluvial sediments derived from the soil material and rocks dominating the county. Examples are Hackers, Moshannon, Senecaville, and Sensabaugh soils on flood plains and Monongahela soils on terraces.

Climate

Winters are cold and snowy at the higher elevations in Lewis 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 Weston, West Virginia, in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 32 degrees F and the average daily minimum temperature is 22 degrees. The lowest temperature on record, which occurred at Weston on January 27, 1963, is -18 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 50.23 inches. Of this, about 26 inches, or more than 50 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 23 inches. The heaviest 1-day rainfall during the period of record was 4.7 inches at Weston on July 24, 1951. Thunderstorms occur on about 45 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 55 inches. The greatest snow depth at any one time during the period of record was 19 inches. On the average, 26 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 west. 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 Braxton, Harrison, Upshur, and Webster Counties, West Virginia. 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. Monongahela-Vandalia-Udorthents

Very deep to shallow, nearly level to very steep, well drained and moderately well drained soils; on terraces, foot slopes, and flood plains

This map unit consists of soils along the West Fork River, Hackers Creek, and Stonecoal Creek and their tributaries. The landscape is characterized by wide, nearly level to very steep valleys that have meandering, slow-moving streams (fig. 2). Slope ranges from 0 to 70 percent.

This map unit makes up about 3 percent of the county. It is about 26 percent Monongahela soils, 21 percent Vandalia soils, 19 percent Udorthents, and 34 percent soils of minor extent.

Monongahela soils are very deep, moderately well drained, and gently sloping. They are on terraces. They formed in alluvium washed from soils on uplands. The surface layer is brown and medium textured. The subsoil is yellowish brown and strong brown and is medium textured. In the lower part it is a mottled, moderately slowly permeable or slowly permeable fragipan.

Vandalia soils are very deep, well drained, and gently sloping to steep. They are on foot slopes. They formed in colluvial material that moved downslope from areas of soils on uplands. The surface layer is dark reddish brown and medium textured. The subsoil is reddish brown and dark reddish brown and is fine textured.

Udorthents are very deep to shallow soils consisting of mixed fine-earth material and rock fragments in areas that have been disturbed by excavation, grading, and filling. These soils are on terraces, foot slopes, uplands, and flood plains. The textures and colors of the surface layer and subsoil vary.

Of minor extent in this map unit are Gilpin, Janelew, and Upshur soils on uplands and Chagrin, Hackers, Holly, Lobdell, Moshannon, Senecaville, and Sensabaugh soils on flood plains.

Most of this map unit has been cleared of trees and is used for cultivated crops, hay, pasture, or urban development.

The Monongahela soils have few limitations in the areas where they are used for cultivated crops. In unvegetated areas the hazard of erosion is moderate. The slope and a severe hazard of erosion are the main management concerns in cultivated areas of the Vandalia soils. The Udorthents are unsuited to cultivated crops, hay, and pasture.

This map unit is suitable for trees, but most of the acreage is cleared.

The main limitations affecting community development are as follows: Monongahela soils—a seasonal high water table, moderately slow or slow permeability, and low strength; Vandalia soils—slope, slow permeability, low strength, and slippage. Onsite

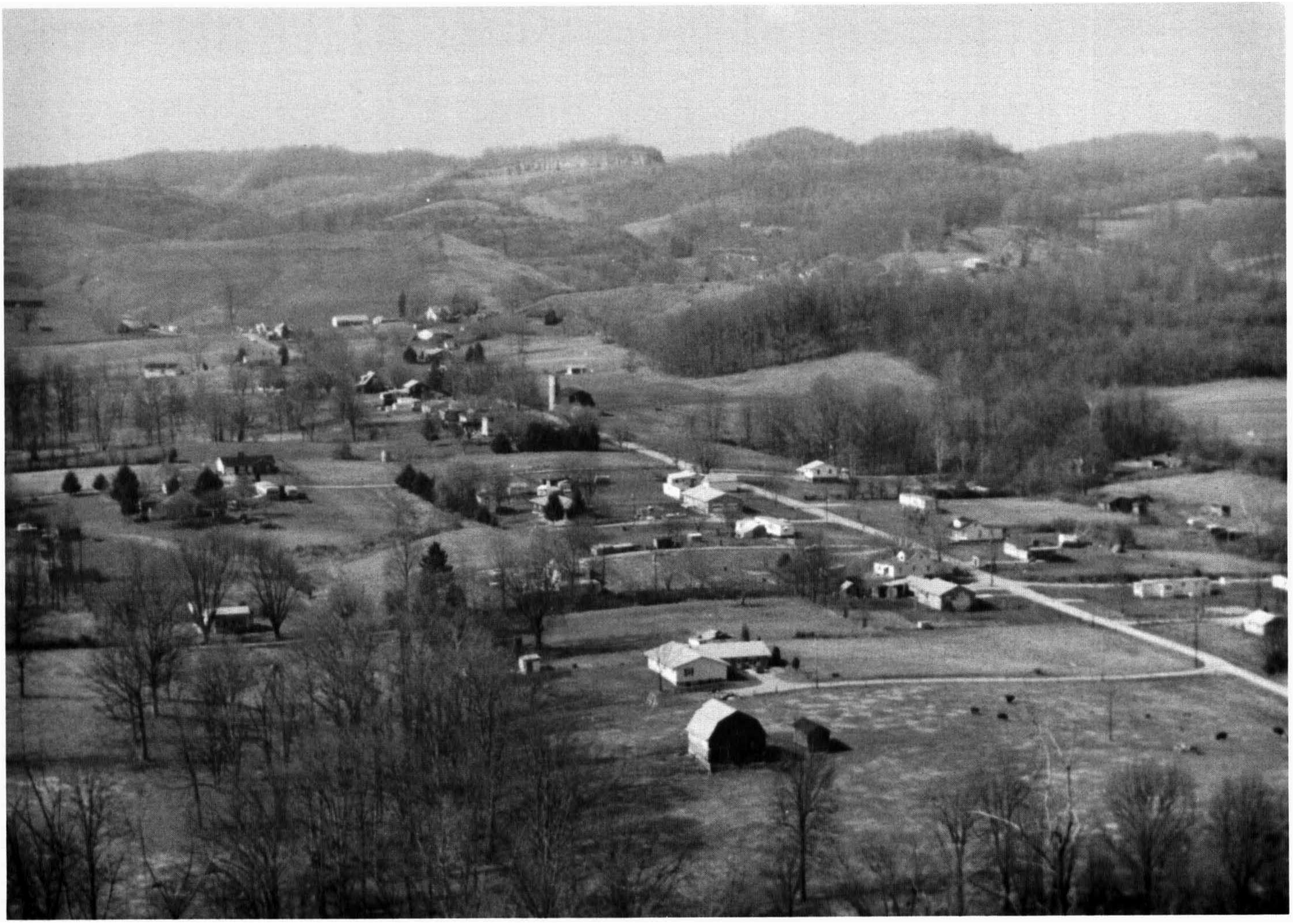

Figure 2.—A typical area of the Monongahela-Vandalia-Udorthents general soil map unit.

investigation is needed to determine the limitations that affect the use of the Udorthents for community development.

2. Gilpin-Upshur-Vandalia

Moderately deep and very deep, gently sloping to very steep, well drained soils; on uplands and foot slopes

This map unit is throughout the county. The landscape is characterized by narrow valleys and rounded hills (fig. 3). It is highly dissected by small drainageways and steep or very steep side slopes. Sandstone rock outcrops and surface stones and boulders are in some areas. Slope ranges from 8 to 70 percent.

This map unit makes up about 92 percent of the county. It is about 38 percent Gilpin soils, 28 percent Upshur soils, 7 percent Vandalia soils, and 27 percent soils of minor extent.

Gilpin soils are moderately deep and are gently sloping to very steep. They are on uplands. They formed in material weathered from interbedded siltstone, shale, and sandstone. The surface layer is dark brown and medium textured. The subsoil is yellowish brown and medium textured.

Upshur soils are very deep and are gently sloping to very steep. They are on uplands. They formed in material weathered from soft, interbedded siltstone and shale. The surface layer is dark reddish brown and medium textured. The subsoil is reddish brown and dark red and is fine textured.

Vandalia soils are very deep and are gently sloping to steep. They are on foot slopes. They formed in colluvial material that moved downslope mainly from areas of Gilpin and Upshur soils. The surface layer is dark reddish brown and medium textured. The subsoil is reddish brown and dark reddish brown and is fine textured.

Of minor extent in this map unit are Janelew and Westmoreland soils on uplands and Holly, Lobdell, and Sensabaugh soils on alluvial fans and flood plains.

About half of this map unit has been cleared of trees and is used for hay, pasture, or urban development.

The Gilpin and Upshur soils on gently sloping to very steep uplands and the Vandalia soils on foot slopes are used extensively for hay or pasture. The soils on steep and very steep side slopes are used for pasture or are reverting to woodland.

More than half of the steep and very steep side slopes are wooded. This map unit is suitable for trees. The slope limits the use of equipment. Erosion and slippage along logging roads and skid trails are major management concerns. Building the roads and trails on the contour helps to control erosion.

The main limitations affecting community development are as follows: Gilpin soils—slope and

Figure 3.—A typical area of the Gilpin-Upshur-Vandalia general soil map unit.

depth to bedrock; Upshur soils—slope, slow permeability, and slippage; Vandalia soils—slope, moderately slow or slow permeability, and slippage.

3. Gilpin-Buchanan-Dekalb

Moderately deep and very deep, gently sloping to very steep, well drained and moderately well drained, very stony soils; on uplands and foot slopes

This map unit is on rugged uplands and foot slopes, mainly in the southern part of the county. The landscape is characterized by rough, mountainous topography. It is a strongly dissected plateau that has narrow ridges and steep or very steep side slopes. Sandstone rock outcrops and surface stones and boulders are common. Slope ranges from 3 to 70 percent.

This map unit makes up about 5 percent of the county. It is about 56 percent Gilpin soils, 11 percent Buchanan soils, 10 percent Dekalb soils, and 23 percent soils of minor extent.

Gilpin soils are moderately deep, well drained, gently sloping to very steep, and very stony. They are on uplands. They formed in material weathered from interbedded siltstone, shale, and sandstone. The surface layer is dark brown and medium textured. The subsoil is yellowish brown and medium textured.

Buchanan soils are very deep, moderately well drained, moderately sloping, and very stony. They are on foot slopes. They formed in colluvial material that moved downslope from areas of soils on uplands. The surface layer is very dark grayish brown and moderately coarse textured. The subsoil is yellowish brown and is medium textured or moderately coarse textured. It is mottled in the lower part.

Dekalb soils are moderately deep, well drained, steep and very steep, and very stony. They are on uplands. They formed in material weathered from interbedded siltstone, shale, and sandstone. The surface layer is very dark gray and moderately coarse textured. The subsoil is light yellowish brown and moderately coarse textured.

Of minor extent in this map unit are Bethesda and Upshur soils on uplands, Vandalia soils on foot slopes, and Holly, Lobdell, and Pope soils on flood plains.

Almost all of the acreage is used as woodland. Because of the slope and the stones on the surface, this map unit is generally unsuited to cultivated crops and cannot be easily managed for pasture.

This map unit is suitable for trees. The slope and the stones on the surface limit the use of equipment. Erosion along logging roads and skid trails is a major management concern. It can be controlled by building the roads and trails on the contour.

The main limitations affecting community development are as follows: Gilpin soils—slope, surface stones, and depth to bedrock; Buchanan soils—slope, a seasonal high water table, slow permeability, and surface stones; Dekalb soils—slope, surface stones, and depth to bedrock.

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 county. 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 silt loam, 8 to 15 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 or soil associations.

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-Upshur silt loams, 15 to 25 percent slopes, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the county, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Gilpin-Dekalb association, very steep, very stony, 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. Rock outcrop is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

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

Soil Descriptions

BrE—Bethesda-Rock outcrop complex, steep, very stony. This map unit consists of a very deep, well drained Bethesda soil intermingled with Rock outcrop. The unit is in areas that have been surface mined for coal, dominantly in the southern and northeastern parts of the county. The Bethesda soil is mainly on side slopes and benches. The Rock outcrop was exposed during mining. Stones that are commonly 1 to 2 feet in diameter cover 1 to 3 percent of the surface. Slopes of the Bethesda soil are dominantly 25 to 35 percent but range from 25 to 70 percent. The Rock outcrop escarpments are nearly vertical.

This map unit is about 15 percent Rock outcrop, 60 percent Bethesda soil, and 25 percent other soils. The Bethesda soil and the Rock outcrop occur as areas so intermingled that it was not practical to map them separately at the scale selected for mapping.

Typically, the surface layer of the Bethesda soil is dark brown channery silt loam about 4 inches thick. The substratum to a depth of 60 inches or more is dark gray very channery silty clay loam and extremely channery silt loam having reddish brown, yellowish brown, and black lithochromic mottles.

Rock outcrop consists of bedrock that was exposed during surface mining. The highwalls are vertical or nearly vertical above the bench floor.

Included in this unit in mapping are areas of the well drained Gilpin, Dekalb, Upshur, and Westmoreland soils. Also included are areas of moderately acid mine soils, areas where stones or boulders cover 15 to 50 percent of the surface, areas of mine refuse dumps, small wet depressional areas on benches, and areas of gently sloping soils.

The available water capacity of the Bethesda soil is very low to moderate. Permeability is moderately slow in the substratum. Runoff is very rapid on out slopes and medium on benches. Natural fertility is low. In unlimed areas the soil is extremely acid to strongly acid. The depth to bedrock is more than 60 inches.

Most of the acreage has not been reclaimed. Some areas have naturally revegetated, and others have been reclaimed by grading and seeding. This unit is not suited to cultivated crops, hay, or pasture.

The potential productivity for trees on the Bethesda soil is moderate. Reclaimed areas have been planted to both conifers and deciduous trees. The planted tree species include Virginia pine, eastern white pine, and some black locust. Aspen and birch have invaded the outer slopes with moderate success. Planting adequate numbers of healthy seedlings that are suited to the soil and planting at the proper time of the year help to establish a desirable stand. Competition from grasses and legumes is moderate. The slope and the bedrock escarpments along mining highwalls restrict the use of logging equipment. Constructing logging roads and skid trails on the contour helps to control erosion.

Onsite investigation is needed to determine the limitations affecting the use of the Bethesda soil for urban development. This soil is generally not suited to urban uses because of the slope, the potential for differential settling, and the stoniness, which makes excavating difficult.

The main limitation affecting most urban uses of the included soils is the slope. Other limitations are the depth to bedrock in Dekalb and Gilpin soils and the shrink-swell potential, low strength, slow permeability in the subsoil, and hazard of slippage in areas of Upshur soils.

The capability subclass is VIIs.

BuC—Buchanan channery loam, 3 to 15 percent slopes, very stony. This is a very deep, moderately well drained soil on foot slopes and around the head of drainageways, dominantly in the southern part of the county. Stones that are commonly 1 to 2 feet in diameter cover 1 to 3 percent of the surface.

Typically, the surface layer is very dark grayish brown and grayish brown channery loam about 6 inches thick. The subsoil extends to a depth of about 53 inches. The upper 3 inches is brown channery loam. The next 7 inches is light yellowish brown channery loam. The next 13 inches is pale brown and light yellowish brown channery loam mottled with light brownish gray, light gray, and strong brown. The lower 24 inches is a firm and brittle fragipan of strong brown very channery loam mottled with light gray and strong brown. The substratum to a depth of 60 inches or more is reddish yellow very channery loam mottled with light gray.

Included with this soil in mapping are a few small areas of the well drained Dekalb, Gilpin, and Pope soils. Also included are well drained soils that formed in material weathered from red shale, poorly drained soils, soils that do not have stones on the surface, soils that are extremely stony or bouldery, soils that have slopes of 15 to 25 percent, and soils that have a fragipan at a depth of more than 40 inches. Included soils make up about 25 percent of this map unit.

The available water capacity is moderate in the Buchanan soil. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Runoff is medium or rapid. Natural fertility is low or medium. In unlimed areas the soil is extremely acid to strongly acid. The seasonal high water table is about 1.5 to 3.0 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 90 percent of the acreage is wooded. This soil is not suited to cultivated crops or hay and cannot be easily managed for pasture.

The potential productivity for trees is moderately high. Constructing logging roads and skid trails on the contour helps to control erosion. The use of equipment is restricted during wet periods because of poor traction. The trees that can be planted for commercial wood production include yellow-poplar, Virginia pine, and eastern white pine.

This soil is not suited to urban uses. It is better suited to woodland and wildlife habitat. The main limitations affecting urban uses are the slope, the stones on the surface, and the restricted permeability in the fragipan.

The main limitations affecting most urban uses of the included soils are the slope and depth to bedrock in areas of Dekalb and Gilpin soils.

The capability subclass is VIs.

BuD—Buchanan channery loam, 15 to 25 percent slopes, very stony. This is a very deep, moderately well drained soil on foot slopes and around the head of drainageways, dominantly in the southern part of the county. Stones that are commonly 1 to 2 feet in diameter cover 1 to 3 percent of the surface.

Typically, the surface layer is very dark grayish brown and grayish brown channery loam about 6 inches thick. The subsoil extends to a depth of about 53 inches. The upper 3 inches is brown channery loam. The next 7 inches is light yellowish brown channery loam. The next 13 inches is pale brown and light yellowish brown channery loam mottled with light brownish gray, light gray, and strong brown. The lower 24 inches is a firm and brittle fragipan of strong brown very channery loam mottled with light gray and strong brown. The substratum to a depth of 60 inches or more is reddish yellow very channery loam mottled with light gray.

Included with this soil in mapping are a few small areas of the well drained Dekalb, Gilpin, and Pope soils. Also included are well drained soils that formed in material weathered from red shale, poorly drained soils, soils that do not have stones on the surface, soils that are extremely stony or bouldery, soils that have a fragipan at a depth of more than 40 inches, and soils that have slopes of less than 15 percent or more than 25 percent. Included soils make up about 25 percent of this map unit.

The available water capacity is moderate in the Buchanan soil. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Runoff is rapid. Natural fertility is low or medium. In unlimed areas the soil is extremely acid to strongly acid. The seasonal high water table is 1.5 to 3.0 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 90 percent of the acreage is wooded. This soil is not suited to cultivated crops or hay and cannot be easily managed for pasture.

The potential productivity for trees is moderately high. Managing the woodland is very difficult. The main management concerns are the hazard of erosion and an equipment limitation caused by the slope. Constructing logging roads and skid trails on the contour helps to control erosion. The use of equipment is restricted during wet periods because of poor traction and low strength. Consequently, timber harvesting is restricted to periods when the soil is dry.

This soil is not suited to urban uses. It is better suited to woodland and wildlife habitat. The main limitations affecting urban uses are the slope, the stones on the surface, and the restricted permeability in the fragipan.

The main limitation affecting most urban uses of the included soils is the slope. The depth to bedrock in Dekalb and Gilpin soils is an additional limitation.

The capability subclass is VIs.

Cn—Chagrin silt loam. This is a very deep, well drained soil on flood plains along the tributaries draining into the Little Kanawha River. About three-fourths of the acreage is along Finks Creek, Leading Creek, Sand Fork, and Clover Fork, and one-fourth is along the smaller tributaries. The soil is occasionally flooded in winter and spring, before crops are planted. Slopes range from 0 to 3 percent.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil is dark brown silt loam about 22 inches thick. The substratum to a depth of 60 inches or more is dark yellowish brown fine sandy loam.

Included with this soil in mapping are a few small areas of the well drained Sensabaugh and Vandalia soils, the moderately well drained Lobdell soils, and the poorly drained Holly soils. Also included are somewhat poorly drained soils, a few small areas of soils that have slopes of 3 to 8 percent, and areas of frequently flooded soils. Included soils make up about 20 percent of this map unit.

The available water capacity of the Chagrin soil is high. Permeability is moderate in the subsoil. Runoff is slow. Natural fertility is high. In unlimed areas the soil 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 corn. Cultivated crops can be grown year after year, but a cover crop is needed to control erosion. Working the residue from the cover crop into the soil helps to maintain fertility and tilth. The flooding in late winter and early spring does not affect crop production. The major 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.

The potential productivity for trees is moderately high. Few limitations affect woodland management, except where access is limited.

The main hazard affecting urban uses is the flooding.

The flooding and restricted access limit the use of this soil as a site for dwellings and septic tank absorption fields. Alternative sites should be selected.

The flooding and restricted access limit the use of this soil as a site for local roads and streets. Constructing the roads and streets on raised fill material helps to prevent the damage to pavement caused by flooding.

The limitations affecting most urban uses of the included soils are occasional flooding on Lobdell and Sensabaugh soils, frequent flooding on Holly soils, the seasonal high water table in Lobdell and Holly soils, and a high shrink-swell potential, low strength, and moderately slow or slow permeability in Vandalia soils.

The capability subclass is IIw.

GaC—Gilpin silt loam, 8 to 15 percent slopes. This is a moderately deep, well drained soil on ridgetops and side slopes throughout the county.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of about 30 inches. The upper 20 inches is yellowish brown silt loam, and the lower 3 inches is yellowish brown channery silt loam. Olive brown, fine grained sandstone and siltstone bedrock is at a depth of about 30 inches.

Included with this soil in mapping are a few small areas of the well drained Dekalb, Upshur, and Westmoreland soils. Also included are soils that are more than 40 inches deep over bedrock, soils that have a subsoil of silty clay, soils that have slopes of 15 to 25 percent or 3 to 8 percent, soils that are stony, soils that are mottled in the lower part of the subsoil and in the substratum, and areas where erosion has removed much of the original surface layer and has exposed the subsoil in places. Included soils make up about 25 percent of this map unit.

The available water capacity of the Gilpin soil is moderate. Permeability is moderate in the subsoil. Runoff is rapid. Natural fertility is low or medium. In unlimed areas the soil is strongly acid to extremely acid. The depth to bedrock is 20 to 40 inches.

Most areas are used for cultivated crops, hay, or pasture. In unvegetated areas erosion is a severe hazard. If cultivated crops are grown, 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 major 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 firm.

The potential productivity for trees is moderately high. Few limitations affect woodland management.

