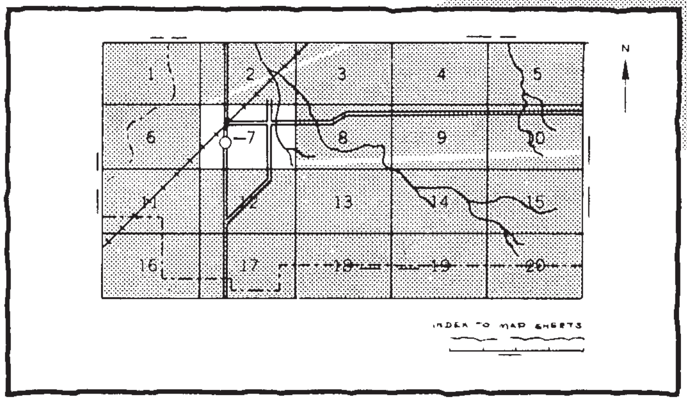
SOIL SURVEY OF

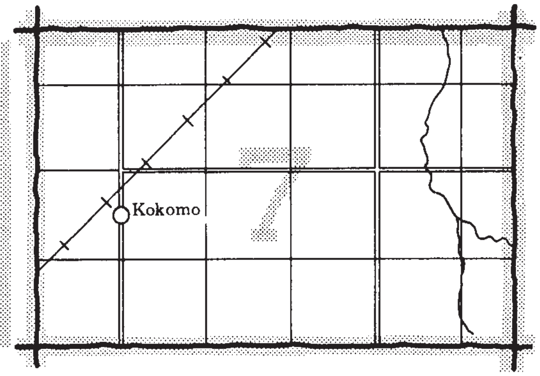
Warrick County, Indiana

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Purdue University Agricultural Experiment Station

HOW TO USE

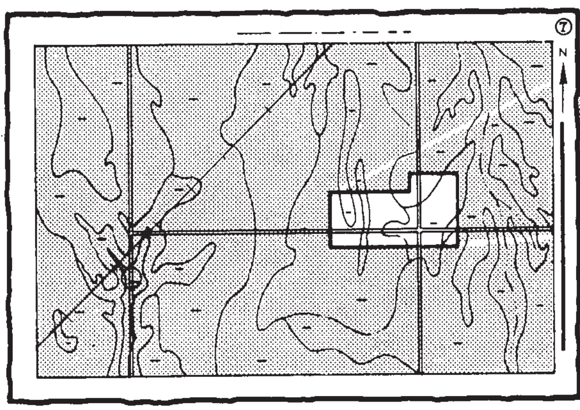
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

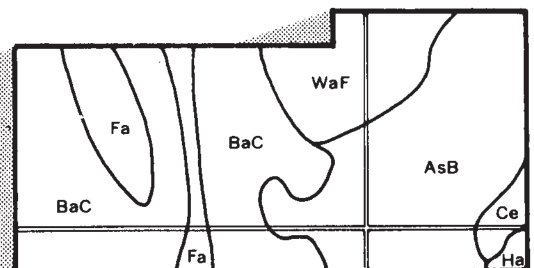




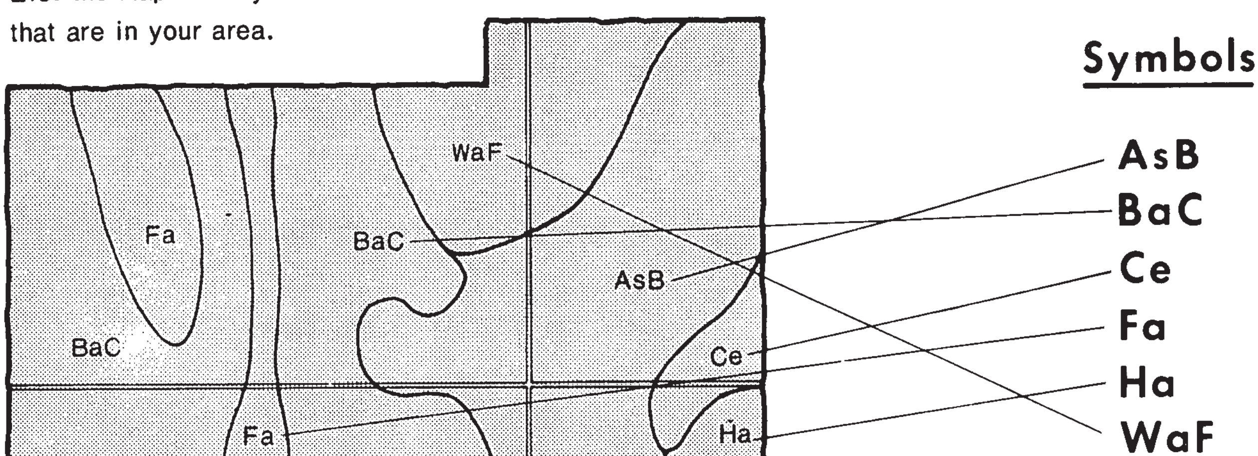
2. Note the number of the map sheet and turn to that sheet.