The main limitations affecting the use of this soil as a site for most urban uses are the slope and the depth to bedrock.

The main limitation affecting the use of this soil as a site for dwellings is the slope. Land shaping and grading help to overcome this limitation. The depth to bedrock is a limitation on sites for dwellings with basements. It increases the cost of excavation and construction. Constructing dwellings without basements is a suitable alternative. Designing the dwellings so that they conform to the natural slope of the land minimizes the need for land shaping and helps to control erosion. Revegetating during or soon after construction also helps to control erosion.

The main limitation on sites for septic tank absorption fields is the depth to bedrock. Enlarged lots may include better suited soils. An alternative system may be needed.

The main limitation affecting the use of this soil as a site for local roads and streets is the slope. Laying out the roads and streets on the contour helps to overcome this limitation.

The main limitations affecting most urban uses of the included soils are the slope of Dekalb and Westmoreland soils and the hazard of slippage, shrink-swell potential, and low strength in areas of Upshur soils.

The capability subclass is IIIe.

GaD—Gilpin silt loam, 15 to 25 percent slopes. This is a moderately deep, well drained soil on ridgetops and side slopes throughout the county.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of about 30 inches. The upper 20 inches is yellowish brown silt loam, and the lower 3 inches is yellowish brown channery silt loam. Olive brown, fine grained sandstone and siltstone bedrock is at a depth of about 30 inches.

Included with this soil in mapping are a few small areas of the well drained Bethesda, Dekalb, Janelew, Upshur, and Westmoreland soils. Also included are soils that are more than 40 inches deep over bedrock, soils that have a subsoil of silty clay, soils that are stony, and soils that are mottled in the lower part of the subsoil and in the substratum, soils that have slopes of 3 to 8 percent or 25 to 35 percent, and areas where erosion has removed much of the original surface layer and has exposed the subsoil in places. Included soils make up about 20 percent of this map unit.

The available water capacity of the Gilpin soil is moderate. Permeability is moderate in the subsoil. Runoff is rapid. Natural fertility is low or medium. In unlimed areas the soil is extremely acid to strongly acid. The depth to bedrock is 20 to 40 inches.

Most areas are used for hay or pasture. Some areas are used for cultivated crops. In unvegetated areas erosion is a severe hazard. If cultivated crops are grown, 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 major 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 firm.

The potential productivity for trees is moderately high. Erosion is a hazard on logging roads and skid trails. Laying out the roads and trails on the contour helps to control erosion. The slope limits the use of some equipment.

The main limitation affecting the use of this soil as a site for dwellings is the slope. Land grading and shaping help to overcome this limitation. Erosion is a hazard. Designing the dwellings so that they conform to the natural slope of the land minimizes the need for land shaping and helps to control erosion. Revegetating during or soon after construction also helps to control erosion.

The main limitations affecting the use of this soil as a site for septic tank absorption fields are the slope and the depth to bedrock. Enlarged lots may include better suited soils. An alternative system may be needed.

The main limitation affecting the use of this soil as a site for local roads and streets is the slope. Laying out the roads and streets on the contour helps to overcome this limitation.

The main limitations affecting most urban uses of the included soils are the slope of Dekalb and Westmoreland soils and the hazard of slippage, shrink-swell potential, and low strength in areas of Upshur soils.

The capability subclass is IVe.

GaE—Gilpin silt loam, 25 to 35 percent slopes. This is a moderately deep, well drained soil on side slopes throughout the county.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of about 30 inches. The upper 20 inches is yellowish brown silt loam, and the lower 3 inches is yellowish brown channery silt loam. Olive brown, fine grained sandstone and siltstone bedrock is at a depth of about 30 inches.

Included with this soil in mapping are a few small areas of the well drained Bethesda, Dekalb, Janelew, Upshur, and Westmoreland soils and the moderately well drained Buchanan soils. Also included are soils that are more than 40 inches deep over bedrock, soils that are stony or very stony, soils that are mottled in the lower part of the subsoil and in the substratum, and soils that have slopes of 15 to 25 percent or 35 to 65 percent. Included soils make up about 20 percent of this map unit.

The available water capacity of the Gilpin soil is moderate. Permeability is moderate in the subsoil. Runoff is very rapid. Natural fertility is low or medium. In unlimed areas the soil is extremely acid to strongly acid. The depth to bedrock is 20 to 40 inches.

Most of the acreage is wooded or is reverting to woodland. Some areas are used as pasture. This soil is poorly suited to cultivated crops and hay. In unvegetated areas erosion is a severe hazard. The major management concern in pastured areas is overgrazing. The main management needs 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 firm.

The potential productivity for trees is moderately high. Erosion is a hazard on logging roads and skid trails. Laying out the roads and trails on the contour helps to control erosion. The slope limits the use of some equipment. The trees that can be planted for commercial wood production include yellow-poplar, Virginia pine, and eastern white pine.

This soil is not suited to most urban uses because of the slope. It is better suited to woodland, pasture, and wildlife habitat.

The main limitation affecting most urban uses of the included soils is the slope.

The capability subclass is VIe.

GaF—Gilpin silt loam, 35 to 70 percent slopes. This is a moderately deep, well drained soil on side slopes throughout the county.

Typically, the surface layer is dark brown silt loam about 5 inches thick. The subsoil extends to a depth of about 29 inches. The upper 18 inches is yellowish brown silt loam, and the lower 6 inches is yellowish brown channery silt loam. Olive brown, fine grained sandstone and siltstone bedrock is at a depth of about 29 inches.

Included with this soil is mapping are a few small areas of the well drained Bethesda, Dekalb, Janelew, Upshur, and Westmoreland soils. Also included are soils that are more than 40 inches deep over bedrock, soils that have a subsoil of silty clay, soils that are severely eroded, soils that are stony or very stony, soils that are mottled in the lower part of the subsoil and in the substratum, and soils that have slopes of 25 to 35 percent. Included soils make up about 25 percent of this map unit.

The available water capacity of the Gilpin soil is moderate. Permeability is moderate in the subsoil. Runoff is very rapid. Natural fertility is low or medium. In unlimed areas the soil is extremely acid to strongly acid. The depth to bedrock is 20 to 40 inches.

Most of the acreage is wooded or is reverting to woodland. Some areas are used as pasture. This soil is not suited to cultivated crops or hay and cannot be easily managed for pasture.

The potential productivity for trees is moderately high. Erosion is a hazard on logging roads and skid trails. Laying out the roads and skid trails on the contour helps to control erosion. The slope limits the use of equipment. The trees that can be planted for commercial wood production include yellow-poplar, Virginia pine, and eastern white pine.

This soil is not suited to urban uses because of the slope. It is better suited to woodland and wildlife habitat.

The main limitation affecting most urban uses of the included soils is the slope.

The capability subclass is VIIe.

GDF—Gilpin-Dekalb association, very steep, very stony. These moderately deep, well drained soils are in areas on mountains dominated by interbedded siltstone, shale, and sandstone bedrock. The Gilpin soil is typically on ridgetops and the middle side slopes. The Dekalb soil is typically on the convex upper side slopes and the lower side slopes. Slopes range from 8 to 70 percent. The landscape is dissected by numerous drainageways. Relief ranges from 900 to 1,700 feet. Stones cover 1 to 3 percent of the surface in most areas.

This map unit is about 60 percent Gilpin and similar soils, 25 percent Dekalb and similar soils, and 15 percent minor soils and rock outcrops.

Typically, the surface layer of the Gilpin soil is very dark grayish brown channery silt loam about 4 inches thick. The subsoil extends to a depth of about 30 inches. The upper 10 inches is yellowish brown silt loam, the next 13 inches is strong brown silt loam and channery silt loam, and the lower 3 inches is strong brown very channery silt loam. Bedrock is at a depth of about 30 inches.

Typically, the surface layer of the Dekalb soil is very dark gray channery loam about 4 inches thick. The subsoil extends to a depth of about 29 inches. The upper 8 inches is yellowish brown channery sandy loam and channery loam, and the lower 17 inches is light yellowish brown very channery and extremely channery sandy loam. The substratum is light yellowish brown extremely channery sandy loam. Bedrock is at a depth of about 36 inches.

Included with these soils in mapping are the deep, moderately well drained Buchanan soils on benches, on the lower side slopes, and in coves. These included soils have a dense, brittle fragipan at a depth of 20 to 30 inches. Also included are Bethesda soils in contour surface-mined areas; Pope soils on narrow flood plains; small areas of rock outcrops on some ridgetops and on the upper and lower side slopes; and, in some drainageways in coves, small areas where stones and boulders cover 3 to 15 percent of the surface.

The available water capacity of the Gilpin soil is moderate. Permeability is moderate in the subsoil. Runoff is very rapid. Natural fertility is low or medium. In unlimed areas the soil is extremely acid to strongly acid.

The available water capacity of the Dekalb soil is very low to moderate. Permeability is rapid in the subsoil. Runoff is very rapid. Natural fertility is low. In unlimed areas the soil is strongly acid or very strongly acid.

Most areas are used as woodland. Some areas of the Gilpin soil on ridgetops and the lower slopes are used for hay or pasture. A few areas have been surfaced mined for coal. Because the slope, the stones on the surface, and the hazard of erosion on the Dekalb soil, these soils are unsuited to cultivated crops and hay and cannot be easily managed for pasture.

These soils are suited to deciduous and coniferous trees. The potential productivity for trees is moderately high. Timber stands are dominantly yellow-poplar, cucumbertree, northern red oak, white oak, chestnut oak, red maple, and eastern hemlock. Erosion is a hazard on logging roads and skid trails and in log-loading areas. Laying out the roads and trails on the contour and seeding and mulching bare areas help to control erosion. Special equipment or harvesting techniques that are suitable on steep slopes are needed. Poor harvesting methods can cause very severe erosion in timbered areas.

These soils are suited to woodland wildlife habitat. Many areas are inhabited by a moderate population of turkey, grouse, and squirrel. The whitetail deer population is high because of past timber practices and the reversion of old farmland to timber. In many areas, especially in north-facing coves and on north-facing side slopes, the locally important understory vegetation consists of ramps, ginseng, trillium, mayapple, and ferns.

In most areas these soils are not suited to urban uses because of the slope. Extensive excavation and leveling would be needed on construction sites. Erosion is a very severe hazard in areas where the plant cover is removed.

The capability subclass is VIIs.

GuC—Gilpin-Upshur silt loams, 8 to 15 percent slopes. These well drained soils are on ridgetops and benches throughout most of the county. Erosion has removed one-fourth to one-half of the original surface layer.

This map unit is about 60 percent moderately deep Gilpin soil, 30 percent deep Upshur soil, and 10 percent other soils. The Gilpin and Upshur 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.

Typically, the surface layer of the Gilpin soil is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of about 30 inches. The upper 20 inches is yellowish brown silt loam, and the lower 3 inches is yellowish brown channery silt loam. Olive brown, fine grained sandstone and siltstone bedrock is at a depth of about 30 inches.

Typically, the surface layer of the Upshur soil is dark reddish brown silt loam about 5 inches thick. The subsoil is silty clay about 34 inches thick. The upper 8 inches is reddish brown, and the lower 26 inches is dark red. The substratum to a depth of 60 inches or more is dark red and dark reddish brown silty clay loam and channery silty clay loam.

Included with these soils in mapping are a few small areas of the well drained Bethesda, Janelew, Vandalia, and Westmoreland soils. Also included are a few small areas of soils that are shallower over bedrock than the Gilpin and Upshur soils, soils that have slopes of 15 to 25 percent, and areas where erosion has removed much of the surface layer and has exposed the subsoil in places.

The available water capacity is moderate in the Gilpin soil and moderate or high in the Upshur soil. Permeability is moderate in the subsoil of the Gilpin soil and slow in the subsoil of the Upshur soil. Runoff is rapid on both soils. Natural fertility is low or medium in the Gilpin soil and medium or high in the Upshur soil. In unlimed areas, the Gilpin soil is extremely acid to strongly acid and the Upshur soil is strongly acid to slightly acid in the upper part of the solum, strongly acid or moderately acid in the lower part of the solum, and strongly acid to mildly alkaline in the substratum. The root zone of some plants is restricted by the bedrock at a depth of 20 to 40 inches in the Gilpin soil. In areas of the Upshur soil, the depth to bedrock is 40 to 60 inches, the shrink-swell potential is high in the subsoil, and slippage is a hazard.

Most areas are used for hay or pasture. These soils are suited to cultivated crops. In unvegetated areas erosion is a severe hazard. 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 major 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 Upshur soil is reasonably firm.

The potential productivity for trees is moderate or moderately high. During wet periods poor traction and low strength restrict the use of equipment on the Upshur soil. Erosion is a hazard on logging roads and skid trails. Laying out the roads and trails on the contour helps to control erosion.

The main limitation affecting most urban uses of these soils is the slope. Also, the depth to bedrock is a limitation in the Gilpin soil, and the shrink-swell potential, slow permeability, low strength, and hazard of slippage are limitations in areas of the Upshur soil.

The main limitation affecting the use of these soils as sites for dwellings is the slope. Land shaping and grading help to overcome this limitation. The depth to bedrock in the Gilpin soil is a limitation on sites for dwellings with basements. It increases the cost of excavation and construction. Constructing dwellings without basements is a suitable alternative. The shrink-swell potential of the Upshur soil is a limitation. Widening and reinforcing footings and installing a properly designed surface and subsurface drainage system that removes water from footings and foundations help to prevent the structural damage caused by shrinking and swelling. Erosion is a hazard in areas where the plant cover is removed. Designing the dwellings so that they conform to the natural slope of the land minimizes the need for land shaping and helps to control erosion. Revegetating during or soon after construction also helps to control erosion.

The main limitations on sites for septic tank absorption fields are the depth to bedrock in the Gilpin soil and the slow permeability in the Upshur soil. Enlarged lots may include better suited soils. An alternative system may be needed.

The main limitation affecting the use of these soils as sites for local roads and streets is the slope of the Gilpin soil. Laying out the roads and streets on the contour helps to overcome this limitation. The shrink-swell potential and low strength are limitations in areas of the Upshur soil. Constructing the roads and streets on coarse grained base material and installing collector ditches with cross culverts that remove surface water help to prevent the damage to pavement caused by shrinking and swelling and by low strength.

The main limitation affecting most urban uses of the included soils is the slope. Other limitations are low strength, moderately slow or slow permeability, and the shrink-swell potential in Vandalia soils. The included Westmoreland soils are moderately limited as sites for most urban uses.

The capability subclass is IIIe.

GuD—Gilpin-Upshur silt loams, 15 to 25 percent slopes. These well drained soils are on ridgetops and benches throughout most of the county. Drainageways commonly dissect the benches. In some areas land slips are common. Erosion has removed one-fourth to one-half of the original surface layer.

This map unit is about 55 percent moderately deep Gilpin soil, 35 percent deep Upshur soil, and 10 percent other soils. The Gilpin and Upshur 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.

Typically, the surface layer of the Gilpin soil is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of about 30 inches. The upper 20 inches is yellowish brown silt loam, and the lower 3 inches is yellowish brown channery silt loam. Olive brown, fine grained sandstone and siltstone bedrock is at a depth of about 30 inches.

Typically, the surface layer of the Upshur soil is dark reddish brown silt loam about 4 inches thick. The subsoil is silty clay about 35 inches thick. The upper 8 inches is reddish brown, and the lower 27 inches is dark red. The substratum to a depth of 60 inches or more is dark red and dark reddish brown silty clay loam and channery silty clay loam.

Included with these soils in mapping are a few small areas of the well drained Bethesda, Janelew, Moshannon, Sensabaugh, Vandalia, and Westmoreland soils. Also included are a few small areas of soils that are shallower over bedrock than the Gilpin and Upshur 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 is moderate in the Gilpin soil and moderate or high in the Upshur soil. Permeability is moderate in the subsoil of the Gilpin soil and slow in the subsoil of the Upshur soil. Runoff is rapid on both soils. Natural fertility is low or medium in the Gilpin soil and medium or high in the Upshur soil. In unlimed areas, the Gilpin soil is extremely acid to strongly acid and the Upshur soil is strongly acid to slightly acid in the upper part of the solum, strongly acid or moderately acid in the lower part of the solum, and strongly acid to mildly alkaline in the substratum. The root zone of some plants is restricted by the bedrock at a depth of 20 to 40 inches in the Gilpin soil.

About half of the acreage is wooded. Most areas that have been cleared are used for hay or pasture. These soils are poorly suited to cultivated crops. In unvegetated areas erosion is a severe hazard. 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 major 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 Upshur soil is reasonably firm.

The potential productivity for trees is moderately high. During wet periods poor traction and low strength restrict the use of equipment on the Upshur soil. Erosion is a hazard on logging roads and skid trails. Laying out the roads and trails on the contour helps to control erosion.

The main limitation affecting most urban uses of these soils is the slope. Also, the depth to bedrock is a limitation in the Gilpin soil, and the shrink-swell potential, slow permeability, low strength, and hazard of slippage are limitations in areas of the Upshur soil.

The main limitations affecting the use of these soils as sites for dwellings is the slope. Land shaping and grading help to overcome this limitation. The depth to bedrock in the Gilpin soil is a limitation on sites for dwellings with basements. It increases the cost of excavation and construction. Constructing dwellings without basements is a suitable alternative. Other limitations are the shrink-swell potential and hazard of slippage in areas of the Upshur soil. Widening and reinforcing footings and installing a properly designed surface and subsurface drainage system that removes water from footings and foundations help to prevent the structural damage caused by shrinking and swelling. Diversions and tile drains that remove surface and subsurface water from the building site and properly constructed retaining walls reduce the hazard of slippage. Erosion is a hazard in areas where the plant cover is removed. Designing the dwellings so that they conform to the natural slope of the land minimizes the need for land shaping and helps to control erosion. Revegetating during or soon after construction also helps to control erosion.

The main limitation affecting the use of these soils as sites for septic tank absorption fields is the slope. The depth to bedrock in the Gilpin soil also is a limitation. Other limitations are the slow permeability and hazard of slippage in areas of the Upshur soil. The absorption fields should be installed on the contour. Enlarged lots may include better suited soils. An alternative system may be needed.

The main limitation affecting the use of these soils as sites for local roads and streets is the slope. Laying out the roads and streets on the contour helps to overcome this limitation. Other limitations are the shrink-swell potential, hazard of slippage, and low strength in areas of the Upshur soil. Constructing the roads and streets on coarse grained base material and installing collector ditches with cross culverts that remove surface water help to prevent the damage to pavement caused by shrinking and swelling and by low strength.

The main limitation affecting most urban uses of the included soils is the slope. Other limitations are occasional flooding on Moshannon and Sensabaugh soils and the shrink-swell potential, low strength, moderately slow or slow permeability, and hazard of slippage in areas of Vandalia soils. The included Westmoreland soils are moderately limited as sites for most urban uses.

The capability subclass is IVe.

GuE—Gilpin-Upshur silt loams, 25 to 35 percent slopes. These well drained soils are on hillsides, benches, and narrow ridgetops throughout most of the county. Drainageways commonly dissect the benches. Erosion has removed one-fourth to one-half of the original surface layer. In some areas land slips are common.

This map unit is about 45 percent moderately deep Gilpin soil, 40 percent deep Upshur soil, and 15 percent other soils. The Gilpin and Upshur 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.

Typically, the surface layer of the Gilpin soil is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of about 30 inches. The upper 20 inches is yellowish brown silt loam, and the lower 3 inches is yellowish brown channery silt loam. Olive brown, fine grained sandstone and siltstone bedrock is at a depth of about 30 inches.

Typically, the surface layer of the Upshur soil is dark reddish brown silt loam about 5 inches thick. The subsoil is silty clay about 34 inches thick. The upper 8 inches is reddish brown, and the lower 26 inches is dark red. The substratum to a depth of 60 inches or more is dark red and dark reddish brown silty clay loam and channery silty clay loam.

Included with these soils in mapping are a few small areas of the well drained Bethesda, Janelew, Moshannon, Sensabaugh, Vandalia, and Westmoreland soils. Also included are a few small areas of soils that are shallower over bedrock than the Gilpin and Upshur soils, a few areas where stones cover 1 to 3 percent of the surface, areas of soils that have slopes of less than 25 percent or more than 35 percent, 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 is moderate in the Gilpin soil and moderate or high in the Upshur soil. Permeability is moderate in the subsoil of the Gilpin soil and slow in the subsoil of the Upshur soil. Runoff is very rapid on both soils. Natural fertility is low or medium in the Gilpin soil and medium or high in the Upshur soil. In unlimed areas, the Gilpin soil is extremely acid to strongly acid and the Upshur soil is strongly acid to slightly acid in the upper part of the solum, strongly acid or moderately acid in the lower part of the solum, and strongly acid to mildly alkaline in the substratum. The root zone of some plants is restricted by the bedrock at a depth of 20 to 40 inches in the Gilpin soil. In areas of the Upshur soil, the depth to bedrock is 40 to 60 inches and the shrink-swell potential is high in the subsoil.

About half of the acreage is used as pasture. The rest is woodland or is reverting to woodland. These soils are not suited to hay or cultivated crops. In unvegetated areas erosion is a very severe hazard. The major management concern in pastured areas is overgrazing. The major management needs are proper stocking rates, which help to maintain desirable grasses and legumes; a rotational grazing system; and deferment of grazing in spring until the Upshur soil is reasonably firm.

The potential productivity for trees is moderately high. During wet periods poor traction and low strength restrict the use of equipment on the Upshur soil. Erosion is a hazard on logging roads and skid trails. Laying out the roads and trails on the contour helps to control erosion. The trees that can be planted for commercial wood production include yellow-poplar, Virginia pine, and eastern white pine.

These soils are not suited to most urban uses because of the slope of both soils and the slow permeability, shrink-swell potential, low strength, and hazard of slippage in areas of the Upshur soil. The soils are better suited to pasture, woodland, and wildlife habitat.

The main limitations affecting most urban uses of the included soils are occasional flooding on Moshannon and Sensabaugh soils and the shrink-swell potential, low strength, moderately slow or slow permeability, and hazard of slippage in areas of

Vandalia soils. The included Westmoreland soils are limited mainly by the slope.

The capability subclass is VIe.

GwF3—Gilpin-Upshur silt loams, 35 to 70 percent slopes, severely eroded. These well drained soils are on hillsides and narrow ridgetops throughout most of the county. In many areas the landscape is characterized by a series of narrow, contour benches on hillsides. In some areas land slips are common. Erosion has removed most of the original surface layer and has exposed the subsoil in places.

This map unit is about 50 percent moderately deep Gilpin soil, 35 percent deep Upshur soil, and 15 percent other soils. The Gilpin and Upshur 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.

Typically, the surface layer of the Gilpin soil is dark brown silt loam about 2 inches thick. The subsoil extends to a depth of about 28 inches. The upper 22 inches is yellowish brown silt loam, and the lower 4 inches is yellowish brown channery silt loam. Olive brown, fine grained sandstone and siltstone bedrock is at a depth of about 28 inches.

Typically, the surface layer of the Upshur soil is dark reddish brown silt loam about 2 inches thick. The subsoil extends to a depth of about 32 inches. The upper 5 inches is reddish brown clay, and the lower 25 inches is dark red silty clay. The substratum to a depth of 60 inches or more is dark red and dark reddish brown silty clay loam and channery silty clay loam.

Included with these soils in mapping are a few small areas of the well drained Bethesda, Janelew, Moshannon, Sensabaugh, Vandalia, and Westmoreland soils. Also included are a few small areas of soils that are shallower over bedrock than the Gilpin and Upshur soils, a few areas where stones cover 1 to 3 percent of the surface, and a few areas of escarpments.

The available water capacity is moderate in the Gilpin soil and moderate or high in the Upshur soil. Permeability is moderate in the subsoil of the Gilpin soil and slow in the subsoil of the Upshur soil. Runoff is very rapid on both soils. Natural fertility is low or medium in the Gilpin soil and medium or high in the Upshur soil. In unlimed areas, the Gilpin soil is extremely acid to strongly acid and the Upshur soil is strongly acid to slightly acid in the upper part of the solum, strongly acid or moderately acid in the lower part of the solum, and strongly acid to mildly alkaline in the substratum. The root zone of some plants is restricted by the bedrock at a depth of 20 to 40 inches in the Gilpin soil. In areas of the Upshur soil, the depth to bedrock is 40 to 60 inches and the shrink-swell potential is high in the subsoil.

About three-fourths of the acreage is wooded or is reverting to woodland. The rest is used as pasture. These soils are not suited to cultivated crops or hay. In unvegetated areas erosion is a very severe hazard. The major management concern in pastured areas is overgrazing. The main management needs are a rotational grazing system and deferment of grazing in spring until the Upshur soil is reasonably firm.

The potential productivity for trees is moderately high. During wet periods poor traction and low strength restrict the use of equipment on the Upshur soil. Erosion is a hazard on logging roads and skid trails. Laying out the roads and trails on the contour helps to control erosion. The trees that can be planted for commercial wood production include yellow-poplar, Virginia pine, and eastern white pine.

These soils are not suited to urban uses because of the slope of both soils and the slow permeability, shrink-swell potential, low strength, and hazard of slippage in areas of the Upshur soil (fig. 4). The soils are better suited to woodland and wildlife habitat.

The limitations affecting most urban uses of the included soils are occasional flooding on Moshannon and Sensabaugh soils and the shrink-swell potential, low strength, moderately slow or slow permeability, and hazard of slippage in areas of Vandalia soils. The included Westmoreland soils are limited mainly by the slope.

The capability subclass is VIIe.

Ha—Hackers silt loam. This is a very deep, well drained soil on low terraces and high bottoms along the West Fork River and its major tributaries. The soil is subject to rare flooding. The Stonewall Jackson Dam provides protection from downstream flooding on this soil. The Army Corps of Engineers can provide information about the frequency of flooding. Slopes range from 0 to 3 percent.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil extends to a depth of about 54 inches. It is dark reddish brown silty clay loam. The substratum to a depth of 65 inches or more also is dark reddish brown silty clay loam.

Included with this soil in mapping are the well drained Moshannon soils and the moderately well drained Monongahela and Senecaville soils. Also included are areas of soils that have a surface layer of sandy loam or loam, wet areas, areas where topsoil has been removed, frequently flooded soils, and soils that have more sand in the subsoil than the Hackers soil. Included soils make up about 20 percent of this map unit.

The available water capacity of the Hackers soil is

Figure 4.—Road damage caused by slippage in an area of Gilpin-Upshur silt loams, 35 to 70 percent slopes, severely eroded.

high. Permeability is moderate in the subsoil. Runoff is slow. Natural fertility is high. In unlimed areas the soil is moderately acid or slightly acid. The depth to bedrock is more than 60 inches.

Most areas are used for cultivated crops, mainly corn. Some areas are used for hay or pasture. A small acreage is wooded. Cultivated crops can be grown year after year, but a cover crop is needed to control erosion. Working the residue from the cover crop 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, and a rotational grazing system.

The potential productivity for trees is moderately high. Few limitations affect woodland management.

The main limitations affecting the development of this soil for most urban uses are the flooding and low strength.

The flooding limits the use of this soil as a site for dwellings and septic tank absorption fields. An alternative site in areas where the soils are not subject to flooding should be selected.

The main limitations affecting most urban uses of the included soils are occasional flooding on Moshannon and Senecaville soils and the seasonal high water table in Senecaville and Monongahela soils.

The capability class is I.

JaE—Janelew channery silt loam, steep. This is a very deep, well drained soil on benches, hill slopes, and out slopes in areas that have been surface mined for coal. The soil is almost entirely in the northern half of the county. It formed in a mixture of fine-earth material and highly weathered fragments of mudstone, sandstone, limestone, siltstone, shale, and coal. The fine-earth material is derived from fragments of calcareous mudstone, which have been crushed by machinery or weathered by natural forces. Some areas have naturally revegetated, and other areas have been reclaimed by grading and seeding. The soil is subject to extensive slippage when wet and in areas where slopes are 15 percent or more. Slopes are dominantly 25 to 35 percent but range from 0 to 80 percent.

Typically, the surface layer is dark brown channery silt loam about 3 inches thick. The substratum to a depth of 60 inches or more is brown very channery or extremely channery silty clay loam.

Included with this soil in mapping are small areas of the well drained Gilpin, Upshur, and Westmoreland soils. Also included are small areas of soils that have less clay in the substratum than the Janelew soil, areas of acid mine soils, areas where stones cover 1 to 3 percent of the surface, areas of mine refuse dumps on unreclaimed mine sites, wet depressions, areas where the available water capacity is low, and bedrock escarpments along mining highwalls. Included areas make up about 25 percent of the map unit.

The available water capacity of the Janelew soil is moderate. Permeability is moderate or moderately slow in the substratum. Runoff is slow or medium on bench slopes and rapid or very rapid on out slopes and hill slopes. Natural fertility is medium or high. In unlimed areas the soil is neutral or mildly alkaline in the surface layer and neutral to moderately alkaline in the substratum. The depth to bedrock is more than 60 inches.

Most of the acreage is reclaimed grassland. This soil is not suited to cultivated crops but is suited to hay and pasture. Erosion is a severe hazard in unreclaimed areas, and slippage is a very severe hazard in areas where slopes are 15 percent or more. The soil requires a higher level of management than natural soils. In areas used for hay or pasture, the amount of available soil moisture and the extent of the plant cover are important management considerations. The major management concern in pastured areas is overgrazing, which can result in severe erosion and can deplete the desirable grasses and legumes. Because of a lack of available moisture, compaction, and heat stress, the grasses and legumes cannot easily recover. The main management needs are proper stocking rates, which help to maintain desirable grasses and legumes; a rotational grazing system; applications of fertilizer; and deferment of grazing in the spring until the soil is reasonably firm.

The potential productivity for trees is moderately high. The major management concerns are the hazard of erosion, the hazard of slippage, and seedling mortality. The survival rate of seeds and seedlings is better if competing vegetation is controlled. The slope, large slips, and bedrock escarpments along mining highwalls restrict the use of logging equipment. Because of the hazard of erosion, logging roads and skid trails should be constructed along the old haul roads. They should not be constructed in slip-prone areas. The trees that can be planted for commercial wood production include Virginia pine, eastern white pine, and European black alder.

Onsite investigation is needed to determine the limitations affecting the development of this soil for urban uses.

The main limitation affecting most urban uses of the included soils is the slope. Other limitations are the depth to bedrock in Gilpin soils and the shrink-swell potential, low strength, slow permeability, and hazard of slippage in areas of Upshur soils.

The capability subclass is VIe.

Lh—Lobdell-Holly silt loams. These very deep soils are mainly along the major streams and their tributaries in the northern and western parts of the county. The Lobdell soil is occasionally flooded and moderately well drained. The Holly soil is frequently flooded and poorly drained. It is in meandering stream channels. Many areas are highly dissected by the stream channels. Slopes range from 0 to 3 percent.

This map unit is about 50 percent Lobdell soil, 30 percent Holly soil, and 20 percent other soils. The Lobdell and Holly soils occur as areas so closely intermingled that it was not practical to map them separately at the scale selected for mapping.

Typically, the surface layer of the Lobdell soil is dark brown silt loam about 6 inches thick. The subsoil extends to a depth of about 32 inches. The upper 12 inches is brown silt loam, and the lower 14 inches is brown loam mottled with grayish brown and strong brown. The substratum extends to a depth of 60 inches or more. It is brown and dark gray sandy loam mottled with dark brown, strong brown, and black.

Typically, the surface layer of the Holly soil is very dark gray silt loam about 3 inches thick. The subsoil extends to a depth of about 32 inches. The upper 21 inches is dark gray silt loam mottled with strong brown and red, and the lower 8 inches is dark gray sandy loam mottled with strong brown and yellowish brown. The substratum to a depth of 60 inches or more is dark gray sandy loam and gravelly sandy loam.

Included with these soils in mapping are a few small areas of the well drained Chagrin and Sensabaugh soils. Also included are soils that have a reddish subsoil, soils that have a subsoil of silty clay loam or silty clay, and soils that have received overwash from surface-mined areas.

The available water capacity of the Lobdell soil is high. Permeability is moderate in the subsoil. Runoff is slow. Natural fertility is high. In unlimed areas the soil is moderately acid to slightly acid. The 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.

The available water capacity of the Holly soil is high. Permeability is moderate or moderately slow in the subsoil. Runoff is slow, and water ponds in some areas. Natural fertility is medium or high. In unlimed areas the soil is moderately acid or slightly acid in the surface layer and moderately acid to neutral in the subsoil and substratum. The seasonal high water table is at or near the surface. It restricts the root zone of many plants. The depth to bedrock is more than 60 inches.

Most areas are used for hay or pasture. A small acreage is wooded. The suitability of these soils for cultivated crops, improved hay, and pasture is limited because of wetness. In places diversions help to intercept runoff from the higher adjacent areas. If the surface is disturbed, sediment ponds are needed in downslope areas to prevent the sedimentation of stream channels. Applying a system of conservation tillage, including hay in the cropping sequence, delaying tillage until the soils are reasonably dry, and returning crop residue to the soils help to maintain fertility and tilth. Flooding is a hazard in some cultivated areas. The main management needs in pastured areas are proper stocking rates, which help to maintain desirable grasses and legumes; the selection of water-tolerant pasture plants; a rotational grazing system; and deferment of grazing in spring until the soils are reasonably firm.

The potential productivity for trees is moderately high. The main management concerns are an equipment limitation, seedling mortality, and plant competition. Another management concern is wetness. The use of heavy equipment is restricted to periods when the soils are dry. Seedlings survive and grow well if competing vegetation is controlled.

The flooding, the seasonal high water table, and the potential for frost action are limitations on sites for dwellings, septic tank absorption fields, and local roads and streets. An alternative site in areas where the soils are not subject to flooding and have fewer limitations should be selected.

The main hazard affecting most urban uses of the included soils is occasional flooding on Chagrin and Sensabaugh soils.

The capability subclass is IIIw.

MoB—Monongahela silt loam, 3 to 8 percent slopes. This is a very deep, moderately well drained soil on high terraces along the West Fork River and its major tributaries.

Typically, the surface layer is brown silt loam about 10 inches thick. The subsoil extends to a depth of about 56 inches. The upper 13 inches is yellowish brown silt loam, the next 6 inches is yellowish brown silt loam mottled with strong brown and light brownish gray, and the lower 27 inches is a firm and brittle fragipan of strong brown silt loam mottled with light brownish gray, brown, and yellowish brown. The substratum to a depth of 65 inches or more is strong brown silt loam mottled with light brownish gray and brown.

Included with this soil in mapping are a few small areas of the well drained Hackers soils. Also included are soils that are less than 60 inches deep over bedrock, small areas of somewhat poorly drained soils, and soils that have slopes of 8 to 15 percent. Included soils make up about 20 percent of this map unit.

The available water capacity of the Monongahela soil is moderate or high. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Runoff is medium. Natural fertility is low. In unlimed areas the soil is very strongly acid or strongly acid. The seasonal high water table is about 1.5 to 3.0 feet below the surface. The water table and the fragipan restrict the root zone of some plants. The depth to bedrock is more than 60 inches.

Most areas are used for cultivated crops, mainly corn. A small acreage is wooded. This soil is suited to hay and pasture. In unvegetated areas erosion is a moderate hazard. 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.

The potential productivity for trees is moderately high. Few limitations affect woodland management. Seedlings survive and grow well if competing vegetation is controlled. The use of equipment is restricted during wet periods, when the soil is soft.

The main limitations affecting the development of this soil for most urban uses are the seasonal high water table, low strength, and the moderately slow or slow permeability in the fragipan.

The seasonal high water table is a limitation on sites for dwellings. Installing foundation drains and sealing foundations help to prevent the wetness in basements caused by the seasonal high water table. Erosion is a hazard in areas where the plant cover is removed. Revegetating during or soon after construction helps to control erosion.

The seasonal high water table and the moderately slow or slow permeability in the subsoil are limitations on sites for septic tank absorption fields. Extending the length of the absorption fields and digging wide, deep trenches below the distribution lines help to overcome these limitations.

The seasonal high water table and low strength are limitations on sites 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. Constructing the roads and streets on coarse grained base material helps to prevent the damage to pavement caused by low strength. Installing a subsurface drainage system helps to prevent the damage to roads and streets caused by the seasonal high water table.

The main hazard affecting most urban uses of the included Hackers soils is flooding.

The capability subclass is IIe.

Ms—Moshannon silt loam. This is a very deep, well drained soil on flood plains along the major streams (fig. 5) and the West Fork River. The soil is occasionally flooded. The Stonewall Jackson Dam provides protection from downstream flooding on this soil. The Army Corps of Engineers can provide information about the frequency of flooding. Slopes range from 0 to 3 percent.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil is dark reddish brown silt loam about 35 inches thick. The substratum to a depth of 60 inches or more is reddish brown silt loam.

Included with this soil in mapping are a few small

Figure 5.—An area of Moshannon silt loam along a stream.

areas of the well drained Gilpin, Hackers, Upshur, and Vandalia soils and the moderately well drained Senecaville soils. Also included are poorly drained and somewhat poorly drained soils and soils that have a gravelly subsoil. Included soils make up about 20 percent of this map unit.

The available water capacity of the Moshannon soil is high. Permeability is moderate. Runoff is slow. Natural fertility is high. In unlimed areas the soil is moderately acid to slightly acid in the solum and moderately acid to neutral in the substratum. The depth to bedrock is more than 60 inches.

Most areas are used for cultivated crops, mainly corn. Some areas are used for hay or pasture. A small acreage is wooded. Cultivated crops can be grown year after year, but a cover crop is needed to control erosion. Working the residue from the cover crop into the soil helps to maintain fertility and tilth. Flooding is a hazard during the growing season in some of the areas used for crops. 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.

The potential productivity for trees is moderately high. The main management concern is low strength during wet periods. The use of heavy equipment is restricted to periods when the soil is dry.

The main limitations affecting the development of this soil for most urban uses are the flooding and the potential for frost action.

The flooding is a hazard on sites for dwellings and septic tank absorption fields. An alternative site in areas where the soils are not subject to flooding should be selected.

The flooding and the potential for frost action are limitations on sites for local roads and streets. Constructing the roads and streets on raised fill, over coarse grained base material, helps to prevent the damage to pavement caused by flooding.

The main limitations affecting most urban uses of the included soils are rare flooding on Hackers soils, occasional flooding and the seasonal high water table in areas of Senecaville soils, and low strength and moderately slow or slow permeability in Vandalia soils.

The capability subclass is IIw.

Po—Pope fine sandy loam. This is a very deep, well drained soil on flood plains along the Little Kanawha River and its tributaries. The soil is occasionally flooded. Slopes range from 0 to 3 percent.

Typically, the surface layer is dark yellowish brown fine sandy loam about 8 inches thick. The subsoil is yellowish brown fine sandy loam about 36 inches thick. The substratum to a depth of 60 inches or more is yellowish brown gravelly sandy loam.

Included with this soil in mapping are areas of the moderately well drained Buchanan soils. Also included are soils that have a surface layer and subsoil of loamy sand or sand, soils that are gravelly throughout, and small areas where stones cover 1 to 3 percent of the surface. Included soils make up about 20 percent of this map unit.

The available water capacity of the Pope soil is moderate or high. Permeability is moderate or moderately rapid in the subsoil. Runoff is slow. Natural fertility is medium. In unlimed areas the soil is extremely acid to strongly acid. The depth to bedrock is more than 60 inches.

About half of the acreage is used for hay (fig. 6) or pasture. Some areas are used for corn. About half of the acreage is wooded. This soil is suited to cultivated crops and to hay and pasture. Cultivated crops can be grown year after year, but a cover crop is needed in some areas. Working the residue from the cover crop 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 firm.

The potential productivity for trees is moderately high. The main management concern is flooding. Equipment and logging facilities should not be located on this soil.

The main limitations affecting the development of this soil for most urban uses are the flooding and seepage.

The flooding is a hazard on sites for dwellings and septic tank absorption fields. An alternative site in areas where the soils are not subject to flooding should be selected.

The flooding is a hazard on sites for local roads and streets. Constructing the roads and streets on raised fill, over coarse grained base material, helps to prevent the damage to pavement caused by flooding.

The main limitations affecting the development of the included Buchanan soils for most urban uses are the slope, wetness, surface stones, and slow permeability in a fragipan in the subsoil.

The capability subclass is IIw.

Sn—Senecaville silt loam. This is a very deep, moderately well drained soil on flood plains along the West Fork River and its tributaries. The soil is occasionally flooded. The Stonewall Jackson Dam provides protection from downstream flooding on this soil. The Army Corps of Engineers can provide information about the frequency of flooding. Slopes range from 0 to 3 percent.

Typically, the surface layer is reddish brown silt loam about 7 inches thick. The subsoil extends to a depth of about 35 inches. The upper 14 inches is reddish brown silt loam, and the lower 14 inches is reddish brown silty clay loam mottled with brown and black. The substratum to a depth of 60 inches or more is reddish brown silt loam mottled with brown, black, and strong brown.

Included with this soil in mapping are a few small areas of the well drained Moshannon and Hackers soils. Also included are poorly drained and somewhat poorly drained soils and soils that have a gravelly subsoil. Included soils make up about 25 percent of this map unit.

The available water capacity of the Senecaville soil is high. Permeability is moderate or moderately slow in the subsoil. Runoff is slow. Natural fertility is medium or high. In unlimed areas the soil is moderately acid or slightly acid. The seasonal high water table is about 1.5 to 3.0 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 for hay or pasture. Some areas are used for cultivated crops. A small acreage is

Figure 6.—An area of Pope fine sandy loam used for hay.

wooded. In some areas the suitability for cultivated crops, hay, and pasture is limited by wetness. Cultivated crops can be grown year after year, but a cover crop is needed to control erosion. Working the residue from the cover crop into the soil helps to maintain fertility and tilth. In places crops can be damaged by flooding during the growing season. 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.

The potential productivity for trees is moderately high. Few limitations affect woodland management. The use of equipment is restricted during wet periods, when the soil is soft. Most of the trees on this soil are in woodlots that generally are too small for commercial wood production.

The main limitations affecting the development of this soil for most urban uses are the flooding and the seasonal high water table.

The flooding and the seasonal high water table are limitations on sites for dwellings and septic tank absorption fields. An alternative site in areas where the soils are not wet and are not subject to flooding should be selected.

The flooding and the seasonal high water table are limitations on sites for local roads and streets. The soil is soft when wet. As a result, the pavement may crack when the roads and streets are subject to heavy traffic.

Constructing the roads and streets on raised fill, over coarse grained base material, helps to prevent the damage to pavement caused by flooding. Installing a drainage system helps to prevent the damage caused by the seasonal high water table.

The hazards affecting most urban uses of the included soils are rare flooding on Hackers soils and occasional flooding on Moshannon soils.

The capability subclass is IIw.

Su—Sensabaugh silt loam. This is a very deep, well drained soil on flood plains and alluvial fans throughout the county. The soil is occasionally flooded. Slopes range from 0 to 3 percent.

Typically, the surface layer is dark brown silt loam about 5 inches thick. The subsoil extends to a depth of about 25 inches. The upper 7 inches is strong brown gravelly loam, and the lower 13 inches is dark reddish brown gravelly loam. The substratum extends to a depth of 60 inches or more. The upper 12 inches is dark reddish brown very gravelly silty clay loam, and the lower 28 inches is reddish brown very gravelly silt loam.

Included with this soil in mapping are areas of the well drained Chagrin, Gilpin, Upshur, and Vandalia soils; areas of the moderately well drained Lobdell soils; areas of the poorly drained Holly soils; and areas of soils that are 20 to 40 inches deep over bedrock. Also included, on alluvial fans, are areas of soils that have slopes of 3 to 10 percent and are only rarely flooded. Included soils make up about 25 percent of this map unit.

The available water capacity of the Sensabaugh soil is moderate or high. Permeability is moderate in the upper part of the subsoil and moderately rapid in the lower part. Runoff is slow. Natural fertility is high. In unlimed areas the soil 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. A small acreage is wooded. Flooding occurs mainly in late winter and early spring, but in some areas local flooding damages crops throughout the growing season. Cultivated crops can be grown year after year, but a cover crop is needed to control erosion. Working the residue from the cover crop 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.