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



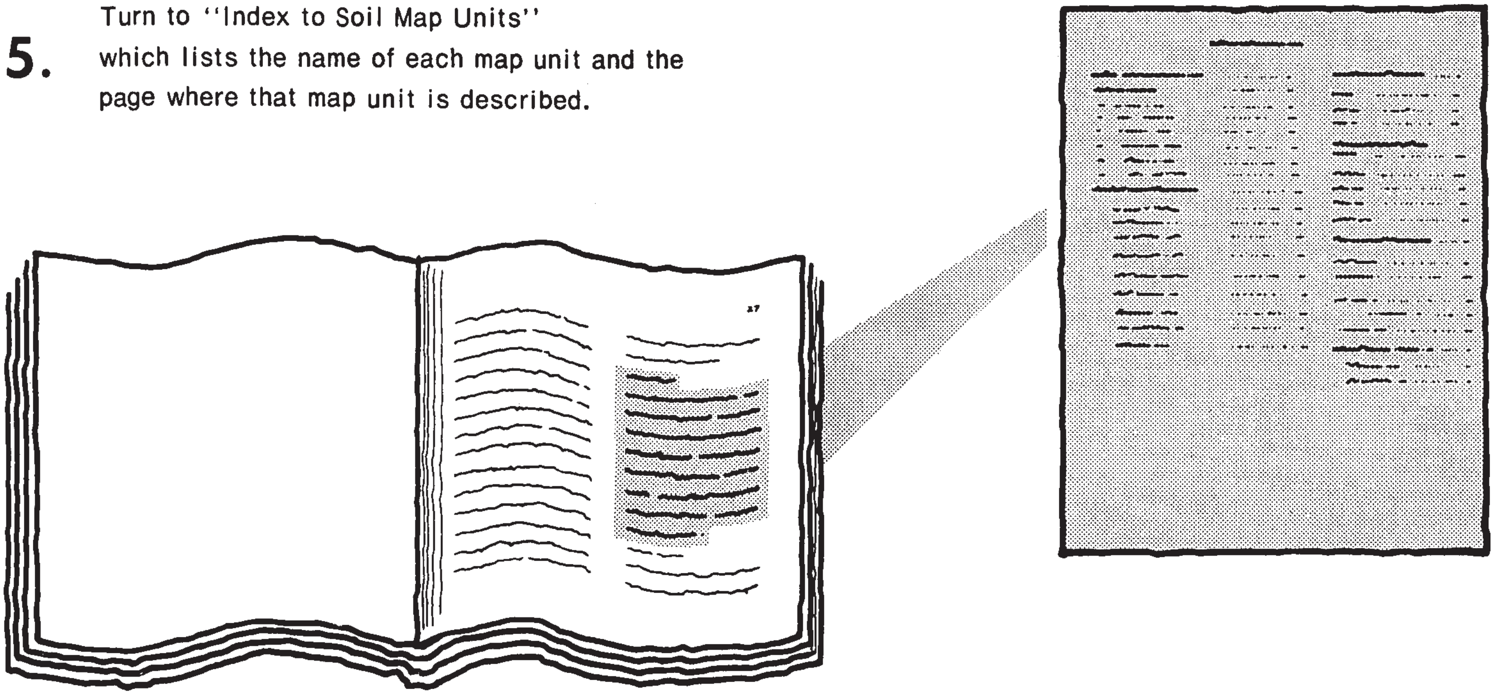


4. List the map unit symbols that are in your area.

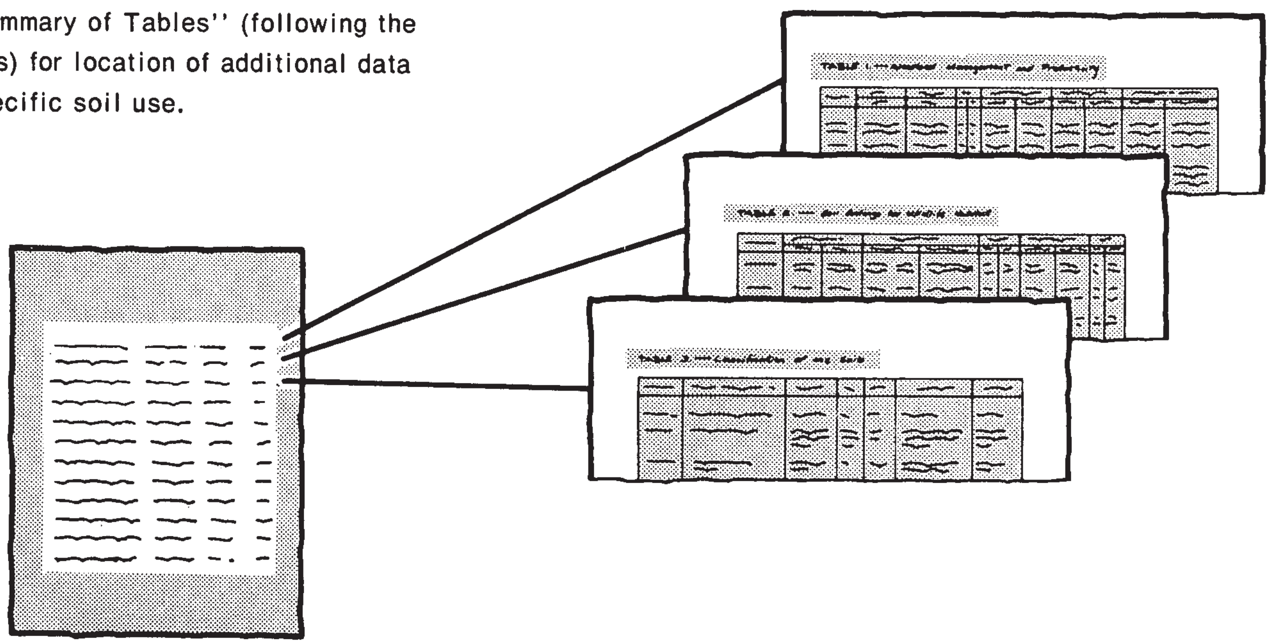


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1971 to 1975. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the Soil Conservation Service and the Purdue University Agricultural Experiment Station. It is part of the technical assistance furnished to the Warrick County Soil and Water Conservation District.

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