The potential productivity for trees is moderately high. The soil is soft during wet periods. As a result, the use of heavy equipment is restricted to periods when the soil is dry.

The flooding is a hazard on sites for dwellings and septic tank absorption fields. An alternative site in areas where the soils are not subject to flooding should be selected.

The flooding is a hazard on sites for local roads and streets. Constructing the roads and streets on raised fill, over coarse grained base material, helps to prevent the damage to pavement caused by flooding.

The main limitations affecting most urban uses of the included soils are occasional flooding on Chagrin and Lobdell soils; frequent flooding on Holly soils; the seasonal high water table in Lobdell and Holly soils; and the shrink-swell potential, moderately slow or slow permeability, hazard of slippage, and low strength in areas of Vandalia soils.

The capability subclass is IIw.

Uf—Udorthents, smoothed. These shallow to very deep, nearly level to very steep, well drained soils formed in a mixture of fine-earth material and rock fragments in areas that have been excavated, graded, or filled. They are mainly along U.S. Route 33 and Interstate 79, in the area of the Stonewall Jackson Dam, and in the towns of Weston and Janelew. Slopes range from 0 to 70 percent. They are generally less than 15 percent.

In a representative profile, the surface layer is dark reddish brown channery silty clay loam about 3 inches thick. The substratum extends to a depth of about 65 inches. The upper 13 inches is strong brown very channery clay loam, and the lower 49 inches is dark reddish brown very channery clay loam.

Included with these soils in mapping are a few small areas of the well drained Gilpin, Moshannon, Upshur, Vandalia, and Westmoreland soils. Also included are areas of soils that are less than 10 inches deep over bedrock. Included soils make up about 15 percent of this map unit.

The available water capacity of the Udorthents is very low to high. Natural fertility is low to high. Runoff is medium or rapid. The depth to bedrock ranges from 0 to more than 6 feet.

Most of the acreage is idle land owned by the State or Federal Government. These soils are not used for cultivated crops, hay, or woodland. The suitability for pasture is limited. The soils are better suited to wildlife habitat than to other uses. Because of the variability of the soils, onsite investigation is necessary to determine the suitability for any proposed use. Removal of the plant cover should be held to a minimum. Establishing a plant cover in unprotected areas and providing for the disposal of surface water help to control erosion and sedimentation.

No capability classification is assigned.

Ur—Udorthents-Urban land complex. This map unit consists of nearly level, very deep, well drained soils intermingled with Urban land. The Udorthents formed in a mixture of fine-earth material and rock fragments in areas that have been excavated, graded, or filled. The unit is on flood plains and terraces in the urban communities of the county, mainly along the West Fork River and its larger tributaries, such as Hackers Creek and Stonecoal Creek. Some low areas are frequently flooded. The Stonewall Jackson Dam provides protection from downstream flooding in areas of this unit. The Army Corps of Engineers can provide information about the frequency of flooding. Slopes range from 0 to 8 percent. They are dominantly 0 to 3 percent.

This map unit is about 30 percent Urban land, 60 percent Udorthents, and 10 percent other soils. The Udorthents and the Urban land occur as areas so closely intermingled that it was not practical to map them separately at the scale selected for mapping.

The Udorthents are in areas covered by material dredged from the adjacent streams, in areas of surface or deep mine spoil, and in areas of cut and fill material from nearby hills.

In a representative profile of the Udorthents, the surface layer is dark reddish brown channery silty clay loam about 3 inches thick. The substratum extends to a depth of about 65 inches. The upper 13 inches is strong brown very channery clay loam, and the lower 49 inches is dark reddish brown very channery 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 areas of the well drained Hackers and Moshannon soils and areas of the moderately well drained Monongahela soils. Also included are poorly drained soils, soils that have slopes of 8 to 15 percent, areas of soil material deposited by erosion, and areas of steeper soils that are subject to slippage. Included soils make up about 15 percent of this map unit.

The available water capacity is very low to high in the Udorthents. Natural fertility is low to high. Runoff is mostly slow or medium. The depth to bedrock ranges from 0 to more than 6 feet.

Most of the acreage is used for recreational areas, such as ball fields, golf courses, and parks, or for urban development. Many open areas are used for lawns or gardens. This map unit is not used for cultivated crops, hay, pasture, or woodland. It is severely limited as a site for urban uses because of the potential for differential settling and the flooding. Onsite investigation is necessary to determine the suitability for any proposed use. Removal of the plant cover should be held to a minimum. Establishing a plant cover in unprotected areas and providing for the disposal of surface water help to control erosion and sedimentation.

No capability classification is assigned.

VaC—Vandalia silt loam, 8 to 15 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 Upshur soils. It is throughout most of the county. Some areas are dissected by drainageways. Land slips and water seeps are common in some areas. In places severe erosion has removed about one-fourth of the surface soil.

Typically, the surface layer is dark reddish brown silt loam about 9 inches thick. The subsoil extends to a depth of about 40 inches. The upper 10 inches is reddish brown silty clay loam, the next 16 inches is reddish brown silty clay, and the lower 5 inches is dark reddish brown silty clay loam. The substratum to a depth of 60 inches or more is dark red channery silty clay loam.

Included with this soil in mapping are areas of the well drained Chagrin, Moshannon, Sensabaugh, Gilpin, and Upshur soils. Also included are areas of soils that have a surface layer of silty clay loam, soils that have slopes of 3 to 8 percent, stony soils, bouldery soils, colluvial soils underlain by bedrock at a depth of less than 4 feet, soils that have a yellowish brown subsoil, and poorly drained soils. Included soils make up about 20 percent of this map unit.

The available water capacity of the Vandalia soil is moderate or high. Permeability is moderately slow or slow in the subsoil. Runoff is rapid. Natural fertility is medium or high. In unlimed areas the soil is strongly acid or moderately acid in the surface layer and subsoil and strongly acid to neutral in the substratum. The depth to bedrock is more than 60 inches. The shrink-swell potential is high in the subsoil. The soil is subject to slippage.

About one-half of the acreage is used for hay or pasture. The rest is woodland. In unvegetated areas erosion is a severe hazard. In cultivated areas 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 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.

The potential productivity for trees is moderately high. Erosion is a hazard on logging roads and skid trails. Laying out the roads and trails on the contour helps to control erosion. During wet periods poor traction and low strength restrict the use of equipment. The use of heavy equipment is restricted to periods when the soil is dry. The trees that can be planted for commercial wood production include yellow-poplar, Virginia pine, and eastern white pine.

The main limitations affecting the development of this soil for most urban uses are the slope, the shrink-swell potential, the moderately slow or slow permeability, low strength, and the hazard of slippage. The soil is better suited to pasture, hay, and woodland.

The slope, the shrink-swell potential, low strength, and the hazard of slippage are limitations on sites for dwellings, septic tank absorption fields, and local roads and streets. Water seeps and land slips are common, and disturbing the surface increases the hazard of slippage.

The limitations affecting most urban uses of the included soils are the depth to bedrock and slope in areas of Gilpin soils; occasional flooding on Moshannon and Sensabaugh soils; and the slope, slow permeability, low strength, shrink-swell potential, and hazard of slippage in areas of Upshur soils.

The capability subclass is IIIe.

VaD—Vandalia silt 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 Upshur soils. It is throughout most of the county. Some areas are dissected by drainageways. Land slips and water seeps are common in some areas. In places severe erosion has removed about one-fourth of the surface soil.

Typically, the surface layer is dark reddish brown silt loam about 9 inches thick. The subsoil extends to a depth of about 40 inches. The upper 10 inches is reddish brown silty clay loam, the next 16 inches is reddish brown silty clay, and the lower 5 inches is dark reddish brown silty clay loam. The substratum to a depth of 60 inches or more is dark red channery silty clay loam.

Included with this soil in mapping are areas of the well drained Chagrin, Moshannon, Sensabaugh, Gilpin, and Upshur soils. Also included are areas of soils that have a surface layer of silty clay loam, stony soils, bouldery soils, severely gullied soils, colluvial soils underlain by bedrock at a depth of less than 4 feet, soils that have a yellowish brown subsoil, and soils that have slopes of 8 to 15 percent or 25 to 35 percent. Included soils make up about 25 percent of this map unit.

The available water capacity of the Vandalia soil is moderate or high. Permeability is moderately slow or slow in the subsoil. Runoff is rapid. Natural fertility is medium or high. In unlimed areas the soil is strongly acid or moderately acid in the surface layer and subsoil and strongly acid to neutral in the substratum. The depth to bedrock is more than 60 inches. The shrink-swell potential is high in the subsoil. The soil is subject to slippage.

About one-half of the acreage is used for hay or pasture. The rest is woodland. In unvegetated areas erosion is a severe hazard. In cultivated areas 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 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.

The potential productivity for trees is moderately high. Erosion is a hazard on logging roads and skid trails. Laying out the roads and trails on the contour helps to control erosion. During wet periods the use of equipment is restricted by poor traction and low strength. The use of heavy equipment is restricted to periods when the soil is dry. The trees that can be planted for commercial wood production include yellow-poplar, Virginia pine, and eastern white pine.

The main limitations affecting the development of this soil for most urban uses are the slope, the shrink-swell potential, the moderately slow or slow permeability, low strength, and the hazard of slippage. The soil is better suited to pasture, hay, and woodland.

The slope, the shrink-swell potential, low strength, and the hazard of slippage are limitations on sites for dwellings, septic tank absorption fields, and local roads and streets. Water seeps and land slips are common, and disturbing the surface increases the hazard of slippage.

The limitations affecting most urban uses of the included soils are the depth to bedrock and slope in areas of Gilpin soils; occasional flooding on Moshannon and Sensabaugh soils; and the slope, slow permeability, low strength, shrink-swell potential, and hazard of slippage in areas of Upshur soils.

The capability subclass is IVe.

VaE—Vandalia silt 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 Upshur soils. It is throughout most of the county. Some areas are dissected by drainageways. Land slips and water seeps are common in some areas. In places severe erosion has removed about one-fourth of the surface soil.

Typically, the surface layer is dark reddish brown silt loam about 7 inches thick. The subsoil extends to a depth of about 38 inches. The upper 10 inches is reddish brown silty clay loam, the next 16 inches is reddish brown silty clay, and the lower 5 inches is dark reddish brown silty clay loam. The substratum to a depth of 60 inches or more is dark red channery silty clay loam.

Included with this soil in mapping are areas of the well drained Chagrin, Moshannon, Sensabaugh, Gilpin, and Upshur soils. Also included are areas of soils that have a surface layer of silty clay loam, stony soils, bouldery soils, very severely eroded soils, colluvial soils underlain by bedrock at a depth of less than 4 feet, soils that have a yellowish brown subsoil, and soils that have slopes of 15 to 25 percent. Included soils make up about 25 percent of this map unit.

The available water capacity of the Vandalia soil is moderate or high. Permeability is moderately slow or slow in the subsoil. Runoff is very rapid. Natural fertility is medium or high. In unlimed areas the soil is strongly acid to moderately acid in the surface layer and subsoil and strongly acid to neutral in the substratum. The depth to bedrock is more than 60 inches. The shrink-swell potential is high in the subsoil. The soil is subject to slippage.

Almost all of the acreage is used as woodland, and about 10 percent is used as pasture. This soil is not suitable for cultivated crops or hay. 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.

The potential productivity for trees is moderately high. The main management concerns are the hazard of erosion and an equipment limitation caused by the slope. During wet periods the use of equipment is restricted by poor traction and low strength. Consequently, timber harvesting is restricted to periods when the soil is dry. Laying out logging roads on the contour helps to control erosion. The trees that can be planted for commercial wood production include black walnut, yellow-poplar, Virginia pine, and eastern white pine.

The main limitations on sites for dwellings, septic tank absorption fields, and local roads and streets are the slope, low strength, the shrink-swell potential, the hazard of slippage, the moderately slow or slow permeability, and in some areas surface stones. Water seeps and land slips are common, and disturbing the surface increases the hazard of slippage. The soil is better suited to woodland and wildlife habitat.

The limitations affecting most urban uses of the included soils are the depth to bedrock and slope in areas of Gilpin soils; occasional flooding on Moshannon and Sensabaugh soils; and the slope, slow permeability, low strength, shrink-swell potential, and hazard of slippage in areas of Upshur soils.

The capability subclass is VIe.

WuE3—Westmoreland-Upshur complex, 25 to 35 percent slopes, severely eroded. These well drained soils are on hillsides, benches, and narrow ridgetops in the northeastern part of the county. Drainageways commonly dissect the benches and hillsides. Land slips are common in some areas. Erosion has removed most of the original surface layer and has exposed the subsoil in places.

This map unit is about 50 percent deep Westmoreland soil, 35 percent very deep Upshur soil, and 15 percent other soils. The Westmoreland and Upshur 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.

Typically, the surface layer of the Westmoreland soil is very dark grayish brown silt loam about 4 inches thick. The subsoil extends to a depth of about 36 inches. The upper 6 inches is strong brown silt loam, the next 11 inches is strong brown channery silty clay loam, the next 6 inches is reddish yellow channery silty clay loam, and the lower 9 inches is strong brown silt loam. The substratum is yellowish brown very channery loam. Shale and sandstone bedrock is at a depth of about 54 inches.

Typically, the surface layer of the Upshur soil is dark reddish brown silt loam about 5 inches. The subsoil is silty clay about 34 inches thick. The upper 8 inches is reddish brown, and the lower 26 inches is dark red. The substratum to a depth of 60 inches or more is dark red and dark reddish brown silty clay loam and channery silty clay loam.

Included with these soils in mapping are a few small areas of the well drained Bethesda, Gilpin, Janelew, Moshannon, Sensabaugh, and Vandalia soils. Also included are a few small areas of soils that are shallower over bedrock than the Westmoreland and Upshur soils, a few areas where stones cover 1 to 3 percent of the surface, areas of soils that have slopes of less than 25 percent or more than 35 percent, a few areas of escarpments, and areas where erosion has not removed most of the original surface layer.

The available water capacity is moderate or high in the Westmoreland soil and moderate or high in the Upshur soil. Permeability is moderate in the subsoil of the Westmoreland soil and slow in the subsoil of the Upshur soil. Runoff is very rapid on both soils. Natural fertility is medium or high. The Westmoreland soil is very strongly acid to moderately acid. The Upshur soil is strongly acid to slightly acid in the upper part of the solum, strongly acid or moderately acid in the lower part of the solum, and strongly acid to mildly alkaline in the substratum. The depth to bedrock in the Westmoreland soil is 40 to 60 inches. In areas of the Upshur soil, the depth to bedrock is more than 60 inches and the shrink-swell potential is high in the subsoil.

About three-fourths of the acreage is woodland or is reverting to woodland. About one-fourth is used as pasture. These soils are not suited to cultivated crops or hay and cannot be easily managed for pasture. They are best suited to woodland and wildlife habitat. In unvegetated areas erosion is a severe hazard. Overgrazing is the major management concern in pastured areas. The main management needs are proper stocking rates, which help to maintain desirable grasses and legumes; a rotational grazing system; and deferment of grazing in spring until the Upshur soil is reasonably firm.

The potential productivity for trees is moderately high. In unvegetated areas erosion is a very severe hazard. Seeding bare areas to a permanent plant cover helps to control erosion. During wet periods poor traction and low strength restrict the use of equipment on the Upshur soil. Erosion is a hazard on logging roads and skid trails. Laying out the roads and trails on the contour helps to control erosion. The trees that can be planted for commercial wood production include yellow-poplar, Virginia pine, and eastern white pine.

These soils are not suited to most urban uses. The main limitations are the slope of both soils and the slow permeability, shrink-swell potential, low strength, and hazard of slippage in areas of the Upshur soil.

The main limitations affecting most urban uses of the included soils are occasional flooding on Moshannon and Sensabaugh soils and the shrink-swell potential, low strength, moderately slow or slow permeability, and hazard of slippage in areas of Vandalia soils.

The capability subclass is VIIe.

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 8,070 acres in the survey area, or more than 3 percent of the total acreage, meets the soil requirements for prime farmland. This land is mainly in the northern part of the county.

The map units in the survey area 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 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 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 soil tests and analyses.

The content of organic matter is low in most of the cultivated 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 and controlling weeds by applications of chemicals rather than by tillage help 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 in the county 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, no-till farming or other kinds of conservation tillage, 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, 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.

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.

About 168,300 acres in Lewis County, or more than 67 percent of the total acreage, is used as woodland. The wooded areas range from small woodlots on farms to large tracts owned by corporations. About half of the wooded areas are old fields that have reverted to trees that have grown to pole and sawtimber size.

The common forest types, or natural associations of tree species, and their percentages in the wooded tracts, are the oak-hickory type, about 56 percent; the maple-beech type, 27 percent; other hardwoods, 15 percent; and pine and other softwood types, 2 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 *(6)*.

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

Jim Hill, district conservationist, Natural Resources Conservation Service, helped prepare this section.

The major recreational activities in Lewis County are hunting and water sports. The county consistently ranks among the top counties in West Virginia for hunting.

Water sports include fishing, swimming, and waterskiing. Two major lakes, Stonecoal Lake and Stonewall Jackson Lake, provide more than 3,000 acres of surface water for these activities. Approximately 18,000 acres managed by the West Virginia Department of Natural Resources is available for hunting, hiking, and nature study. Other recreational activities in the county are horseback riding, camping, and boating.

The county operates recreational facilities, including an Olympic-size pool, tennis and volleyball courts, and a miniature golf course. A nine-hole golf course is approximately 2 miles northwest of Weston, near Deerfield.

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.

Lewis County has a large and varied population of wildlife. The most common game species are wild turkey, ruffed grouse, mourning dove, gray squirrel, fox squirrel, and cottontail rabbit. An extremely large population of white-tailed deer is throughout the county. A variety of furbearers inhabit the county in harvestable numbers. The lakes, ponds, and streams in the county support increasing numbers of waterfowl.

The nongame species that inhabit the county include numerous raptors, wood warblers, and other songbirds. Several species of reptiles and amphibians inhabit many areas.

The kinds and quantities of wildlife that inhabit a given area are determined by land use and vegetative type. Since more than 67 percent of the county is forested, the wildlife species that rely on deciduous forests for food and cover tend to dominate. Openland species, such as meadowlark and cottontail rabbit, are generally restricted to the better agricultural bottom land. If the openland in the county continues to revert to forest, such species as bobwhite quail will decrease in number while such species as turkey will increase.

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, 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, irrigation, 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.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone and by soil reaction.

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 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 county. 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 Entisol.

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 Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

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 Fluvaquents (*Fluv*, meaning flood plain, plus *aquent*, the suborder of the Entisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fluvaquents.

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, nonacid, mesic Typic Fluvaquents.

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 county 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 county 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."

Bethesda Series

The Bethesda series consists of very deep, well drained soils that formed in acid regolith derived from the surface mining of coal. The regolith is a mixture of partly weathered fine-earth material, fragments of sandstone, siltstone, and mudstone, and small amounts of coal. These soils are on benches, hill slopes, and out slopes in the southern and southeastern parts of the county. Slope ranges from 25 to 70 percent.

Bethesda soils are near Gilpin, Dekalb, Upshur, and Westmoreland soils. The nearby soils did not form in regolith derived from surface mining.

Typical pedon of Bethesda channery silt loam, in an area of Bethesda-Rock outcrop complex, steep, very stony, on a strip-mine bench, 4,200 feet north of the junction of County Routes 54 and 54/1, about 1,050 feet west of Fallen Timber Run:

A—0 to 4 inches; dark brown (10YR 4/3) channery silt loam; common fine and medium reddish brown, yellowish brown, and black lithochromic mottles; moderate fine granular and subangular blocky structure; friable; common fine and medium roots; about 20 percent channers (80 percent sandstone, 15 percent mudstone, and 5 percent shale); strongly acid; abrupt smooth boundary.

C1—4 to 16 inches; dark gray (10YR 4/1) very channery silty clay loam; common fine and medium reddish brown, yellowish brown, and black lithochromic mottles; massive; firm; few fine roots; about 40 percent channers (75 percent mudstone, 15 percent sandstone, 5 percent shale, and 5 percent coal); very strongly acid; clear wavy boundary.

C2—16 to 65 inches; variegated extremely channery silt loam that is 60 percent dark gray (10YR 4/1) and 40 percent gray (10YR 6/1); common fine and medium brown, reddish brown, yellowish brown, and black lithochromic mottles; massive; friable; about 70 percent channers (80 percent mudstone, 10 percent sandstone, and 10 percent coal); very strongly acid.

The depth to bedrock is more than 60 inches. The content of mudstone, sandstone, siltstone, and coal fragments, mostly less than 10 inches in size, ranges, by volume, from 15 to 80 percent in individual horizons but averages more than 35 percent in the particle-size control section. Some pedons have stones and boulders. In most pedons some or all horizons have brown, red, yellow, or black lithochromic mottles. In unlimed areas reaction is extremely acid to strongly acid.

The A horizon has hue of 7.5YR, 10YR, or 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 8.

The C horizon has hue of 7.5YR, 10YR, 2.5Y, or 5Y or is neutral in hue. It has value of 3 to 6 chroma of 0 to 8. The fine-earth material is loam, silt loam, clay loam, or silty clay loam.

Buchanan Series

The Buchanan series consists of very deep, moderately well drained soils that formed in acid colluvial material that moved downslope from soils on uplands. The Buchanan soils are on foot slopes, along drainageways, on benches, and in coves, mainly in the southern part of the county. Slope ranges from 3 to 25 percent.

Buchanan soils are near Dekalb, Gilpin, and Pope soils. Unlike Buchanan soils, Dekalb and Gilpin soils are moderately deep and do not have a fragipan and Pope soils are occasionally flooded.

Typical pedon of Buchanan channery loam, 15 to 25 percent slopes, very stony, 5,300 feet east of the junction of County Routes 50 and 50/6, about 20 feet north of County Route 50/6, in a wooded area:

Oi—3 inches to 1 inch; slightly decayed hardwood leaf litter.

Oa—0 to 1 inch; highly decayed hardwood leaf litter.

A—1 to 3 inches; very dark grayish brown (10YR 3/2) channery loam; weak fine granular structure; very friable; many fine and medium roots; about 20 percent rock fragments; very strongly acid; abrupt wavy boundary.