Cover: Zanesville and Wellston soils are in hay and pasture.

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Issued February 1979

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Summary of Tables

Foreword

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

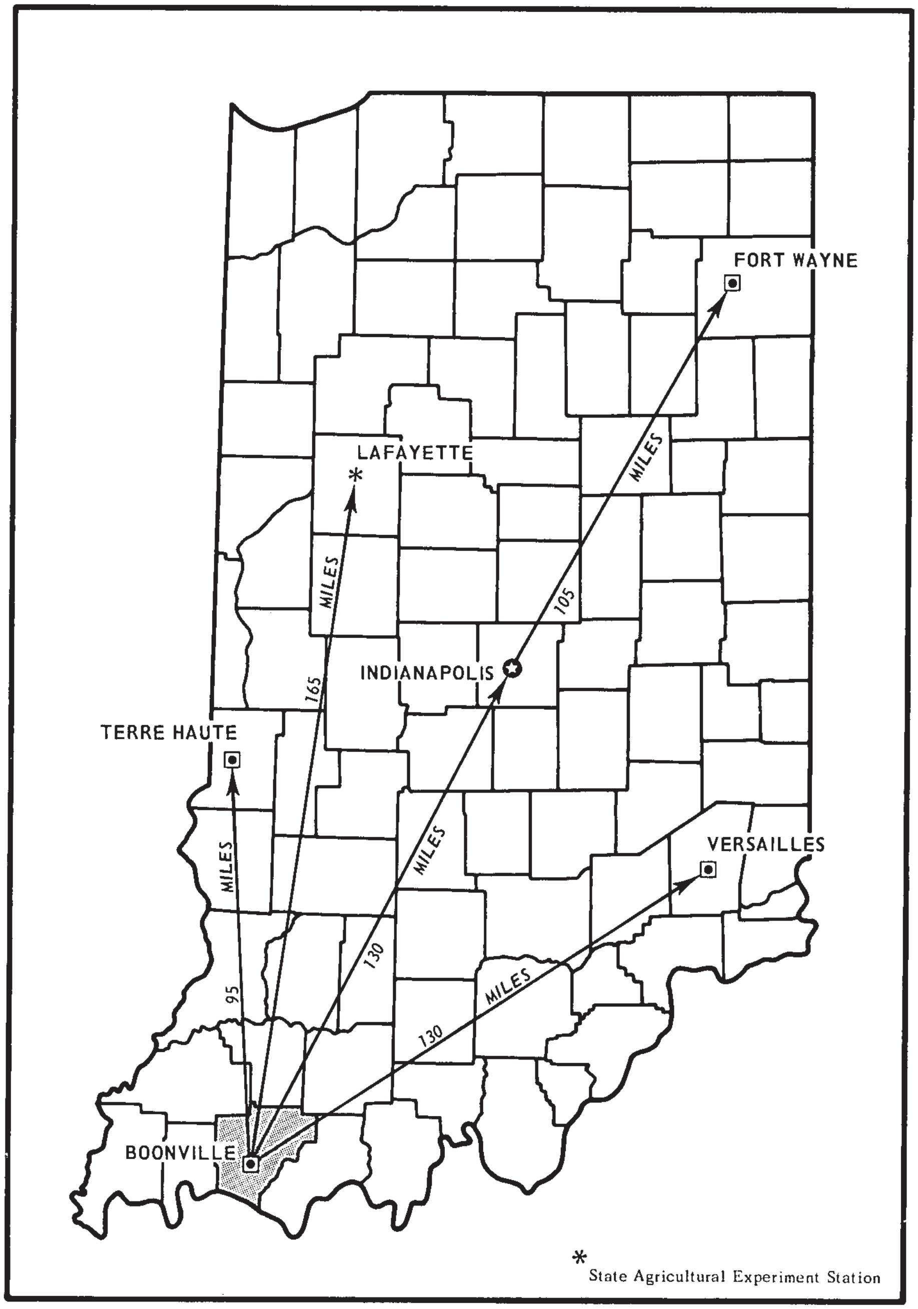
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers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

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

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

State Conservationist
Soil Conservation Service



Location of Warrick County in Indiana.