E—3 to 6 inches; grayish brown (10YR 5/2) channery loam; weak fine granular structure; very friable; many fine and medium roots; about 30 percent rock fragments; very strongly acid; abrupt wavy boundary.

BE—6 to 9 inches; brown (10YR 5/3) channery loam; weak fine subangular blocky structure; friable; many fine and medium roots; about 20 percent rock fragments; very strongly acid; abrupt wavy boundary.

Bt1—9 to 16 inches; light yellowish brown (10YR 6/4) channery loam; moderate fine and medium subangular blocky structure; friable; many fine and medium roots; few faint clay films on faces of peds; about 15 percent rock fragments; very strongly acid; clear wavy boundary.

Bt2—16 to 22 inches; pale brown (10YR 6/3) channery loam; common medium yellowish brown (10YR 5/8), few medium grayish brown (10YR 5/2), and common fine light brownish gray (2.5Y 6/2) mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; few faint clay films on faces of peds; about 30 percent rock fragments; very strongly acid; clear wavy boundary.

Bt3—22 to 29 inches; light yellowish brown (10YR 6/4) channery loam; many fine strong brown (7.5YR 5/8) and common fine light gray (10YR 7/2) mottles; weak medium subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; about 20 percent rock fragments; very strongly acid; clear wavy boundary.

Bx—29 to 53 inches; strong brown (7.5YR 5/6) very channery loam; common medium light gray (10YR 7/1) mottles; few black (N 2/0) films; moderate very coarse prismatic structure parting to weak platy; firm and brittle; about 40 percent rock fragments; very strongly acid; clear wavy boundary.

C—53 to 65 inches; reddish yellow (7.5YR 6/6) very channery loam; common fine light gray (10YR 7/1) mottles; few black (N 2/0) films; massive; firm; about 45 percent rock fragments; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock is more than 60 inches. Depth to the fragipan ranges from 20 to 36 inches. The content of sandstone, siltstone, and shale fragments ranges, by volume, from 5 to 30 percent above the fragipan, from 10 to 50 percent in the fragipan, and from 40 to 60 percent in the C horizon. In unlimed areas reaction is extremely acid to strongly acid.

The A and E horizons have hue of 10YR, value of 3 to 5, and chroma of 1 to 4. The fine-earth material in the E horizon is loam or silt loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 6. The fine-earth material is loam, sandy clay loam, or clay loam.

The Bx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 8. The fine-earth material is loam or clay loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 6. The fine-earth material is loam, sandy clay loam, or clay loam.

Chagrin Series

The Chagrin series consists of very deep, well drained soils that formed in alluvial material that washed from soils on uplands. The Chagrin soils are on nearly level flood plains and low terraces along the major streams in the county. They are occasionally flooded in winter and spring, before crops are planted. Slope ranges from 0 to 3 percent.

Chagrin soils are near Sensabaugh, Lobdell, and Holly soils. Unlike Chagrin soils, Sensabaugh soils have a gravelly subsoil and substratum, Lobdell soils are moderately well drained, and Holly soils are very poorly drained.

Typical pedon of Chagrin silt loam, in a field of hay, about 150 feet south of U.S. Route 33 and 250 feet west of the junction of U.S. Route 33 and County Route 119/4:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam; weak fine and medium granular structure; friable; many fine and common medium roots; slightly acid; abrupt smooth boundary.

Bw—6 to 28 inches; dark brown (7.5YR 4/4) silt loam; weak coarse and medium subangular blocky structure; friable; common fine roots; slightly acid; clear wavy boundary.

C—28 to 65 inches; dark yellowish brown (10YR 4/4) fine sandy loam; massive; friable; few fine roots; slightly acid.

The thickness of the solum ranges from 24 to 40 inches. The depth to bedrock is more than 60 inches. The content of sandstone, shale, and siltstone fragments ranges from 0 to 10 percent, by volume, throughout the profile. In unlimed areas reaction is moderately acid or slightly acid in the A horizon and moderately acid to neutral in the B and C horizons.

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

The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The fine-earth material is silt loam or loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6. The fine-earth material is sandy loam, fine sandy loam, loam, or silt loam and can be stratified.

Dekalb Series

The Dekalb series consists of moderately deep, well drained soils that formed in acid material weathered from sandstone and some interbedded siltstone and shale. These soils are on ridgetops, benches, and hillsides in the southern part of the county. Slope ranges from 35 to 70 percent.

Dekalb soils are near Gilpin, Bethesda, and Buchanan soils. Gilpin soils have a lower content of rock fragments in the solum than the Dekalb soils. Unlike Dekalb soils, Gilpin soils are fine-loamy, Buchanan soils are very deep and have a fragipan, and Bethesda soils have been disturbed by surface mining.

Typical pedon of Dekalb channery loam, in a wooded area of Gilpin-Dekalb association, very steep, very stony, 900 feet southwest of the intersection of County Routes 50 and 50/7:

Oi—1 inch to 0; slightly decayed hardwood leaf litter.

Oa—0 to 2 inches; highly decayed hardwood leaf litter.

A—2 to 4 inches; very dark gray (10YR 3/1) channery loam; weak fine granular structure; very friable; about 20 percent rock fragments; many fine roots; very strongly acid; abrupt wavy boundary.

Bw1—4 to 6 inches; yellowish brown (10YR 5/6) channery sandy loam; weak fine subangular blocky structure; very friable; about 30 percent rock fragments; many fine and medium roots; very strongly acid; clear wavy boundary.

Bw2—6 to 12 inches; yellowish brown (10YR 5/6) channery loam; weak fine subangular blocky structure; friable; few fine and common medium roots; about 30 percent rock fragments; very strongly acid; clear wavy boundary.

Bw3—12 to 23 inches; light yellowish brown (10YR 6/4) extremely channery sandy loam; moderate medium subangular blocky structure; friable; common medium roots; about 60 percent rock fragments; very strongly acid; clear wavy boundary.

BC—23 to 29 inches; light yellowish brown (10YR 6/4) very channery sandy loam; weak fine subangular blocky structure; friable; few medium roots; about 55 percent rock fragments; very strongly acid; clear irregular boundary.

C—29 to 36 inches; light yellowish brown (10YR 6/4) extremely channery sandy loam; massive; friable; few medium roots; about 80 percent rock fragments; very strongly acid; gradual irregular boundary.

R—36 inches; fractured, gray and brown sandstone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of sandstone fragments and of some siltstone and shale fragments ranges, by volume, from 15 to 60 percent in the solum and from 50 to 90 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 2 or 3, and chroma of 1 or 2.

The Bw and BC horizons have hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. The fine-earth material is loam, fine sandy loam, or sandy loam.

The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. The fine-earth material is sandy loam or loamy sand.

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 county. Slope ranges from 8 to 70 percent.

Gilpin soils are near Bethesda, Buchanan, Dekalb, Upshur, Westmoreland, and Vandalia soils. Unlike Gilpin soils, Dekalb soils are loamy-skeletal, Upshur and Vandalia soils are clayey, Westmoreland soils are deep, Buchanan soils have a fragipan in the subsoil, and Bethesda soils have been disturbed by surface mining.

Typical pedon of Gilpin silt loam, in a pastured area of Gilpin-Upshur silt loams, 25 to 35 percent slopes, 5,400 feet southwest of the junction of County Routes 23 and 24 and 6,200 feet northeast of the junction of the West Fork River and County Route 44:

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine and medium roots; about 5 percent rock fragments; moderately acid; abrupt smooth boundary.

Bt1—7 to 14 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; many fine and medium roots; about 5 percent rock fragments; few faint clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—14 to 27 inches; yellowish brown (10YR 5/8) silt loam; moderate medium subangular blocky structure; firm; common faint clay films on faces of peds; many fine roots; about 10 percent rock fragments; very strongly acid; clear wavy boundary.

BC—27 to 30 inches; yellowish brown (10YR 5/6) channery silt loam; weak coarse subangular blocky structure; firm; few fine roots; about 20 percent rock fragments; very strongly acid; gradual irregular boundary.

R—30 inches; olive brown, fine grained sandstone and siltstone bedrock.

The solum ranges from 20 to 35 inches in thickness. The depth to bedrock ranges from 20 to 40 inches. The content of shale, siltstone, and sandstone 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 extremely acid to strongly acid.

The Ap horizon has hue of 10YR, value of 3 to 5, 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. The fine-earth material is silt loam, silty clay loam, or loam.

The BC horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 6. The fine-earth material is silt loam, loam, or silty clay loam.

Hackers Series

The Hackers series consists of very deep, well drained soils that formed in alluvial material washed from soils on uplands. The Hackers soils are on low terraces and high flood plains along the West Fork River and its tributaries. They are subject to rare flooding. Slope ranges from 0 to 3 percent.

Hackers soils are near Moshannon, Monongahela, and Senecaville soils. Unlike Hackers soils, Moshannon and Senecaville soils are occasionally flooded and Monongahela soils are fine-loamy, have a fragipan, and are not subject to flooding.

Typical pedon of Hackers silt loam, in a field of corn, 400 feet west of County Route 7 and 2,300 feet northwest of the intersection of County Routes 7 and 13, near the community of Berlin:

Ap—0 to 10 inches; dark brown (7.5YR 3/4) silt loam; weak fine granular structure; friable; many fine and medium roots; neutral; clear smooth boundary.

Bt—10 to 31 inches; dark reddish brown (5YR 3/4) silty clay loam; moderate medium subangular blocky structure; friable and slightly firm; common fine clay films on faces of peds; few fine roots; moderately acid; clear wavy boundary.

BC—31 to 54 inches; dark reddish brown (5YR 3/4) silty clay loam; weak coarse subangular blocky structure parting to weak medium subangular blocky; firm; very few fine roots; moderately acid; clear wavy boundary.

C—54 to 65 inches; dark reddish brown (5YR 3/4) silty clay loam; massive; friable; few fine pores; slightly acid.

The thickness of the solum ranges from 30 to 55 inches. The depth to bedrock is more than 60 inches. In some pedons the content of sandstone, shale, and siltstone fragments is, by volume, as much as 5 percent in the solum and as much as 20 percent in the C horizon. In unlimed areas reaction is moderately acid or slightly acid.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4.

The Bt and BC horizons have hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 4 to 8. The fine-earth material is silt loam or silty clay loam.

The C horizon has hue of 5YR or 2.5YR and value and chroma of 3 or 4. The fine-earth material is dominantly loam, silt loam, or silty clay loam. In some pedons, however, it is stratified fine sandy loam, sandy loam, or clay loam.

Holly Series

The Holly series consists of very deep, poorly drained soils that formed in alluvial material washed from soils on uplands. The Holly soils are on flood plains along the major streams in the county. They are frequently flooded. Slope ranges from 0 to 3 percent.

Holly soils are near Chagrin, Lobdell, and Sensabaugh soils. Unlike Holly soils, Chagrin, Lobdell, and Sensabaugh soils are occasionally flooded, Chagrin and Sensabaugh soils are well drained, Lobdell soils are moderately well drained, and Sensabaugh soils have a gravelly subsoil and substratum.

Typical pedon of Holly silt loam, in a pastured area of Lobdell-Holly silt loams, about 700 feet south of the junction of County Routes 2/3 and 2 and 125 feet west of Smoke Camp Run:

A—0 to 3 inches; very dark gray (10YR 3/1) silt loam, light brownish gray (10YR 6/2) dry; few fine and medium grayish brown (10YR 5/2) and strong brown (7.5YR 5/8) mottles; weak fine and medium granular structure; friable; common fine and medium roots; moderately acid; clear wavy boundary.

Bg1—3 to 10 inches; dark gray (10YR 4/1) silt loam; common medium strong brown (7.5YR 5/8) and red (2.5YR 4/8) mottles; weak medium subangular blocky structure; friable; common fine and medium roots; moderately acid; clear wavy boundary.

Bg2—10 to 24 inches; dark gray (10YR 4/1) silt loam; many medium strong brown (7.5YR 5/8) and red (2.5YR 4/8) mottles; weak coarse subangular blocky structure; friable; few fine and medium roots; moderately acid; clear wavy boundary.

Bg3—24 to 32 inches; dark gray (2.5Y 4/0) sandy loam; common medium yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) mottles; weak very coarse subangular blocky structure; friable; few medium roots; moderately acid; clear wavy boundary.

Cg1—32 to 44 inches; dark gray (5Y 4/1) sandy loam; massive; very friable and loose; slightly acid; clear wavy boundary.

Cg2—44 to 65 inches; dark gray (5Y 4/1) gravelly sandy loam; massive; very friable and loose; about 15 percent rock fragments; slightly acid.

The thickness of the solum ranges from 20 to 35 inches. The depth to bedrock is more than 60 inches. In some pedons the content of gravel is, by volume, as much as 10 percent in the solum and 0 to 15 percent in the C horizon. In unlimed areas reaction is moderately acid or slightly acid.

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

The Bg horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 or 5 and chroma of 0 or 1. The fine-earth material is silt loam, loam, or sandy loam.

The Cg horizon is neutral in hue or has hue of 5Y, value of 3 or 4, and chroma of 1. The fine-earth material is dominantly loam, silt loam, or sandy loam. Some pedons are stratified below a depth of 40 inches. In these pedons the fine-earth material is loamy sand or sand.

Janelew Series

The Janelew series consists of very deep, well drained soils that formed in calcareous regolith derived from the surface mining of coal. The regolith is a mixture of partially weathered fine-earth material and bedrock fragments, mainly soft, blocky, calcareous mudstone and small amounts of sandstone, limestone, siltstone, shale, and coal. These soils are on hilltops, benches, and out slopes. Slope ranges from 0 to 80 percent.

Janelew soils are near Gilpin, Westmoreland, and Upshur soils. The nearby soils did not form in regolith derived from the surface mining of coal.

Typical pedon of Janelew channery silt loam, steep, in a pastured area where the slope is 6 percent, 0.75 mile south of Jesse Run and 2.8 miles east of Interstate 79:

A—0 to 3 inches; dark brown (10YR 3/3) channery silt loam; weak fine subangular blocky structure; friable; many fine roots; about 15 percent rock fragments (90 percent mudstone and 10 percent sandstone); neutral; clear wavy boundary.

C1—3 to 21 inches; brown (10YR 4/3) channery silty clay loam; common medium olive (5Y 4/4), dark brown (10YR 3/3), and strong brown (7.5YR 4/6) lithochromic mottles; massive; firm; many fine roots; about 25 percent rock fragments (95 percent mudstone and 5 percent sandstone); slight effervescence; moderately alkaline; clear wavy boundary.

C2—21 to 33 inches; brown (10YR 4/3) very channery silty clay loam; common medium dark brown (10YR 3/3), olive (5Y 4/4), and black (N 2/0) lithochromic mottles; massive; firm; about 55 percent rock fragments (85 percent mudstone, 10 percent sandstone, and 5 percent limestone); slight effervescence; mildly alkaline; clear wavy boundary.

C3—33 to 65 inches; brown (10YR 4/3) extremely channery silty clay loam; common medium yellowish brown (10YR 5/4 and 5/8) and gray (5Y 5/1) lithochromic mottles; massive; firm; about 65 percent rock fragments (90 percent mudstone and 10 percent sandstone); slight effervescence; mildly alkaline.

The depth to bedrock is more than 60 inches. The content of mudstone, sandstone, limestone, siltstone, shale, and coal fragments ranges, by volume, from 20 to 80 percent in individual horizons but averages 35 to 75 percent in the particle-size control section. The mudstone fragments make up 65 to 100 percent of the total content of rock fragments in the control section. The rock fragments are mainly channers, but some are stones or boulders. The fine-earth fraction of the particle-size control section ranges from 23 to 35 percent clay and from 7 to 23 percent fine sand and coarser sand. The content of fine sand and coarser sand is commonly less than 15 percent. Most pedons have lithochromic mottles in some or all horizons. In unlimed areas reaction is neutral or mildly alkaline in the A horizon and neutral to moderately alkaline in the C horizon.

The A horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 2 to 6. The fine-earth material is silt loam or silty clay loam.

The C horizon has hue of 2.5YR, 5YR, 7.5YR, 10YR, or 2.5Y, value of 3 to 5, and chroma of 1 to 8. The fine-earth material is silty clay loam or silt loam.

Lobdell Series

The Lobdell series consists of very deep, moderately well drained soils that formed in alluvial material washed from soils on uplands. The Lobdell soils are on low terraces and flood plains along the major streams in the county. They are occasionally flooded. Slope ranges from 0 to 3 percent.

Lobdell soils are near Chagrin, Sensabaugh, and Holly soils. Unlike Lobdell soils, Chagrin and Sensabaugh soils are well drained, Holly soils are poorly drained, and Sensabaugh soils have a gravelly subsoil and substratum.

Typical pedon of Lobdell silt loam, in a pastured area of Lobdell-Holly silt loams, 480 feet south of the junction of County Routes 2/3 and 2, about 75 feet west of Smoke Camp Run:

Ap—0 to 6 inches; dark brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common fine and medium roots; moderately acid; abrupt smooth boundary.

Bw1—6 to 18 inches; brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine and medium roots; moderately acid; clear smooth boundary.

Bw2—18 to 32 inches; brown (7.5YR 4/4) loam; few medium grayish brown (10YR 5/2) and strong brown (7.5YR 5/8) and common medium brown (10YR 5/3) mottles; weak very coarse subangular blocky structure; friable; few fine roots; moderately acid; clear smooth boundary.

C—32 to 56 inches; brown (10YR 4/3) sandy loam; many medium dark brown (7.5YR 3/4) and strong brown (7.5YR 5/8) and few medium black (N 2/0) and grayish brown (10YR 5/2) mottles; massive; friable; about 10 percent rock fragments; slightly acid; clear wavy boundary.

Cg—56 to 65 inches; dark gray (10YR 4/1) sandy loam;

common medium dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/8) mottles; massive; friable; about 5 percent rock fragments; slightly acid.

The thickness of the solum ranges from 24 to 38 inches. The depth to bedrock is more than 60 inches. In some pedons the content of sandstone, shale, and siltstone fragments is, by volume, as much as 5 percent in the solum and as much as 15 percent in the C horizon. In unlimed areas reaction is moderately acid or slightly acid in the A horizon and moderately acid to neutral in the B and C horizons.

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

The Bw horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 3 or 4. The fine-earth material is dominantly silt loam or loam, but some pedons have thin subhorizons of fine sandy loam or silty clay loam.

The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 4. The fine-earth material is silt loam, loam, sandy loam, or fine sandy loam. Some pedons are stratified below a depth of 40 inches. These pedons may have thin layers of gravel or stones.

Monongahela Series

The Monongahela series consists of very deep, moderately well drained soils that formed in old alluvium washed from soils on uplands. The Monongahela soils are on high terraces along the West Fork River and its tributaries. Slope ranges from 3 to 8 percent.

Monongahela soils are near Hackers, Moshannon, and Senecaville soils. Unlike Monongahela soils, Hackers, Moshannon, and Senecaville soils do not have a fragipan, are subject to flooding, and are fine-silty.

Typical pedon of Monongahela silt loam, 3 to 8 percent slopes, in a field of corn, 250 feet north of the West Fork River, 0.3 mile from the intersection of a railroad and County Route 10:

Ap—0 to 10 inches; brown (10YR 4/3) silt loam; weak coarse subangular blocky structure parting to weak fine granular; friable; many fine roots; neutral; abrupt smooth boundary.

Bt1—10 to 23 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few distinct clay films on faces of peds; common fine roots; moderately acid; clear wavy boundary.

Bt2—23 to 29 inches; yellowish brown (10YR 5/6) silt loam; common medium strong brown (7.5YR 5/6) and common fine light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common distinct clay films on faces of peds; few fine roots; about 5 percent rock fragments; strongly acid; clear wavy boundary.

Btx1—29 to 40 inches; strong brown (7.5YR 4/6) silt loam; common medium brown (10YR 5/3) and yellowish brown (10YR 5/8) and few fine light brownish gray (10YR 6/2) mottles; weak very coarse prismatic structure parting to weak medium subangular blocky; firm and brittle; few faint clay films on faces of peds; about 5 percent rock fragments; very strongly acid; clear wavy boundary.

Btx2—40 to 56 inches; strong brown (7.5YR 4/6) loam; common medium brown (10YR 5/3) and few fine light brownish gray (10YR 6/2) mottles; few fine black (10YR 2/1) coatings on some peds; weak very coarse prismatic structure parting to weak medium platy; firm and brittle; few faint clay films on faces of peds; very strongly acid; clear wavy boundary.

C—56 to 65 inches; strong brown (7.5YR 4/6) silt loam; common medium brown (7.5YR 5/4) and light brownish gray (10YR 6/2) mottles; massive; firm; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. The depth to bedrock is more than 60 inches. Depth to the fragipan ranges from 18 to 30 inches. The content of sandstone and shale fragments ranges, by volume, from 0 to 15 percent above the fragipan, from 0 to 25 percent in the fragipan, and from 10 to 40 percent in the C horizon. In unlimed areas reaction is very strongly acid or strongly acid.

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

The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. The fine-earth material is silt loam, loam, clay loam, or sandy clay loam.

The Btx horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 5 or 6, and chroma of 2 to 8. The fine-earth material is loam, silt loam, sandy clay loam, or clay loam.

The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 8. The fine-earth material is silt loam, sandy loam, loam, or clay loam.

Moshannon Series

The Moshannon series consists of very deep, well drained soils that formed in alluvial material washed from soils on uplands. The Moshannon soils are on flood plains along the major streams in the county. They are occasionally flooded. Slope ranges from 0 to 3 percent.

Moshannon soils are near Hackers, Monongahela, and Senecaville soils. Unlike Moshannon soils, Hackers soils are subject to rare flooding, Monongahela soils have a fragipan in the subsoil and are fine-loamy, and Senecaville soils are moderately well drained.

Typical pedon of Moshannon silt loam, in a field of hay, 150 feet southwest of Jesse Run and 3.5 miles from the intersection of County Routes 7 and 8:

Ap—0 to 7 inches; dark brown (7.5YR 3/4) silt loam; weak fine granular structure; very friable; many fine and medium roots; moderately acid; clear smooth boundary.