SOIL SURVEY OF WARRICK COUNTY, INDIANA

By Jerold L. Shively, Soil Conservation Service

Fieldwork by Jerold L. Shively, George McElrath, Jr., and Leo A. Kelly

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Purdue University Agricultural Experiment Station

WARRICK COUNTY is in the southwestern part of Indiana (see facing page). It has a total area of 250,240 acres, or 391 square miles. Boonville, the county seat, is in the center of the county. It had a population of 5,736 in 1970. In 1974, according to U.S. census, the total population of the county was 33,300 (*8*). There were 766 farms in Warrick County in 1969. The average size of farms is 171 acres. Principal industries, in addition to farming, include coal mining, aluminum smelting, and manufacturing. The climate is favorable for farming.

About 48 percent of Warrick County is cropland and pasture, and 31 percent is woodland. Much of the coal mine land has been reclaimed and is included in the estimates of woodland or pasture. The rest of the county is in active mining and other uses, such as housing (*3*).

Relief ranges from nearly level on the flood plain and terraces to very steep on the highly dissected hilly uplands. Most of the upland is gently sloping or moderately sloping and 400 and 550 feet above sea level. The Ohio River bottom land is 342 feet above sea level in the southwestern part of the county (*5*). Drainage is generally in a southerly direction into three major tributaries of the Ohio River. Nearly level lacustrine terraces are in basins of these tributaries.

The upland soils are mostly on or in formations of siltstone, shale, or sandstone that has a silty loess cap. Loess thickness ranges from 20 feet in the southern part of the county to 2 1/2 feet in the northwestern part. The main source of loess was the lowlands along the Wabash and Ohio Rivers to the west and south.

Generally, the bottom land floods, the terraces are wet, and the uplands are erodible.

General nature of the county

This part of the survey describes features in Warrick County that affect soil use. These are climate, relief, water, transportation facilities, manufacturing and business services of agriculture, and trends in population and land use.

Climate.—Warrick County has a warmer and longer growing season than most other counties in Indiana. Rainfall is usually adequate for diversified agriculture, but in summer, when moisture utilization is high, a month of below normal rainfall can affect lawns, pastures, and crops.

The climate is affected by a succession of weather fronts and associated centers of high and low air pressure passing through the Ohio River Basin. In general, a high pressure center brings cooler temperatures, lower humidity, and sunny days. An approaching low brings warmer temperatures, increasing southerly winds, high humidities, and rain. This activity increases in winter, producing greater changes in temperature.

Precipitation is evenly distributed throughout the year. The wettest week is usually early in April, when there is a 43 percent chance for an inch or more of rainfall. The probability drops to 20 percent late in October and early in November.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Evansville and Boonville for the period 1928 to 1973. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring.

In winter the average temperature is 35 degrees F, and the average daily minimum temperature is 26 degrees. The lowest temperature on record, which occurred at Evansville on February 2, 1951, is -23 degrees. In summer the average temperature is 76 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred on July 13, 1936, is 108 degrees.

Of the total annual precipitation, 21.8 inches, or 52 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 16.9 inches. The heaviest 1-day rainfall during the period of record was 5.94 inches at Boonville on June 10, 1934. Thunderstorms occur on about 46 days each year, 8 of which occur in July.

Average seasonal snowfall is 13 inches. On the average, 12 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity at the noon hour in spring is less than 57 percent. Humidity is higher at night, and the average at dawn is about 81 percent. The percentage of possible sunshine is 76 in August and 40 in December. The prevailing wind is from the south-southwest. Average windspeed is 8.3 miles per hour.

Lawrence A. Shaa, State climatologist, Department of Agronomy, Purdue University, helped prepare this information on climate.

Relief.—The relief is generally nearly level on the Ohio River bottom land, Ohio River terraces, lacustrine terraces, and stream terraces. Most soils of the uplands are gently sloping to moderately sloping. Steeper upland soils are adjacent to the Ohio River terraces and bottom land in the southern part of the county, the Big and Little Ditney Hills in the western part, Ringham Hill and Dyson Knob north of Lynnville in the northern part, Cole Knob north of Tennyson in the eastern part, and the Selvin-Heilman area in the northeastern part. The highest point in the county, 658 feet, is north of Lynnville. Big Ditney Hill is 648 feet high. The lowest point, 342 feet, is the downstream end of the Ohio River below Newburg.

Water.—Ground water supply is closely related to the geology of the county.

The Ohio River bottom land and terraces have good sources of good quality water. The lacustrine terraces have fair or poor sources of water that is of fair quality. The uplands and associated bottom land have poor or nonexistant sources of water. The Ohio River bottom land and terraces are the major sources of water, which is pumped by waterlines throughout the county. Only Lynnville uses other water. Its source is stripper pits. Drilled wells are uncommon on the uplands and stream bottom land. Most drinking water is hauled in.

Transportation facilities.—Barges are used for transportation on the Ohio River. An interstate highway crosses the northern part of Warrick County, connecting it to the St. Louis and Louisville markets. Other State and federal highways have only two lanes. The Southern, the Penn Central, and private industrial company railroads serve the county. Transportation to agricultural markets is adequate.

Manufacturing and business services of agriculture.—Adequate grain terminals for sale of grain are throughout the county. Livestock terminals are nearby. All major machinery companies have stores within the county or in adjoining counties. There are many fertilizer, chemical, and seed suppliers throughout the county.

Trends in population and land use.—Population is concentrated in the southwestern part, near Newburgh, Chandler, and Boonville. In this area it is expanding rapidly. The population of the rest of the county is remaining constant. In areas owned by coal companies, population is decreasing. The county is mainly agricultural, except in areas near the coal fields and in the Newburgh area, which is rapidly changing to urban uses. Disposal of effluent is limited by the slowly or very slowly permeable subsoil on most uplands in the Hosmer-Zanesville and Zanesville-Tilsit-Wellston units. This is explained under the heading "Sanitary facilites."

Surface mining for coal will eventually cover about 40 percent of the county, mostly the uplands and stream bottom land. The coal is used to produce electricity. Most of the aluminum produced in Indiana is produced along the Ohio River near Yankeetown. Most nonagricultural land uses involve coal and aluminum.

How this survey was made

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

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

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

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

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

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

General soil map for broad land use planning

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

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

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Map unit descriptions

1. Huntington-Newark-Wheeling

Nearly level and gently sloping, well drained and somewhat poorly drained soils formed in alluvium; on flood plains and river terraces

This map unit occupies long swells and swales of bottom land parallel to the Ohio River and areas on terraces that are about 15 to 30 feet higher in elevation than the adjacent bottom land.

This unit makes up about 2 percent of the county. It is about 24 percent Huntington soils (fig. 1), 22 percent Newark soils, 19 percent Wheeling soils, and 35 percent minor soils.

The well drained, nearly level Huntington soils, on flood plains throughout the unit, are dominantly nearest the river. The somewhat poorly drained, nearly level Newark soils, in lower areas of the flood plains, are dominantly near the drainageways. The well drained, nearly level and gently sloping Wheeling soils are on terraces above the flood plains. All have a silt loam surface layer. Only the Newark soils have a seasonal high water table.

Minor in this unit, on flood plains, are the well drained Woodmere soils, the moderately well drained Wilbur soils, and the somewhat poorly drained Birds soils. The moderately well drained Sciotoville soils and the somewhat poorly drained Weinbach soils are minor soils on the terraces.

This unit is used mainly as cropland and pasture. Some areas are woodland. Flooding is the main limitation. Wetness is an additional limitation in the Newark soils.

The potential is fair for cultivated crops that are not protected from floodwater. Planting is often delayed, and sometimes crops are damaged. The potential is poor for residential and other urban uses because of flooding.

2. Orthents

Gently sloping to very steep, well drained soil on strip mined lands on uplands

This map unit consists of series of parallel long steep swales and swells about 20 to 50 feet between the peak and valley. About one-third of the association consists of smoothed undulating stripmine lands in a random pattern.

This unit occupies about 16 percent of the county. About 79 percent is made up of Orthents and 21 percent minor soils.

The well drained, gently sloping to very steep Orthents are on uplands that have been strip mined to remove coal.

The minor soils are the well drained Hosmer soils, the well drained Alford soils, the well drained Zanesville soils, and the well drained Wellston soils on high lying portions of the landscape that have not been disturbed by mining operations. The somewhat poorly drained Wakeland and Stendal soils, the poorly drained Birds and Bonnie soils, and the moderately well drained Wilbur and Steff soils are on lower lying portions of the landscape that have not been disturbed in mining operations.

The soils in this unit when smoothed or leveled are used for cropland, hayland, and pasture. Unleveled areas are used for woodland. The main concerns of management are control of erosion, clayeyness, and stoniness.

The soils dominantly have poor potential for all uses unless smoothed or leveled. The smoothed areas have fair potential for agricultural crops when conservation measures are used to prevent excessive soil losses caused by erosion. These areas have fair potential for woodland and urban uses. Slope, uneven compaction and settling of material, moderately slow permeability, and shrinking and swelling limit use.

3. Alford-Muren

Nearly level to moderately steep, well drained and moderately well drained soils formed in deep loess; on uplands

Areas of this map unit are on uplands in the southern part of the county, near the Ohio River. Differences in elevation between the major ridgetop and lower side slopes range from 20 to 50 feet or more.