Bw1—7 to 25 inches; dark reddish brown (5YR 3/4) silt loam; weak medium subangular blocky structure; friable; common fine roots; moderately acid; gradual wavy boundary.

Bw2—25 to 42 inches; dark reddish brown (5YR 3/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; moderately acid; gradual wavy boundary.

C—42 to 65 inches; reddish brown (5YR 4/4) silt loam; massive; friable; slightly acid.

The solum ranges from 32 to 48 inches in thickness. The depth to bedrock is more than 60 inches. The content of sandstone, shale, and siltstone fragments ranges, by volume, from 0 to 5 percent in the solum and from 5 to 20 percent in the C horizon. In unlimed areas reaction is moderately or slightly acid in the solum and moderately acid to neutral in the C horizon.

The Ap horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4.

The Bw horizon has hue of 2.5YR or 5YR and value and chroma of 3 to 6. The fine-earth material is silt loam or silty clay loam.

The C horizon has hue of 5YR, value of 3 or 4, and chroma of 2 to 4. The fine-earth material is silt loam, fine sandy loam, or loam.

Pope Series

The Pope series consists of very deep, well drained soils that formed in alluvial material washed from soils on uplands. The Pope soils are on flood plains along the major streams in the southern part of the county. They are occasionally flooded. Slope ranges from 0 to 3 percent.

Pope soils are near Buchanan soils. Unlike Pope soils, Buchanan soils have a fragipan and are moderately well drained.

Typical pedon of Pope fine sandy loam, in a field of hay, 150 feet north of the Right Fork of the Little Kanawha River, 1,050 feet northeast of the junction of the Right Fork of the Little Kanawha River and Andy Run:

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium and fine granular structure; very friable; many fine roots; strongly acid; abrupt smooth boundary.

Bw1—8 to 20 inches; yellowish brown (10YR 5/6) fine sandy loam; weak fine and medium subangular blocky structure; very friable; few fine roots; very strongly acid; clear wavy boundary.

Bw2—20 to 44 inches; yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable; few fine roots; very strongly acid; gradual wavy boundary.

C—44 to 65 inches; yellowish brown (10YR 5/6) gravelly sandy loam; massive; very friable; about 15 percent rock fragments; very strongly acid.

The solum ranges from 30 to 50 inches in thickness. The depth to bedrock is more than 60 inches. The content of gravel ranges, by volume, from 0 to 30 percent in the solum and from 0 to 40 percent in the C horizon. In unlimed areas reaction is extremely acid to strongly acid.

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

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. The fine-earth material is fine sandy loam, sandy loam, or loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. The fine-earth material is loam, sandy loam, or loamy sand.

Senecaville Series

The Senecaville series consists of very deep, moderately well drained soils that formed in alluvial material washed from soils on uplands. The Senecaville soils are on low terraces and flood plains along the West Fork River and its tributaries. They are occasionally flooded. Slope ranges from 0 to 3 percent.

Senecaville soils are near Hackers, Moshannon, and Monongahela soils. Unlike Senecaville soils, Hackers and Moshannon soils are well drained, Monongahela soils have a fragipan in the subsoil and are fine-loamy, and Hackers soils are subject to rare flooding.

Typical pedon of Senecaville silt loam, in a field of hay, about 300 feet south of County Route 8, about 1,575 feet west of the junction of County Routes 8/4 and 8:

Ap—0 to 7 inches; reddish brown (5YR 4/3) silt loam; moderate medium and fine granular structure; friable; many fine and medium roots; slightly acid; abrupt smooth boundary.

Bw1—7 to 21 inches; reddish brown (5YR 4/4) silt loam;

moderate medium subangular blocky structure; common fine and medium roots; friable; few fine black coatings on faces of peds; slightly acid; clear wavy boundary.

Bw2—21 to 35 inches; reddish brown (5YR 4/4) silty clay loam; common fine and medium brown (7.5YR 5/2) and black (N 2/0) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; friable and firm; few fine roots; slightly acid; clear wavy boundary.

C—35 to 65 inches; reddish brown (5YR 4/4) silt loam; many coarse brown (7.5YR 5/2) and black (N 2/0) and common strong brown (7.5YR 5/8) mottles; massive; very few fine roots; firm; slightly acid.

The solum ranges from 30 to 45 inches in thickness. The depth to bedrock is more than 60 inches. The content of sandstone, shale, and siltstone fragments ranges, by volume, from 0 to 5 percent in the solum and from 0 to 20 percent in the C horizon. In unlimed areas reaction is moderately acid or slightly acid throughout the profile.

The Ap horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4.

The Bw horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. The fine-earth material is silt loam or silty clay loam.

The C horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 2 to 5, and chroma of 2 to 6. The fine-earth material is silt loam, silty clay loam, or loam.

Sensabaugh Series

The Sensabaugh series consists of very deep, well drained soils that formed in limy and acid alluvial material washed from soils on uplands. The Sensabaugh soils are on narrow flood plains along small streams and on alluvial fans at the mouth of hollows throughout the county. They are occasionally flooded. Slope ranges from 0 to 3 percent.

Sensabaugh soils are near Chagrin, Gilpin, Hackers, Holly, Lobdell, Moshannon, Senecaville, Upshur, and Vandalia soils. Unlike Sensabaugh soils, Lobdell and Senecaville soils are moderately well drained and Holly soils are poorly drained; Hackers, Moshannon, and Senecaville soils are fine-silty; Upshur and Vandalia soils are clayey; Chagrin, Hackers, and Moshannon soils do not have a gravelly subsoil and substratum; and Gilpin, Upshur, and Vandalia soils are not subject to flooding.

Typical pedon Sensabaugh silt loam, in a field of hay, 45 feet northeast of Beechlick Run, 2,800 feet southeast of the intersection of U.S. Routes 33 and 119 and County Route 34:

Ap—0 to 5 inches; dark brown (7.5YR 4/4) silt loam; moderate fine granular structure; friable; many fine roots; about 5 percent rock fragments; slightly acid; clear wavy boundary.

Bw1—5 to 12 inches; strong brown (7.5YR 4/6) gravelly loam; weak medium subangular blocky structure; friable; common fine roots; about 15 percent rock fragments; slightly acid; clear wavy boundary.

Bw2—12 to 25 inches; dark reddish brown (5YR 3/4) gravelly loam; weak medium and coarse subangular blocky structure; friable; common fine roots; about 20 percent rock fragments; neutral; gradual wavy boundary.

C1—25 to 37 inches; dark reddish brown (5YR 3/4) very gravelly silty clay loam; few fine dark red (10R 3/6) and common fine black (5YR 2.5/1) lithochromic mottles; massive; friable; few fine roots; about 35 percent rock fragments; neutral; gradual wavy boundary.

C2—37 to 65 inches; reddish brown (5YR 4/4) very gravelly silt loam; few fine black (10YR 2/1) and common fine strong brown (7.5YR 5/8) mottles; massive; friable; about 55 percent rock fragments; neutral.

The solum ranges from 24 to 50 inches in thickness. The depth to bedrock is more than 60 inches. The content of sandstone, shale, and siltstone fragments ranges, by volume, from 0 to 20 percent in the upper part of the solum, from 15 to 40 percent in the lower part of the solum, and from 20 to 70 percent in the C horizon. It averages less than 35 percent in the particle-size control section. In unlimed areas reaction is moderately acid to neutral.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4.

The Bw horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 3 to 6. The fine-earth material is loam, silt loam, or silty clay loam.

The C horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 3 to 6. The fine-earth material is loam, silt loam, silty clay loam, or fine sandy loam and can be stratified.

Udorthents

Udorthents are shallow to very deep, well drained soils in areas that have been disturbed by human activities. These soils formed in a mixture of soil material and rock fragments in excavations, filled areas, or other disturbed areas used for highways, railroads, construction sites, flood-control structures, and other kinds of industrial, urban, or recreational development. Slope ranges from 1 percent in some areas to nearly vertical in cut areas.

A typical pedon of Udorthents is not given because of the variability of these soils. The depth to bedrock is generally more than 40 inches. It ranges from 0 to more than 6 feet. The rock fragments vary in kind, size, and amount. Reaction ranges from extremely acid to neutral.

The A horizon has hue of 10R to 2.5Y, value of 2 to 7, and chroma of 4 to 8. Low chromas are lithochromic. The fine-earth material is sandy loam, loam, silt loam, silty clay loam, or clay loam.

The C horizon has hue of 10R to 2.5Y, value of 2 to 8, and chroma of 4 to 8. Low chromas are lithochromic. The fine-earth material is sandy loam, loam, silt loam, silty clay loam, clay loam, or silty clay.

Upshur Series

The Upshur series consists of deep and very deep, well drained soils that formed in material weathered from shale, siltstone, and fine grained sandstone. These soils are on ridgetops, benches, and hillsides throughout the county. Slope ranges from 8 to 70 percent.

Upshur soils are near Bethesda, Janelew, Gilpin, Sensabaugh, Vandalia, and Westmoreland soils. Unlike Upshur soils, Bethesda and Janelew soils have been disturbed by surface mining; Gilpin, Sensabaugh, and Westmoreland soils are fine-loamy; and Sensabaugh soils are occasionally flooded. Upshur soils have more clay in the upper part than Vandalia soils.

Typical pedon of Upshur silt loam, in a pastured area of Gilpin-Upshur silt loams, 25 to 35 percent slopes, 1,200 feet south of the junction of the West Fork River and Sycamore Run, northwest of Jackson's Mill:

Ap—0 to 5 inches; dark reddish brown (5YR 3/4) silt loam; moderate medium granular structure; very friable; many fine roots; strongly acid; gradual wavy boundary.

Bt1—5 to 13 inches; reddish brown (5YR 4/4) silty clay; strong medium angular blocky structure; firm, plastic and sticky; few distinct clay films on faces of peds; common fine roots; strongly acid; gradual wavy boundary.

Bt2—13 to 27 inches; dark red (2.5YR 3/6) silty clay; moderate coarse prismatic structure parting to strong medium subangular blocky; very firm, very plastic and very sticky; common distinct clay films on faces of peds; few fine roots; strongly acid; gradual wavy boundary.

BC—27 to 39 inches; dark red (10R 3/6) silty clay; moderate medium subangular blocky structure; firm, plastic and sticky; about 5 percent rock fragments; strongly acid; gradual wavy boundary.

C1—39 to 51 inches; dark red (10R 3/6) silty clay loam; massive; slightly sticky and slightly plastic; about 10 percent rock fragments; mildly alkaline; gradual wavy boundary.

C2—51 to 65 inches; dark reddish brown (2.5YR 3/4) channery silty clay loam; massive; very friable; about 30 percent rock fragments; mildly alkaline.

The solum ranges from 26 to 50 inches in thickness. The depth to bedrock is more than 60 inches. The content of weathered shale and siltstone fragments and of some sandstone fragments ranges, by volume, from 0 to 10 percent in the upper part of the solum, from 0 to 25 percent in the lower part of the solum, and from 5 to 75 percent in the C horizon. In unlimed areas reaction is strongly acid to slightly acid in the A horizon, strongly acid or moderately acid in the B horizon, and strongly acid to mildly alkaline in the C horizon.

The Ap horizon has hue of 7.5YR or 5YR and value and chroma of 2 to 4.

The Bt horizon has hue of 10R, 2.5YR, or 5YR, value of 3 or 4, and chroma of 3 to 6. The fine-earth material is silty clay or clay.

The BC and C horizons have hue of 10R or 2.5YR, value of 3 or 4, and chroma of 3 to 6. The fine-earth material is silty clay or silty clay loam.

Vandalia Series

The Vandalia series consists of very deep, well drained soils that formed in limy and acid colluvial material derived from soils on uplands. The Vandalia soils are on colluvial foot slopes, on fans, and around the head of drainageways. Slope ranges from 8 to 35 percent.

Vandalia soils are near Gilpin, Upshur, and Sensabaugh soils. Unlike Vandalia soils, Gilpin and Sensabaugh soils are fine-loamy and Sensabaugh soils are occasionally flooded. Vandalia soils have less clay in the upper part of the subsoil than Upshur soils.

Typical pedon of Vandalia silt loam, 15 to 25 percent slopes, in a field of corn, 2,700 feet northeast of the junction of County Route 14 and U.S. Routes 33 and 19, about 500 feet northwest of County Route 14, along Smith Run:

Ap—0 to 9 inches; dark reddish brown (5YR 3/4) silt loam, light reddish brown (5YR 6/4) dry; weak fine and medium granular structure; friable; common fine and medium roots; slightly acid; abrupt smooth boundary.

Bt1—9 to 19 inches; reddish brown (2.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm, plastic and sticky; few fine roots; few distinct clay films on faces of peds; moderately acid; clear wavy boundary.

Bt2—19 to 35 inches; reddish brown (2.5YR 4/4) silty clay; strong medium subangular blocky structure; firm, plastic and sticky; very few fine roots; few distinct clay films on faces of peds; about 5 percent rock fragments (sandstone and shale); strongly acid; clear smooth boundary.

Bt3—35 to 40 inches; dark reddish brown (5YR 4/4) silty clay loam; many fine black (N 2/0) coatings on peds and in pores; weak coarse subangular blocky structure parting to weak medium subangular blocky; firm, plastic and sticky; common distinct clay films on faces of peds; about 5 percent rock fragments; strongly acid; gradual wavy boundary.

C—40 to 65 inches; dark red (2.5YR 3/6) channery silty clay loam; many medium black (N 2/0) coatings and few fine pinkish gray (7.5YR 6/2) and light gray (N 7/0) mottles; massive; firm, plastic and sticky; about 30 percent rock fragments; strongly acid.

The solum ranges from 40 to 60 inches in thickness. The depth to bedrock is more than 60 inches. The content of shale and sandstone fragments ranges, by volume, from 5 to 15 percent in the solum and from 5 to 50 percent in the C horizon. In unlimed areas reaction is strongly acid or moderately acid in the solum and strongly acid to neutral in the C horizon.

The Ap horizon has hue of 5YR, value of 3 to 5 (6 dry), and chroma of 2 to 4.

The BC horizon has hue of 2.5YR or 5YR, value of 3 or 4, and chroma of 4 to 6. The fine-earth material is silty clay loam or silty clay.

The C horizon has hue of 5YR or 2.5YR, value of 4 to 6, and chroma of 3 to 6. The fine-earth material is silty clay, silty clay loam, or clay loam. Some pedons have pockets of fine-earth material that is mottled with chroma of 2 or less.

Westmoreland Series

The Westmoreland series consists of deep, well drained soils that formed in acid and limy material weathered from interbedded shale, siltstone, sandstone, and some limestone. These soils are on ridgetops, side slopes, and benches in the northern and northeastern parts of the county. Slope ranges from 25 to 35 percent.

Westmoreland soils are near Bethesda, Janelew, Gilpin, and Upshur soils. Unlike Westmoreland soils, Gilpin soils are moderately deep, Upshur soils are clayey, and Bethesda and Janelew soils have been disturbed by surface mining.

Typical pedon of Westmoreland silt loam, in a pastured area of Westmoreland-Upshur complex, 25 to 35 percent slopes, severely eroded, 1,250 feet south of the junction of the West Fork River and Sycamore Run, northeast of Jackson's Mill:

Ap—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam; weak medium granular structure; friable; many fine roots; less than 5 percent rock fragments; slightly acid; abrupt smooth boundary.

BA—4 to 10 inches; strong brown (7.5YR 5/8) silt loam; weak medium subangular blocky structure; friable, slightly plastic and slightly sticky; many fine roots; about 10 percent rock fragments; strongly acid; gradual wavy boundary.

Bt1—10 to 21 inches; strong brown (7.5YR 5/8) channery silty clay loam; moderate medium subangular blocky structure; friable, slightly plastic and slightly sticky; common distinct clay films on faces of peds; common fine roots; about 20 percent rock fragments; very strongly acid; gradual wavy boundary.

Bt2—21 to 27 inches; reddish yellow (7.5YR 6/8) channery silty clay loam; weak medium subangular blocky structure; friable, slightly plastic and slightly sticky; common distinct clay films on faces of peds; few fine roots; about 15 percent rock fragments; very strongly acid; gradual wavy boundary.

BC—27 to 36 inches; strong brown (7.5YR 5/6) silt loam; weak fine and medium subangular blocky structure; friable; about 10 percent rock fragments; many mica flakes; strongly acid; gradual wavy boundary.

C—36 to 54 inches; yellowish brown (10YR 5/4) very channery loam; massive; friable; about 50 percent rock fragments; strongly acid.

R—54 inches; grayish brown (10YR 5/2) and dark brown (10YR 3/3) shale and sandstone bedrock.

The solum ranges from 20 to 40 inches in thickness. The depth to bedrock is 40 to 60 inches. The content of shale, siltstone, and limestone fragments ranges, by volume, from 5 to 30 percent in individual horizons in the solum and from 45 to 80 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 3 or 4, and chroma of 2 or 3.

The BA, Bt, and BC horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. The fine-earth material is silt loam or silty clay loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The fine-earth material is silt loam or loam.

Formation of the Soils

The origin and development of the soils in Lewis 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 Lewis 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 Lewis County formed in residual, colluvial, and alluvial material. Most formed in material weathered from interbedded shale, siltstone, sandstone, and some limestone. Gilpin and Upshur soils, for example, formed in material weathered from interbedded shale, siltstone, and fine grained sandstone.

The residuum is the oldest parent material in the county. Soil formation has been retarded by clayey material, resistant rock, the slope, and 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 Upshur soils, and Buchanan soils formed in colluvium below areas of Dekalb 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 soils, such as Monongahela soils, are strongly leached and have a moderately well developed profile.

The alluvium on flood plains is the youngest parent material in the county. Most of the soils on flood plains have a weakly developed profile because the soil-forming processes have had little time to act. Pope, Holly, and Lobdell 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 material, thus releasing plant nutrients.

Human activities also affect soil formation. Clearing the forest, plowing, and mining, for example, affect the characteristics of the surface layer. Human activities also include adding fertilizer, mixing some of the soil horizons, and moving soil material from one place to another.

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 the gently sloping and strongly sloping soils in Lewis County. 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 the 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. It also is the layer of maximum leaching, or eluviation, of clay and iron.

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 Lewis 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, strong brown, dark red, 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 Monongahela 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 areas that have been recently disturbed by mining or construction.

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.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 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.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

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

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.

Lithochromic mottles. Mottles that have inherited their color from the parent rocks.

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 1951-80 at Weston, West Virginia)

Month	Temperature						Precipitation				
				2 years in 10 will have--		Average		2 years in 10 will have--		Average	
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	number of growing degree days*	Average	Less than--	More than--	number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	40.5	19.7	30.1	72	-8	59	4.50	3.08	5.80	12	16.6
February	43.2	20.6	31.9	72	-5	60	3.80	2.31	5.13	10	12.4
March	53.6	28.7	41.2	82	9	161	4.56	3.03	5.95	11	9.0
April	65.0	37.9	51.5	88	20	349	4.17	2.87	5.36	11	1.8
May	75.3	46.9	61.1	91	28	654	4.30	2.63	5.80	9	.0
June	82.5	55.9	69.2	94	40	876	4.61	2.89	6.14	9	.0
July	85.6	60.5	73.1	96	46	1,026	5.00	3.40	6.47	10	.0
August	84.6	59.4	72.0	94	45	992	4.50	2.49	6.27	8	.0
September	79.1	52.3	65.7	94	35	771	3.73	2.32	4.98	7	.0
October	67.6	39.7	53.7	87	22	430	3.35	1.49	4.94	7	.3
November	55.2	31.3	43.3	79	11	136	3.32	2.20	4.33	9	4.0
December	44.3	24.3	34.3	74	2	74	4.39	2.68	5.92	11	10.6
Yearly:											
Average	64.7	39.8	52.3	---	---	---	---	---	---	---	---
Extreme	---	---	---	97	-8	---	---	---	---	---	---
Total	---	---	---	---	---	5,588	50.23	45.30	55.04	114	54.7

* 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 1951-80 at Weston, 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 3	May 16
2 years in 10 later than--	Apr. 19	Apr. 28	May 11
5 years in 10 later than--	Apr. 9	Apr. 19	May 2
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 17	Oct. 11	Oct. 1
2 years in 10 earlier than--	Oct. 23	Oct. 16	Oct. 5
5 years in 10 earlier than--	Nov. 2	Oct. 26	Oct. 13

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-80 at Weston, 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	183	170	146
8 years in 10	191	177	152
5 years in 10	207	190	163
2 years in 10	223	203	175
1 year in 10	231	210	181

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

Map symbol	Soil name	Acres	Percent
BrE	Bethesda-Rock outcrop complex, steep, very stony	1,460	0.6
BuC	Buchanan channery loam, 3 to 15 percent slopes, very stony	235	0.1
BuD	Buchanan channery loam, 15 to 25 percent slopes, very stony	1,200	0.5
Cn	Chagrin silt loam	1,650	0.7
GaC	Gilpin silt loam, 8 to 15 percent slopes	590	0.2
GaD	Gilpin silt loam, 15 to 25 percent slopes	670	0.3
GaE	Gilpin silt loam, 25 to 35 percent slopes	715	0.3
GaF	Gilpin silt loam, 35 to 70 percent slopes	1,610	0.6
GDF	Gilpin-Dekalb association, very steep, very stony	5,185	2.1
GuC	Gilpin-Upshur silt loams, 8 to 15 percent slopes	2,200	0.9
GuD	Gilpin-Upshur silt loams, 15 to 25 percent slopes	12,870	5.2
GuE	Gilpin-Upshur silt loams, 25 to 35 percent slopes	29,265	11.7
GwF3	Gilpin-Upshur silt loams, 35 to 70 percent slopes, severely eroded	134,015	53.7
Ha	Hackers silt loam	270	0.1
JaE	Janelew channery silt loam, steep	13,970	5.6
Lh	Lobdell-Holly silt loams	1,220	0.5
MoB	Monongahela silt loam, 3 to 8 percent slopes	2,220	0.9
Ms	Moshannon silt loam	1,545	0.6
Po	Pope fine sandy loam	205	0.1
Sn	Senecaville silt loam	1,525	0.6
Su	Sensabaugh silt loam	2,875	1.2
Uf	Udorthents, smoothed	3,475	1.4
Ur	Udorthents-Urban land complex	1,080	0.4
VaC	Vandalia silt loam, 8 to 15 percent slopes	5,605	2.2
VaD	Vandalia silt loam, 15 to 25 percent slopes	9,560	3.8
VaE	Vandalia silt loam, 25 to 35 percent slopes	4,215	1.7
WuE3	Westmoreland-Upshur complex, 25 to 35 percent slopes, severely eroded	6,075	2.4
	Water	3,895	1.6
	Total	249,400	100.0

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
Cn	Chagrin silt loam
Ha	Hackers silt loam
Ms	Moshannon silt loam
Po	Pope fine sandy loam
Sn	Senecaville silt loam
Su	Sensabaugh silt 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*
BrE**: Bethesda-Rock outcrop	VIIs	---	---	---	---	---	---
BuC: Buchanan	VIs	---	---	---	---	---	3.5
BuD: Buchanan	VIs	---	---	---	---	---	3.0
Cn: Chagrin	IIw	125	80	50	4.0	5.5	5.5
GaC: Gilpin	IIIe	85	60	35	3.0	3.5	4.5
GaD: Gilpin	IVe	80	55	30	2.5	3.0	4.0
GaE: Gilpin	VIe	---	---	---	---	---	3.0
GaF: Gilpin	VIIe	---	---	---	---	---	---
GDF**: Gilpin-Dekalb	VIIs	---	---	---	---	---	---
GuC**: Gilpin-Upshur	IIIe	90	60	35	3.0	3.5	4.5
GuD**: Gilpin-Upshur	IVe	85	55	30	2.5	3.0	4.0
GuE**: Gilpin-Upshur	VIe	---	---	---	---	---	3.5
GwF3**: Gilpin-Upshur	VIIe	---	---	---	---	---	---
Ha: Hackers	I	140	80	50	3.5	5.0	5.5
JaE: Janelew	VIe	---	---	---	---	---	3.5
Lh**: Lobdell-Holly	IIIw	110	75	---	3.0	---	5.0
MoB: Monongahela	IIe	100	65	40	3.0	3.5	4.5
Ms: Moshannon	IIw	125	75	45	4.5	5.0	5.5

See footnotes at end of table.