This map unit makes up about 5 percent of the county. It is about 72 percent Alford soils (fig. 2), 8 percent Muren soils, and 20 percent minor soils.

The well drained Alford soils are on the tops and sides of ridges. They are nearly level to moderately steep and are slightly higher in elevation than Muren soils. The moderately well drained Muren soils are mainly on the flatter ridgetops. They are nearly level and gently sloping. Both soils have a silt loam surface layer. The Muren soils have a seasonal high water table that fluctuates between depths of 3 and 6 feet.

Minor in this unit are the poorly drained Birds soils and the somewhat poorly drained Wakeland and Iva soils in depressions or along drainageways. The well drained Hosmer and Wellston soils are at high positions on the landscape. Small areas of Orthents, which have been smoothed or leveled, are also included.

This unit is used mainly as cropland, hayland, and pasture. A few areas are woodland. Erosion is a hazard in cultivated areas.

The potential is good for cultivated crops. It is also good for residential and other urban uses.

4. Zipp-McGary-Evansville

Nearly level, very poorly drained to somewhat poorly drained soils formed in lacustrine sediments; on terraces

This map unit is on lake plains dissected by drainageways that cut into and expose stratified clay and silt. Differences in elevation range from a few inches per mile on the plains to a 20-foot drop into the drainageways.

This unit makes up about 13 percent of the county. It is about 30 percent Zipp soils (fig. 3), 17 percent McGary soils, 11 percent Evansville soils, and 42 percent minor soils.

The very poorly drained Zipp soils are in very slightly concave depressions in terrace plains throughout the unit, dominantly on broad flats away from the drainageways. The somewhat poorly drained McGary soils are on broad, very slightly convex flats on terrace plains throughout the unit. The poorly drained Evansville soils are in very slightly concave depressions in terrace plains away from the principal drainageways.

Minor in this unit are the well drained Markland and Uniontown soils at higher positions on the landscape. There are also small areas of the moderately well drained Wilbur soils, the somewhat poorly drained Wakeland and Henshaw soils, and the poorly drained Patton soils.

This unit is used mainly as cropland, hayland, and pasture. Some areas are woodland. Drainage has been established in most areas. There are some swampy undrained areas in the woodland. Wetness is the main limitation. Permeability is also restricted.

The potential is good for cultivated farm crops in areas that are adequately drained. Wetness is such a severe limitation and so difficult to overcome that the potential for residential and other urban uses is poor.

5. Hosmer-Zanesville

Nearly level to strongly sloping, well drained soils with fragipan, formed in loess; on uplands

This map unit occurs as scattered areas throughout the county. The soils are on loess covered till plains on uplands. Differences in elevation range from 5 to 80 feet.

This unit makes up about 31 percent of the county. It is about 59 percent Hosmer soils (fig. 4), 14 percent Zanesville soils, and 27 percent minor soils.

The well drained, nearly level to strongly sloping Hosmer soils are on ridgetops, side slopes, and toe slopes. The well drained, sloping and strongly sloping Zanesville soils are on side slopes. Both soils have a silt loam surface layer and a fragipan.

Minor in this unit are the well drained Wellston and Gilpin soils and Orthents and the somewhat poorly drained Iva and Johnsburg soils on the uplands. Other minor soils include the moderately well drained Steff and Wilbur soils, the somewhat poorly drained Stendal and Wakeland soils, and the poorly drained Birds and Bonnie soils on the flood plains.

This unit is used mainly as cropland, hayland, and pasture. Some areas are woodland. The main concerns of management are erosion, the slow movement of water through the soil, and the limited root zone.

The potential is fair for cultivated crops. Erosion is a hazard in most areas and crops can lack adequate moisture. The potential is fair for residential and other urban uses. The water table is perched on top of the fragipan for short periods. Commercial sewers are generally needed, because the fragipan is slowly or very slowly permeable and thus greatly restricts the downward movement of effluent or water through the soil.

6. Zanesville-Tilsit-Wellston

Nearly level to moderately steep, well drained and moderately well drained soils formed in loess and the underlying residuum from siltstone, sandstone, and shale; on uplands

This map unit occurs as scattered areas throughout the northern half of the county. The soils are mantled with loess less than 4 feet thick. Differences in elevation from the toe slopes to the ridgetops range from 25 to 150 feet.

This unit makes up about 18 percent of the county. It is about 62 percent Zanesville soils (fig. 5), 9 percent Tilsit soils, 7 percent Wellston soils, and 22 percent minor soils.

The well drained, gently sloping to strongly sloping Zanesville soils are at the higher positions throughout the unit. The moderately well drained, nearly level and gently sloping Tilsit soils are dominantly at lower positions, mainly on flats and toe slopes. The well drained, strongly sloping or moderately steep Wellston soils are on upland side slopes.

Minor in this unit on uplands are the well drained Gilpin and Hosmer soils and Orthents and the somewhat poorly drained Johnsburg soils. Also included along drainageways are the moderately well drained Steff soils, the somewhat poorly drained Stendal soils, and the poorly drained Bonnie soils.