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

Soil name and map symbol	Land capability	Corn	Oats	Wheat	Grass-legume hay	Alfalfa hay	Kentucky bluegrass
		Bu	Bu	Bu	Tons	Tons	AUM*
Po-------------- Pope	IIw	125	75	45	3.5	---	4.5
Sn-------------- Senecaville	IIw	130	80	45	3.5	4.5	5.5
Su-------------- Sensabaugh	IIw	125	75	45	3.5	3.0	5.5
Uf. Udorthents							
Ur** Udorthents-Urban land							
VaC------------- Vandalia	IIIe	100	60	35	3.0	4.5	4.5
VaD------------- Vandalia	IVe	90	55	30	2.5	4.0	4.0
VaE------------- Vandalia	VIe	---	---	---	---	---	3.5
WuE3**---------- Westmoreland-Upshur	VIIe	---	---	---	---	---	---

* 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	270	---	---	---
II	10,020	2,220	7,800	---
III	9,615	8,395	1,220	---
IV	23,100	23,100	---	---
V	---	---	---	---
VI	49,600	48,165	---	1,435
VII	148,345	141,700	---	6,645
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. Site index for map units that have slopes of more than 15 percent 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 ft/acre	Board ft/acre	Cords/acre
BrE**:										
Bethesda***	2R	Moderate	Moderate	Moderate	Moderate	Northern red oak	52	36	70	0.41
						Eastern white pine	---	---	---	---
						Virginia pine	---	---	---	---
						Black locust	---	---	---	---
						Bigtooth aspen	---	---	---	---
Rock outcrop.										
BuC	4A	Slight	Slight	Slight	Severe	Northern red oak	80	62	250	.81
Buchanan						Yellow-poplar	90	90	440	1.04
						Virginia pine	---	---	---	---
						Eastern white pine	---	---	---	---
BuD	4R	Moderate	Moderate	Slight	Severe	Northern red oak	80	62	250	.81
Buchanan						Yellow-poplar	90	90	440	1.04
						Virginia pine	---	---	---	---
						Eastern white pine	---	---	---	---
Cn	5A	Slight	Slight	Slight	Severe	Northern red oak	86	68	292	.89
Chagrin						Yellow-poplar	96	100	524	1.15
						Sugar maple	86	---	---	---
						White oak	---	---	---	---
						Black cherry	---	---	---	---
						White ash	---	---	---	---
						Black walnut	---	---	---	---
GaC	4A	Slight	Slight	Slight	Moderate	Northern red oak	80	63	250	.81
Gilpin						Yellow-poplar	95	98	510	1.14
GaD, GaE	4R	Moderate	Moderate	Slight	Moderate	Northern red oak	80	63	250	.81
Gilpin						Yellow-poplar	95	98	510	1.14
GaF	4R	Severe	Severe	Slight	Moderate	Northern red oak	80	63	250	.81
Gilpin						Yellow-poplar	95	98	510	1.14
GDF**:										
Gilpin	4R	Severe	Severe	Slight	Moderate	Northern red oak	80	63	250	.81
						Yellow-poplar	95	98	510	1.14
Dekalb	4R	Moderate	Severe	Moderate	Moderate	Northern red oak	76	58	222	.75
GuC**:										
Gilpin	4A	Slight	Slight	Slight	Moderate	Northern red oak	80	63	250	.81
						Yellow-poplar	95	98	510	1.14
Upshur	3C	Moderate	Slight	Slight	Moderate	Northern red oak	65	48	145	.60
						Yellow-poplar	80	71	520	.83
						Eastern white pine	80	---	---	---
						Virginia pine	66	---	---	---
GuD**:										
Gilpin	4R	Moderate	Moderate	Slight	Moderate	Northern red oak	80	63	250	.81
						Yellow-poplar	95	98	510	1.14

See footnotes 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 ft/acre	Board ft/acre	Cords/ acre
GuD**:										
Upshur	4R	Moderate	Severe	Slight	Moderate	Northern red oak	70	52	180	.67
						Yellow-poplar	90	90	440	1.04
						Eastern white pine	90	---	---	---
						Virginia pine	70	---	---	---
GuE**:										
Gilpin	4R	Moderate	Moderate	Slight	Moderate	Northern red oak	80	63	250	.81
						Yellow-poplar	95	98	510	1.14
Upshur	4R	Severe	Severe	Slight	Moderate	Northern red oak	70	52	180	.67
						Yellow-poplar	90	90	440	1.04
						Eastern white pine	90	---	---	---
						Virginia pine	70	---	---	---
GwF3**:										
Gilpin	4R	Severe	Severe	Slight	Moderate	Northern red oak	80	63	250	.81
						Yellow-poplar	95	98	510	1.14
Upshur	4R	Severe	Severe	Slight	Moderate	Northern red oak	70	52	180	.67
						Yellow-poplar	90	90	440	1.04
						Eastern white pine	90	---	---	---
						Virginia pine	70	---	---	---
Ha Hackers	5A	Slight	Slight	Slight	Severe	Northern red oak	85	67	285	.88
						Yellow-poplar	95	98	510	1.14
						White ash	85	---	---	---
JaE Janelew	4R	Moderate	Moderate	Slight	Moderate	Northern red oak	75	57	215	.74
						Black locust	---	---	---	---
						Yellow-poplar	---	---	---	---
Lh**:										
Lobdell	5A	Slight	Slight	Slight	Severe	Northern red oak	87	69	299	.91
						Yellow-poplar	96	100	521	1.15
						Sugar maple	---	---	---	---
						White ash	---	---	---	---
						White oak	---	---	---	---
						Black cherry	---	---	---	---
Holly	5W	Slight	Severe	Moderate	Severe	Pin oak	90	72	320	.95
						Swamp white oak	---	---	---	---
						Red maple	---	---	---	---
						Black cherry	---	---	---	---
						Eastern cottonwood	---	---	---	---
MoB Monongahela	4A	Slight	Slight	Slight	Severe	Northern red oak	70	52	180	.67
						Yellow-poplar	85	81	380	.93
						Eastern white pine	72	---	---	---
						Virginia pine	66	---	---	---
						White ash	---	---	---	---
						Black walnut	---	---	---	---
Ms Moshannon	5A	Slight	Slight	Slight	Severe	Northern red oak	85	67	285	.88
						Yellow-poplar	95	98	510	1.14
						Sugar maple	85	---	---	---
						Black walnut	---	---	---	---
						White oak	---	---	---	---
						White ash	---	---	---	---
						Black cherry	---	---	---	---

See footnotes at end of table.

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

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Average annual growth*: Cubic ft/acre	Average annual growth*: Board ft/acre	Average annual growth*: Cords/acre
Po-------------- Pope	4A	Slight	Slight	Slight	Severe	Northern red oak----	80	62	250	.81
						Yellow-poplar-------	96	100	524	1.15
						American beech------	---	---	---	---
						White oak-----------	80	62	243	.80
						Blackgum------------	---	---	---	---
						American sycamore---	---	---	---	---
						American basswood---	---	---	---	---
						Eastern hemlock-----	---	---	---	---
						Bitternut hickory---	---	---	---	---
Sn-------------- Senecaville	5A	Slight	Slight	Slight	Severe	Northern red oak----	85	67	285	.88
						Yellow-poplar-------	95	98	510	1.14
						White ash-----------	85	---	---	---
						White oak-----------	85	67	285	.88
Su-------------- Sensabaugh	4A	Slight	Slight	Moderate	Severe	White oak-----------	80	62	250	.81
						Yellow-poplar-------	100	107	580	1.23
						Shortleaf pine------	80	---	---	---
						Virginia pine-------	75	---	---	---
VaC------------- Vandalia	4C	Moderate	Slight	Slight	Severe	Northern red oak----	73	55	201	.71
						Yellow-poplar-------	75	72	265	.73
						Virginia pine-------	70	---	---	---
VaD------------- Vandalia	4C	Moderate	Severe	Slight	Severe	Northern red oak----	77	59	236	.78
						Yellow-poplar-------	90	90	440	1.04
						Virginia pine-------	80	---	---	---
VaE------------- Vandalia	4R	Severe	Severe	Slight	Severe	Northern red oak----	77	59	236	.78
						Yellow-poplar-------	90	90	440	1.04
						Virginia pine-------	80	---	---	---
WuE3**:										
Westmoreland---	4R	Moderate	Moderate	Slight	Severe	Northern red oak----	81	63	257	.82
						Yellow-poplar-------	90	90	440	1.04
						Eastern white pine--	75	---	---	---
						Virginia pine-------	---	---	---	---
Upshur---------	4R	Severe	Severe	Slight	Moderate	Northern red oak----	70	52	180	.67
						Yellow-poplar-------	90	90	440	1.04
						Eastern white pine--	90	---	---	---
						Virginia pine-------	70	---	---	---

* Average annual growth is the total volume growth at rotation divided by the rotation age. The actual annual volume growth varies with stand vigor and other factors. Yield data are based on site indices of natural stands at age 50. The international 1/4 Log Rule is used for board feet. Cords are standard rough cords. This information should be used for planning only.

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

*** Interpretations for the Bethesda soil are estimates based on similar soils.

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
BrE*:					
Bethesda	Variable	Variable	Variable	Variable	Variable.
Rock outcrop.					
BuC Buchanan	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: large stones, slope, small stones.	Slight	Severe: small stones.
BuD Buchanan	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Moderate: slope.	Severe: slope, small stones.
Cn Chagrin	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
GaC Gilpin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, thin layer.
GaD Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
GaE, GaF Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
GDF*:					
Gilpin	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: small stones, large stones, slope.
Dekalb	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones, large stones.	Severe: slope.	Severe: slope, small stones.
GuC*:					
Gilpin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, thin layer.
Upshur	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
GuD*:					
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Upshur	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
GuE*, GwF3*:					
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Upshur	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Ha Hackers	Severe: flooding.	Slight	Slight	Slight	Slight.
JaE Janelew	Variable	Variable	Variable	Variable	Variable.
Lh*:					
Lobdell	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight	Moderate: flooding.
Holly	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
MoB Monongahela	Moderate: wetness.	Moderate: wetness.	Moderate: slope, small stones.	Severe: erodes easily.	Slight.
Ms Moshannon	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Po Pope	Severe: flooding.	Slight	Moderate: small stones, flooding.	Slight	Moderate: flooding.
Sn Senecaville	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: wetness, flooding.	Slight	Moderate: flooding.
Su Sensabaugh	Severe: flooding.	Slight	Moderate: small stones.	Slight	Moderate: flooding.
Uf. Udorthents					
Ur*: Udorthents.					
Urban land	Variable	Variable	Variable	Variable	Variable.
VaC Vandalia	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
VaD Vandalia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
VaE Vandalia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, 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
WuE3*:					
Westmoreland	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Upshur	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.

* 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							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
BrE*:										
Bethesda	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Rock outcrop.										
BuC, BuD Buchanan	Very poor.	Poor	Good	Good	---	Poor	Very poor.	Poor	Good	Very poor.
Cn Chagrin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
GaC Gilpin	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
GaD Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
GaE Gilpin	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
GaF Gilpin	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
GDF*:										
Gilpin	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Dekalb	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
GuC*:										
Gilpin	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Upshur	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GuD*:										
Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Upshur	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GuE*:										
Gilpin	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Upshur	Very poor.	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
GwF3*:										
Gilpin	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

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 herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
GwF3*:										
Upshur	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Ha Hackers	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
JaE Janelew	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Lh*:										
Lobdell	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Holly	Fair	Fair	Poor	Fair	Fair	Good	Good	Fair	Fair	Good.
MoB Monongahela	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ms Moshannon	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Po Pope	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Sn Senecaville	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Su Sensabaugh	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Uf. Udorthents										
Ur*:										
Udorthents.										
Urban land.										
VaC Vandalia	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
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.
WuE3*:										
Westmoreland	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Upshur	Very poor.	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

* 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
BrE*:						
Bethesda	Variable	Variable	Variable	Variable	Variable	Variable.
Rock outcrop.						
BuC Buchanan	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Moderate: wetness, slope, frost action.	Severe: small stones.
BuD Buchanan	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope, small stones.
Cn Chagrin	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
GaC Gilpin	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer.
GaD, GaE, GaF Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
GDF*:						
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, large stones, slope.
Dekalb	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope, small stones.
GuC*:						
Gilpin	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer.
Upshur	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell, slippage.	Severe: shrink-swell, low strength.	Moderate: slope.
GuD*, GuE*, GwF3*:						
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Upshur	Severe: slope, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, low strength.	Severe: slope.

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
Ha: Hackers	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding, frost action.	Slight.
JaE: Janelew	Variable	Variable	Variable	Variable	Variable	Variable.
Lh*:						
Lobdell	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Holly	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness, flooding.
MoB: Monongahela	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: low strength, wetness.	Slight.
Ms: Moshannon	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Po: Pope	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Sn: Senecaville	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Su: Sensabaugh	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Uf. Udorthents						
Ur*: Udorthents.						
Urban land	Variable	Variable	Variable	Variable	Variable	Variable.
VaC: Vandalia	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope, slippage.	Severe: low strength, shrink-swell.	Moderate: slope.
VaD, VaE: 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.

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
WuE3*:						
Westmoreland-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Upshur-----------	Severe: slope, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, low strength.	Severe: slope.

* 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 "severe," "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
BrE*:					
Bethesda	Variable	Variable	Variable	Variable	Variable.
Rock outcrop.					
BuC Buchanan	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Moderate: slope, wetness.	Poor: small stones.
BuD Buchanan	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: wetness, slope.	Severe: slope.	Poor: small stones, slope.
Cn Chagrin	Severe: flooding.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Fair: thin layer.
GaC Gilpin	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
GaD, GaE, GaF 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.
GDF*:					
Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
Dekalb	Severe: slope, depth to rock, poor filter.	Severe: slope, depth to rock, seepage.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage, depth to rock.	Poor: slope, small stones, area reclaim.
GuC*:					
Gilpin	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Upshur	Severe: percs slowly.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
GuD*, GuE*, GwF3*:					
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.

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
GuD*, GuE*, GwF3*:					
Upshur	Severe: slope, percs slowly, slippage.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope, slippage.	Poor: slope, too clayey, hard to pack.
Ha Hackers	Moderate: flooding.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
JaE Janelew	Variable	Variable	Variable	Variable	Variable.
Lh*:					
Lobdell	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
Holly	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
MoB Monongahela	Severe: percs slowly, wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: small stones, wetness.
Ms Moshannon	Severe: flooding.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Fair: too clayey.
Po Pope	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.
Sn Senecaville	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Su Sensabaugh	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Poor: small stones.
Uf. Udorthents					
Ur*: Udorthents.					
Urban land	Variable	Variable	Variable	Variable	Variable.
VaC Vandalia	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.

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------------ Vandalia	Severe: slope, percs slowly, slippage.	Severe: slope.	Severe: slope, too clayey, slippage.	Severe: slope, slippage.	Poor: too clayey, hard to pack, slope.
WuE3*:					
Westmoreland-------	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: small stones, slope.
Upshur-------------	Severe: slope, percs slowly, slippage.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope, slippage.	Poor: slope, too clayey, hard to pack.

* 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
BrE*:				
Bethesda	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
BuC Buchanan	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
BuD Buchanan	Fair: slope, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones, area reclaim.
Cn Chagrin	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
GaC Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
GaD Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
GaE, GaF Gilpin	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
GDF*:				
Gilpin	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Dekalb	Poor: slope, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
GuC*:				
Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Upshur	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GuD*:				
Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
GuD*:				
Upshur	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
GuE*, GwF3*:				
Gilpin	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Upshur	Poor: slope, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
Ha Hackers	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
JaE Janelew	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Lh*:				
Lobdell	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Holly	Poor: wetness.	Probable	Probable	Poor: wetness.
MoB Monongahela	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ms Moshannon	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
Po Pope	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Sn Senecaville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Su Sensabaugh	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Uf. Udorthents				
Ur*:				
Udorthents.				
Urban land	Variable	Variable	Variable	Variable.
VaC Vandalia	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
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.
WuE3*:				
Westmoreland---------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Upshur---------------	Poor: slope, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.

* 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--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
BrE*:						
Bethesda	Severe: slope.	Severe: piping.	Deep to water	Slope, large stones, droughty.	Slope, large stones, slippage.	Large stones, slope, droughty.
Rock outcrop.						
BuC, BuD Buchanan	Severe: slope.	Severe: piping.	Percs slowly, slope.	Slope, percs slowly, wetness.	Slope, percs slowly, rooting depth.	Slope, percs slowly, rooting depth.
Cn Chagrin	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
GaC, GaD, GaE, GaF Gilpin	Severe: slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
GDF*:						
Gilpin	Severe: slope.	Severe: piping.	Deep to water	Slope, large stones, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Dekalb	Severe: seepage, slope.	Severe: piping, large stones.	Deep to water	Slope, droughty, depth to rock.	Slope, depth to rock, large stones.	Slope, large stones, droughty.
GuC*, GuD*, GuE*, GwF3*:						
Gilpin	Severe: slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Upshur	Severe: slope, slippage.	Severe: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Ha Hackers	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
JaE Janelew	Severe: slope.	Moderate: large stones.	Deep to water	Slope, droughty, rooting depth.	Slope, large stones.	Large stones, slope, droughty.
Lh*:						
Lobdell	Severe: seepage.	Severe: piping.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Erodes easily.
Holly	Severe: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
MoB--------------- Monongahela	Moderate: seepage, slope.	Severe: piping.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness, rooting depth.	Erodeseasily, rooting depth, percs slowly.
Ms---------------- Moshannon	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
Po---------------- Pope	Severe: seepage.	Severe: piping.	Deep to water	Favorable------	Favorable------	Favorable.
Sn---------------- Senecaville	Moderate: seepage.	Severe: piping.	Flooding, frost action.	Wetness, flooding, erodes easily.	Wetness--------	Favorable.
Su---------------- Sensabaugh	Severe: seepage.	Moderate: large stones.	Deep to water	Flooding-------	Large stones---	Large stones.
Uf. Udorthents						
Ur*: Udorthents.						
Urban land-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable.
VaC, VaD, VaE----- Vandalia	Severe: slope, slippage.	Moderate: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily.	Slope, erod easily, percs slowly.
WuE3*: Westmoreland-----	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope----------	Slope.
Upshur-----------	Severe: slope, slippage.	Severe: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.

* 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	
BrE*:											
Bethesda	0-4	Channery silt loam.	ML, GM, GM-GC, CL-ML	A-4, A-6	0-15	65-90	55-80	50-80	35-75	25-40	4-14
	4-65	Very channery silty clay loam, extremely channery silt loam.	GM, GC, ML, CL	A-4, A-6, A-7, A-2	10-30	40-80	25-65	20-65	18-60	24-50	3-23
Rock outcrop.											
BuC, BuD Buchanan	0-6	Very stony loam	GM, ML, CL, CL-ML	A-2, A-4	3-20	50-90	45-75	40-75	30-65	20-35	2-11
	6-29	Channery loam, silt loam, channery sandy clay loam.	GM, ML, CL, SM	A-2, A-4	0-20	50-100	45-90	40-90	20-80	20-35	2-15
	29-65	Very channery loam, loam, channery clay loam.	GM, ML, CL, SM	A-2, A-4, A-6	0-20	50-100	30-80	30-75	20-60	20-35	2-15
Cn Chagrin	0-6	Silt loam	ML, CL, CL-ML	A-4	0	95-100	85-100	80-100	70-90	20-35	2-10
	6-28	Silt loam, loam, sandy loam.	ML, SM	A-4, A-2, A-6	0	90-100	75-100	55-90	30-80	20-40	NP-14
	28-65	Stratified silt loam to gravelly fine sand.	ML, SM, SP-SM	A-4, A-2	0	75-100	65-100	40-85	10-80	20-40	NP-10
GaC, GaD, GaE, GaF Gilpin	0-7	Silt loam	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	7-27	Channery loam, silt loam, 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
	27-30	Channery loam, channery silt loam, very channery 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
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
GDF*:											
Gilpin	0-7	Very stony silt loam.	GC, CL, SC, CL-ML	A-2, A-4, A-6	10-40	50-90	45-85	35-75	30-70	20-40	4-15
	7-27	Channery silt loam, channery loam, silty clay loam.	GM-GC, CL, CL-ML, SC	A-2, A-4, A-5	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	27-30	Channery loam, channery silt loam, very channery silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-5	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
GDF*:											
Dekalb----------	0-4	Very stony loam	SM, GM, ML, CL-ML	A-2, A-4, A-1	10-30	50-90	45-80	40-75	20-55	10-32	NP-10
	4-29	Channery sandy loam, channery loam, very channery sandy loam.	SM, GM, ML, GM-GC	A-2, A-4, A-1	5-40	50-85	40-75	40-75	20-55	15-32	NP-9
	29-36	Channery sandy loam, flaggy sandy loam, very flaggy loamy sand.	SM, GM, SC, GC	A-2, A-4, A-1	10-50	45-85	25-75	20-65	15-40	15-32	NP-9
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
GuC*:											
Gilpin----------	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	7-27	Channery loam, silt loam, 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
	27-30	Channery loam, channery silt loam, very channery 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
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Upshur----------	0-5	Silt loam--------	CL-ML, ML, CL	A-6, A-4	0	95-100	95-100	85-100	65-90	25-40	5-15
	5-39	Silty clay, clay	MH, CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40
	39-65	Silty clay loam, silty clay, clay.	CL, ML, MH, CH	A-6, A-7	0	80-100	65-100	60-100	55-95	35-55	11-25
GuD*:											
Gilpin----------	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	7-27	Channery loam, silt loam, 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
	27-30	Channery loam, channery silt loam, very channery 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
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Upshur----------	0-5	Silt loam--------	CL-ML, ML, CL	A-6, A-4	0	95-100	95-100	85-100	65-90	25-40	5-15
	5-39	Silty clay, clay	MH, CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40
	39-65	Silty clay loam, silty clay, clay.	CL, ML, MH, CH	A-6, A-7	0	80-100	65-100	60-100	55-95	35-55	11-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
GuE*:											
Gilpin----------	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	7-27	Channery loam, silt loam, 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
	27-30	Channery loam, channery silt loam, very channery 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
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Upshur----------	0-5	Silt loam--------	CL-ML, ML, CL	A-6, A-4	0	95-100	95-100	85-100	65-90	25-40	5-15
	5-39	Silty clay, clay	MH, CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40
	39-65	Silty clay loam, silty clay, clay.	CL, ML, MH, CH	A-6, A-7	0	80-100	65-100	60-100	55-95	35-55	11-25
GwF3*:											
Gilpin----------	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	7-27	Channery loam, silt loam, 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
	27-30	Channery loam, channery silt loam, very channery 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
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Upshur----------	0-5	Silt loam--------	CL-ML, ML, CL	A-6, A-4	0	95-100	95-100	85-100	65-90	25-40	5-15
	5-39	Silty clay, clay	MH, CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40
	39-65	Silty clay loam, silty clay, clay.	CL, ML, MH, CH	A-6, A-7	0	80-100	65-100	60-100	55-95	35-55	11-25
Ha-------------- Hackers	0-10	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	90-100	90-100	75-100	60-90	20-35	3-12
	10-54	Silt loam, clay loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	90-100	90-100	90-100	75-95	25-40	4-18
	54-65	Stratified fine sandy loam to silty clay loam.	ML, CL, SM, SC	A-4, A-6	0	85-100	60-100	55-95	40-85	20-40	1-15
JaE------------- Janelew	0-3	Channery silt loam.	ML, CL, CL-ML, GM-GC	A-4, A-6	0-5	55-80	50-75	45-70	40-65	20-35	4-11
	3-65	Channery silty clay loam, very channery silty clay loam, extremely channery silty clay loam.	SC, GC	A-2, A-4, A-6	10-25	35-70	30-65	30-60	25-50	25-40	8-14

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Lh*:											
Lobdell	0-6	Silt loam	ML, CL-ML, CL	A-4	0	95-100	90-100	80-100	65-90	20-30	NP-8
	6-32	Loam, silt loam	ML	A-4	0	90-100	80-100	70-95	55-85	20-35	NP-10
	32-65	Stratified sandy loam to silt loam.	ML, SM, CL-ML, CL	A-4	0	90-100	80-100	65-85	40-80	15-35	NP-10
Holly	0-3	Silt loam	ML	A-4	0	90-100	85-100	80-100	70-90	25-35	3-10
	3-24	Silt loam, loam, sandy loam.	ML, SM	A-4, A-6	0	85-100	75-100	70-95	45-85	20-40	NP-14
	24-32	Silt loam, loam, sandy loam.	ML, SM	A-4, A-2	0	85-100	75-100	50-95	25-80	20-40	NP-10
	32-65	Stratified silt loam to gravelly sand.	ML, SM, SP-SM	A-4, A-2, A-1-b	0-5	70-100	65-100	40-90	10-70	20-40	NP-10
MoB: Monongahela	0-10	Silt loam	ML, SM, CL-ML, SM-SC	A-4	0-5	90-100	85-100	75-100	45-90	20-35	1-10
	10-29	Silt loam, clay loam, gravelly loam.	ML, CL, CL-ML	A-4, A-6	0-15	90-100	80-100	75-100	70-90	20-40	5-15
	29-56	Silt loam, loam, gravelly loam.	ML, CL, SM, SC	A-4, A-6	0-10	80-100	60-100	55-95	45-95	20-40	3-15
	56-65	Silt loam, clay loam, gravelly sandy loam.	ML, CL, SM, SC	A-4, A-6	10-20	75-100	60-90	60-85	40-85	20-40	1-15
Ms: Moshannon	0-7	Silt loam	ML, CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	70-95	22-40	3-15
	7-42	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	90-100	80-95	25-40	3-15
	42-65	Silt loam, clay loam, gravelly fine sandy loam.	ML, CL, CL-ML, SC	A-4, A-6	0	80-100	70-100	55-100	35-80	25-40	3-15
Po: Pope	0-8	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-2, A-4	0	85-100	75-100	51-85	25-55	<20	NP-5
	8-44	Fine sandy loam, sandy loam, loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	95-100	80-100	51-95	25-75	<30	NP-7
	44-65	Gravelly sandy loam, loamy sand.	SM, SM-SC, ML, GM	A-2, A-1, A-4	0-20	45-100	35-100	30-95	15-70	<30	NP-7
Sn: Senecaville	0-7	Silt loam	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	75-100	60-90	20-35	3-12
	7-35	Silty clay loam, silt loam.	CL, ML, CL-ML	A-4, A-6	0	90-100	90-100	85-100	75-95	25-40	4-18
	35-65	Silt loam, fine sandy loam, loam.	ML, SM, SC, CL	A-4, A-6	0-5	90-100	70-100	65-95	45-90	20-40	1-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Su---------------- Sensabaugh	0-5	Silt loam--------	CL-ML, CL, ML	A-4	0-5	90-100	75-95	65-85	55-75	16-29	3-9
	5-25	Gravelly loam, gravelly clay loam, gravelly silty clay loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	2-18	70-95	55-90	45-75	35-65	20-35	5-14
	25-37	Gravelly loam, gravelly clay loam, very gravelly silty clay loam.	SM-SC, SC, GM-GC, GC	A-4, A-6	5-25	70-90	55-75	45-65	35-55	22-36	6-15
	37-65	Gravelly loam, gravelly clay loam, gravelly fine sandy loam.	SM-SC, SC, GM-GC, GC	A-4, A-6, A-2	5-30	55-90	25-75	25-65	20-55	20-36	6-15
Uf. Udorthents											
Ur*: Udorthents.											
Urban land.											
VaC, VaD, VaE---- Vandalia	0-9	Silt loam--------	ML, CL	A-4, A-6, A-7	0-5	80-100	75-100	70-95	50-90	25-45	5-20
	9-40	Silty clay loam, silty clay, clay.	CL, CH, ML	A-6, A-7	0-5	75-100	70-95	65-90	60-85	35-55	15-30
	40-65	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
WuE3*: Westmoreland----	0-4	Silt loam--------	ML, CL	A-4, A-6	0	85-100	80-100	75-95	60-95	<35	NP-10
	4-36	Silty clay loam, channery loam, silt loam.	CL, ML, GM, GC	A-4, A-6, A-7	0-15	65-100	55-95	50-90	45-85	22-45	2-20
	36-54	Very channery loam, very channery silt loam, channery silty clay loam.	GM, GC, SM, SC	A-2, A-1, A-4, A-6	0-20	25-95	20-95	15-90	15-80	20-40	2-20
	54	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Upshur----------	0-5	Silt loam--------	CL-ML, ML, CL	A-6, A-4	0	95-100	95-100	85-100	65-90	25-40	5-15
	5-39	Silty clay, clay	MH, CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40
	39-65	Silty clay loam, silty clay, clay.	CL, ML, MH, CH	A-6, A-7	0	80-100	65-100	60-100	55-95	35-55	11-25

* 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
BrE*:										
Bethesda	0-4	18-27	1.40-1.55	0.6-2.0	0.10-0.16	3.6-5.5	Low	0.28	5	<.5
	4-65	18-35	1.60-1.90	0.2-0.6	0.04-0.10	3.6-5.5	Low	0.32		
Rock outcrop.										
BuC, BuD Buchanan	0-6	10-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low	0.24	3-2	---
	6-29	18-30	1.30-1.60	0.6-2.0	0.10-0.16	3.6-5.5	Low	0.24		
	29-65	18-35	1.40-1.70	0.06-0.2	0.06-0.10	3.6-5.5	Low	0.17		
Cn Chagrin	0-6	10-27	1.20-1.40	0.6-2.0	0.20-0.24	5.6-6.5	Low	0.32	5	2-4
	6-28	18-30	1.20-1.50	0.6-2.0	0.14-0.20	5.6-7.3	Low	0.32		
	28-65	5-25	1.20-1.40	0.6-2.0	0.08-0.20	5.6-7.3	Low	0.32		
GaC, GaD, GaE, GaF Gilpin	0-7	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low	0.32	3	.5-4
	7-27	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24		
	27-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low	0.24		
	30	---	---	---	---	---	-------------	----		
GDF*:										
Gilpin	0-7	15-27	1.20-1.40	0.6-2.0	0.08-0.14	3.6-5.5	Low	0.24	3	---
	7-27	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24		
	27-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low	0.24		
	30	---	---	---	---	---	-------------	----		
Dekalb	0-4	10-20	1.20-1.50	6.0-20	0.08-0.12	4.5-6.5	Low	0.17	2	2-4
	4-29	7-18	1.20-1.50	6.0-20	0.06-0.12	4.5-5.5	Low	0.17		
	29-36	5-15	1.20-1.50	>6.0	0.05-0.10	4.5-5.5	Low	0.17		
	36	---	---	---	---	---	-------------	----		
GuC*:										
Gilpin	0-7	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low	0.32	3	.5-4
	7-27	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24		
	27-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low	0.24		
	30	---	---	---	---	---	-------------	----		
Upshur	0-5	15-27	1.20-1.40	0.6-2.0	0.12-0.16	5.1-6.5	Moderate	0.43	3	1-4
	5-39	40-55	1.30-1.60	0.06-0.2	0.10-0.14	5.1-6.0	High	0.32		
	39-65	27-45	1.30-1.60	0.06-0.2	0.08-0.12	5.1-7.8	Moderate	0.32		
GuD*:										
Gilpin	0-7	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low	0.32	3	.5-4
	7-27	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24		
	27-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low	0.24		
	30	---	---	---	---	---	-------------	----		
Upshur	0-5	15-27	1.20-1.40	0.6-2.0	0.12-0.16	5.1-6.5	Moderate	0.43	3	1-4
	5-39	40-55	1.30-1.60	0.06-0.2	0.10-0.14	5.1-6.0	High	0.32		
	39-65	27-45	1.30-1.60	0.06-0.2	0.08-0.12	5.1-7.8	Moderate	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
GuE*:										
Gilpin	0-7	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low	0.32	3	.5-4
	7-27	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24		
	27-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low	0.24		
	30	---	---	---	---	---	---	----		
Upshur	0-5	15-27	1.20-1.40	0.6-2.0	0.12-0.16	5.1-6.5	Moderate	0.43	3	1-4
	5-39	40-55	1.30-1.60	0.06-0.2	0.10-0.14	5.1-6.0	High	0.32		
	39-65	27-45	1.30-1.60	0.06-0.2	0.08-0.12	5.1-7.8	Moderate	0.32		
GwF3*:										
Gilpin	0-7	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low	0.32	3	.5-4
	7-27	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24		
	27-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low	0.24		
	30	---	---	---	---	---	---	----		
Upshur	0-5	15-27	1.20-1.40	0.6-2.0	0.12-0.16	5.1-6.5	Moderate	0.43	3	1-4
	5-39	40-55	1.30-1.60	0.06-0.2	0.10-0.14	5.1-6.0	High	0.32		
	39-65	27-45	1.30-1.60	0.06-0.2	0.08-0.12	5.1-7.8	Moderate	0.32		
Ha Hackers	0-10	15-27	1.20-1.40	0.6-2.0	0.18-0.24	5.6-6.5	Low	0.32	4	2-4
	10-54	18-35	1.30-1.50	0.6-2.0	0.12-0.18	5.6-6.5	Moderate	0.37		
	54-65	18-35	1.30-1.50	0.6-2.0	0.12-0.18	5.6-6.5	Low	0.28		
JaE Janelew	0-3	18-30	1.65-1.95	0.2-2.0	0.13-0.16	6.6-7.8	Low	0.24	5	1-5
	3-65	23-35	1.65-1.95	0.2-2.0	0.09-0.13	6.6-8.4	Moderate	0.20		
Lh*:										
Lobdell	0-6	15-27	1.20-1.40	0.6-2.0	0.20-0.24	5.6-6.5	Low	0.37	5	1-3
	6-32	18-30	1.25-1.60	0.6-2.0	0.17-0.22	5.6-7.3	Low	0.37		
	32-65	15-30	1.20-1.60	0.6-6.0	0.12-0.18	5.6-7.3	Low	0.37		
Holly	0-3	15-27	1.20-1.40	0.6-2.0	0.20-0.24	5.6-6.5	Low	0.28	5	2-5
	3-24	18-30	1.20-1.50	0.2-2.0	0.17-0.21	5.6-6.5	Low	0.28		
	24-32	10-27	1.20-1.45	0.6-2.0	0.10-0.20	5.6-6.5	Low	0.28		
	32-65	10-27	1.20-1.40	0.6-6.0	0.07-0.18	5.6-6.5	Low	0.28		
MoB Monongahela	0-10	10-27	1.20-1.40	0.6-2.0	0.18-0.24	4.5-5.5	Low	0.43	3	2-4
	10-29	18-35	1.30-1.50	0.6-2.0	0.14-0.18	4.5-5.5	Low	0.43		
	29-56	18-35	1.30-1.60	0.06-0.6	0.08-0.12	4.5-5.5	Low	0.43		
	56-65	10-35	1.20-1.40	0.2-0.6	0.08-0.12	4.5-5.5	Low	0.37		
Ms Moshannon	0-7	15-27	1.20-1.50	0.6-2.0	0.20-0.24	5.6-6.5	Low	0.37	5	1-3
	7-42	18-32	1.20-1.50	0.6-2.0	0.18-0.22	5.6-6.5	Low	0.37		
	42-65	12-32	1.20-1.50	0.6-2.0	0.14-0.18	5.6-7.3	Low	0.37		
Po Pope	0-8	5-15	1.20-1.40	2.0-6.0	0.10-0.16	3.6-5.5	Low	0.28	5	1-4
	8-44	5-18	1.30-1.60	0.6-6.0	0.10-0.18	3.6-5.5	Low	0.28		
	44-65	5-20	1.30-1.60	0.6-6.0	0.10-0.18	3.6-5.5	Low	0.28		
Sn Senecaville	0-7	15-27	1.20-1.40	0.6-2.0	0.18-0.24	5.6-6.5	Low	0.32	5	2-4
	7-35	18-35	1.20-1.40	0.2-2.0	0.12-0.18	5.6-6.5	Moderate	0.37		
	35-65	18-35	1.20-1.40	0.6-2.0	0.12-0.18	5.6-6.5	Low	0.28		
Su Sensabaugh	0-5	8-25	1.25-1.40	0.6-6.0	0.12-0.18	5.6-7.3	Low	0.24	5	1-3
	5-25	18-35	1.30-1.50	0.6-6.0	0.10-0.16	5.6-7.3	Low	0.20		
	25-37	12-35	1.30-1.50	0.6-6.0	0.10-0.15	5.6-7.3	Low	0.17		
	37-65	12-38	1.25-1.50	0.6-6.0	0.08-0.14	5.6-7.3	Low	0.17		

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		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
Uf. Udorthents										
Ur*: Udorthents.										
Urban land.										
VaC, VaD, VaE----- Vandalia	0-9	20-35	1.20-1.50	0.2-2.0	0.12-0.18	5.1-6.0	Moderate-----	0.37	4	1-3
	9-40	35-50	1.30-1.60	0.06-0.6	0.12-0.15	5.1-6.0	High---------	0.32		
	40-65	27-50	1.30-1.60	0.06-0.6	0.08-0.12	5.1-7.3	High---------	0.32		
WuE3*: Westmoreland----	0-4	15-30	1.20-1.40	0.6-2.0	0.16-0.20	4.5-6.0	Low----------	0.37	3	1-4
	4-36	20-35	1.20-1.50	0.6-2.0	0.12-0.18	4.5-6.0	Low----------	0.28		
	36-54	18-35	1.20-1.50	0.6-2.0	0.06-0.10	5.1-6.0	Low----------	0.17		
	54	---	---	---	---	---	-------------	----		
Upshur----------	0-5	15-27	1.20-1.40	0.6-2.0	0.12-0.16	5.1-6.5	Moderate-----	0.43	3	1-4
	5-39	40-55	1.30-1.60	0.06-0.2	0.10-0.14	5.1-6.0	High---------	0.32		
	39-65	27-45	1.30-1.60	0.06-0.2	0.08-0.12	5.1-7.8	Moderate-----	0.32		

* 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				
BrE*:										
Bethesda	C	None	>6.0	---	---	>60	---	Moderate	Moderate	High.
Rock outcrop.										
BuC, BuD Buchanan	C	None	1.5-3.0	Perched	Nov-Mar	>60	---	Moderate	High	High.
Cn Chagrin	B	Occasional	4.0-6.0	Apparent	Feb-Mar	>60	---	Moderate	Low	Moderate.
GaC, GaD, GaE, GaF Gilpin	C	None	>6.0	---	---	20-40	Soft	Moderate	Low	High.
GDF*:										
Gilpin	C	None	>6.0	---	---	20-40	Soft	Moderate	Low	High.
Dekalb	C	None	>6.0	---	---	20-40	Hard	Low	Low	High.
GuC*, GuD*, GuE*, GwF3*:										
Gilpin	C	None	>6.0	---	---	20-40	Soft	Moderate	Low	High.
Upshur	D	None	>6.0	---	---	>40	Soft	Moderate	High	Moderate.
Ha Hackers	B	Rare**	>6.0	---	---	>60	---	Moderate	Low	Moderate.
JaE Janelew	C	None	>6.0	---	---	>60	---	Moderate	High	Low.
Lh*:										
Lobdell	B	Occasional	2.0-3.5	Apparent	Dec-Apr	>60	---	High	Low	Moderate.
Holly	D	Frequent	0-1.0	Apparent	Dec-May	>60	---	High	High	Moderate.
MoB Monongahela	C	None	1.5-3.0	Perched	Dec-Apr	>60	---	Moderate	High	High.
Ms Moshannon	B	Occasional**	4.0-6.0	Apparent	Feb-Mar	>60	---	High	Low	Moderate.

See footnotes 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				
Po---------------- Pope	B	Occasional------	>6.0	---	---	>60	---	Moderate	Low------	High.
Sn---------------- Senecaville	B	Occasional**----	1.5-3.0	Apparent	Dec-Apr	>60	Hard	High-----	Moderate	Moderate.
Su---------------- Sensabaugh	B	Occasional------	4.0-6.0	Apparent	Jan-Apr	>60	---	---	Low------	Low.
Uf. Udorthents										
Ur*: Udorthents.										
Urban land.										
VaC, VaD, VaE----- Vandalia	D	None------------	4.0-6.0	Perched	Feb-Apr	>60	---	Moderate	High-----	Moderate.
WuE3*: Westmoreland-----	B	None------------	>6.0	---	---	>40	Hard	Moderate	Low------	High.
Upshur-----------	D	None------------	>6.0	---	---	>40	Soft	Moderate	High-----	Moderate.

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

** The frequency of flooding has been reduced in areas downstream from the Stonewall Jackson Dam. The Army Corps of Engineers can provide further data on flooding.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Bethesda	Loamy-skeletal, mixed, acid, mesic Typic Udorthents
Buchanan	Fine-loamy, mixed, mesic Aquic Fragiudults
Chagrin	Fine-loamy, mixed, mesic Dystric Fluventic Eutrochrepts
Dekalb	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Gilpin	Fine-loamy, mixed, mesic Typic Hapludults
Hackers	Fine-silty, mixed, mesic Typic Hapludalfs
Holly	Fine-loamy, mixed, nonacid, mesic Typic Fluvaquents
Janelew	Loamy-skeletal, mixed (calcareous), mesic Typic Udorthents
Lobdell	Fine-loamy, mixed, mesic Fluvaquentic Eutrochrepts
Monongahela	Fine-loamy, mixed, mesic Typic Fragiudults
Moshannon	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
Pope	Coarse-loamy, mixed, mesic Fluventic Dystrochrepts
Senecaville	Fine-silty, mixed, mesic Fluvaquentic Eutrochrepts
Sensabaugh	Fine-loamy, mixed, mesic Dystric Fluventic Eutrochrepts
Udorthents	Udorthents
Upshur	Fine, mixed, mesic Typic Hapludalfs
Vandalia	Fine, mixed, mesic Typic Hapludalfs
Westmoreland	Fine-loamy, mixed, mesic Ultic Hapludalfs

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