This unit is used mainly as hayland (fig. 6), pasture, and woodland. Some areas are used for cultivated crops. The main concern of management is erosion. Crops can lack adequate moisture. Slope, the fragipan in most of the soils, and bedrock limit this soil for other uses.

The potential is poor for cultivated crops. It is also poor for residential and other urban uses. The potential is fair for woodland.

7. Stendal-Wakeland-Bonnie

Nearly level, somewhat poorly drained and poorly drained soils formed in alluvium; on flood plains

This map unit consists of nearly level flood plains characterized by swell and swale topography. Most swells are along stream channels.

This unit makes up about 15 percent of the county. It is about 32 percent Stendal soils (fig. 7), 25 percent Wakeland soils, 22 percent Bonnie soils, and 21 percent minor soils.

The somewhat poorly drained Stendal and Wakeland soils are at the higher positions on the landscape or on the very gradual swells. The poorly drained Bonnie soils are dominantly in the large slightly concave swales away from the main stream. All have a silt loam surface layer.

Minor in this unit on the flood plains are the poorly drained Birds soils; the moderately well drained Wilbur and Steff soils at the highest positions on the landscape; and the somewhat poorly drained, nearly level Bartle soils, which are also on swells. The moderately well drained Pekin soils and the poorly drained Peoga soils are on the slightly higher stream terraces adjacent to this unit.

This unit is used as cropland, hayland, and pasture. Some areas are woodland. Flooding and wetness are the main limitations.

The potential is only fair for cultivated crops unless the soils are adequately drained and protected from flooding. The potential is poor for residential and other urban uses.

Broad land use considerations

Deciding what land should be used for urban development is important in the survey area. Each year a considerable amount of land is developed for urban uses in Chandler, Stevenson, Newburgh, Boonville, and other cities in the county. An estimated 12,000 acres of the survey area is urban or built-up land. The general soil map is most helpful for planning the general outline of urban areas, but it cannot be used to select sites for specific urban structures. In areas where the potential is good for cultivated crops, potential may not be good for urban development. The data about specific soils in this survey can be helpful in planning future land use patterns.

Areas where the soils are so unfavorable that urban development is prohibitive are not extensive in the survey area. Large areas of the Huntington-Newark-Wheeling and the Stendal-Wakeland-Bonnie units are on flood plains where flooding is a severe limitation. Many parts of the Zanesville-Tilsit-Wellston unit are moderately sloping to moderately steep soils that have hard bedrock a few feet below the surface. Urban development is costly on such soils. The potential is poor for urban development on the clayey soils of the Zipp-McGary-Evansville unit because of high shrink-swell potential.

In some areas are soils that can be developed for urban uses at a lower cost than that necessary for the soils just mentioned. These include most of the Alford-Muren unit, the gently sloping part of the Orthents unit, and the less sloping parts of the Zanesville-Tilsit-Wellston and the Hosmer-Zanesville units. The Alford-Muren unit is excellent farmland, and this potential should not be overlooked when broad land uses are considered. The Orthents unit is in leveled strip mine areas. In the Alford-Muren and Orthents units, there are soils that have a fragipan with a perched water table. Wetness is easy to overcome, but the slow movement of water through the soil restricts the use of onsite sanitary facilities.

In some areas potential is good for farming but is fair to poor for nonfarm uses. The Zipp-McGary-Evansville unit is an example. Wetness is a limitation to nonfarm uses, but proper drainage and shaping of the surface can overcome this limitation. The potential is good, however, for farming, and many farmers provide sufficient drainage for crops. The potential is fair for farming and poor for nonfarm uses in the Huntington-Newark-Wheeling and the Stendal-Wakeland-Bonnie units. Flooding is the main limitation of these units.

In most soils of the county the potential is good or fair for woodland. Commercially valuable trees are less common and generally do not grow so rapidly on the wetter soils of the Zipp-McGary-Evansville and the Stendal-Wakeland-Bonnie units as they do on the other soils.

The potential is excellent as sites for parks and extensive recreation areas in the hilly Zanesville-Tilsit-Wellston unit. Hardwood forests enhance the beauty of many of the areas. Undrained marshes and swamps in the Zipp-McGary-Evansville unit are suitable areas for nature study. All these units provide habitat for many important wildlife species.

Soil maps for detailed planning

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

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

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

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

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

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes, soil associations, and undifferentiated groups.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Gilpin soils, gullied, 12 to 18 percent slopes, is an undifferentiated group in this survey area.

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

The acreage and proportionate extent of each map unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

AfB2—Alford silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on broad convex ridgetops, long side slopes, and concave toe slopes of the uplands. Slopes are 100 to 175 feet long. Most areas are broad and irregular. Areas are dominantly 40 acres but range from 2 to 150 acres.

In a typical profile the surface layer is brown silt loam about 8 inches thick. The subsoil is about 52 inches thick. The upper part is yellowish brown or strong brown, firm light silty clay loam. The lower part is strong brown, mottled, firm silt loam. The substratum to a depth of 80 inches is brown, mottled silt loam.

In some places the subsoil is not so thick. In small eroded areas on steeper slopes, it has been mixed with the surface layer through plowing and the present surface layer is a light silty clay loam.

Included with this soil in mapping are a few small, slightly depressional areas of wetter Muren soils. Also included are small areas of soils that have slopes of less than 2 percent and areas less than 75 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is very high, and permeability is moderate. The organic matter content is moderate because part of the surface layer has been removed by erosion. Surface runoff is medium in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. Root development is good.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. Some are used for hay or pasture, and a few are orchards or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion control is needed in cultivated areas. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. Crop residue and cover crops help to control erosion and also improve and maintain tilth and organic matter content.

Keeping this soil in grasses and legumes for hay or pasture is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

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

Soil features that affect the engineering use of this soil are the high frost action potential, moderate permeability, poor compaction characteristics of the substratum material, and the severe hazard of erosion during construction.

Limitations are moderate for building sites because of low strength or shrink-swell and severe for local roads and streets because of frost action and low strength. Limitations are slight for septic absorption fields and moderate for sewage lagoons.

Footings and basement walls should be designed to prevent structural damage caused by shrinking and swelling and low strength. Roads should be constructed on the contour and the base material strengthened. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction. Grasses should be planted as soon as possible. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. The seepage problem of lagoons can usually be overcome by special treatment to seal the bottom of the lagoon. Capability subclass IIe; woodland subclass 1o.

AfC—Alford silt loam, 6 to 12 percent slopes. This moderately sloping, deep, well drained soil is on side slopes adjacent to drainageways of the uplands. Slopes are 125 to 175 feet long. Areas are small and long and narrow. They are dominantly about 8 acres but range from 2 to 40 acres.

In a typical profile the surface layer is dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil is about 47 inches thick. The upper part is yellowish brown or strong brown, firm silty clay loam. The lower part is brown, mottled, firm heavy silt loam. The substratum to a depth of 80 inches is brown, mottled silt loam.

In some wooded areas the surface layer is very dark grayish brown. In areas it is dark grayish brown.

Included with this soil in mapping are a few small areas of severely eroded Alford soils. Also included are areas less than 75 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is very high, and permeability is moderate. The organic matter content is moderate. Surface runoff is medium in cultivated areas. Reaction in the surface layer is medium acid to neutral. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. Root development is good.

Most of the acreage is woodland. Some of it is farmed. Some areas are used for corn, soybeans, and small grain, and some for hay and pasture.

This soil is suited to corn, soybeans, and small grain. If it is cultivated, the erosion hazard is severe. Crop rotations, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures are needed to control runoff and erosion and prevent excessive soil loss. Crop residue and cover crops also reduce runoff and the risk of erosion. In addition, they help in maintaining tilth and the organic matter content.

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

This soil is suited to trees (fig. 8). Most areas are in hardwoods. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

Soil features that affect the engineering use of this soil are the high frost action potential, moderate permeability, poor compaction characteristics of the substratum material, and the severe hazard of erosion during construction.

Limitations are moderate for building sites because of low strength and shrink-swell. They are severe for local roads and streets because of frost action and low strength. Limitations are moderate for septic tank absorption fields and severe for sewage lagoons because of the slope. Foundations and footings of buildings should be properly designed to prevent structural damage caused by shrinking and swelling and low strength. Roads should be constructed on the contour, and the base material strengthened. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction. Grasses should be planted as soon possible. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. The seepage problem of lagoons can usually be overcome by special treatment to seal the bottom of the lagoon. Capability subclass IIIe; woodland subclass 1o.

AfC3—Alford silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on side slopes between ridgetops and drainageways of the uplands. Slopes are 125 to 175 feet long. Areas are generally long and narrow. They are dominantly about 15 acres but range from 2 to 40 acres.

In a typical profile the surface layer is yellowish brown heavy silt loam about 6 inches thick. The subsoil is about 40 inches thick. The upper part is strong brown, firm silty clay loam, and the lower part is strong brown, mottled, firm silt loam. The substratum to a depth of 80 inches is brown, mottled silt loam.

In places the subsoil is not so thick. In the more severely eroded areas the surface layer is silty clay loam.

Included with this soil in mapping are a few small areas that are less eroded and areas where slopes are less than 6 percent. Also included are some steeper Alford soils on narrow escarpments less than 75 feet wide, some narrow gullied areas, and areas generally less than 50 feet wide along drainageways of wetter soils that formed in alluvium.

Available water capacity is very high, and permeability is moderate. The organic matter content is low because part of the surface layer has been removed by erosion. Surface runoff is rapid. Reaction in the surface layer varies widely as a result of local liming practices. The surface layer is friable. Tilling within the proper range of moisture reduces soil compaction and the tendency to clod. Root development is good.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. Other areas are used for hay and pasture. A few are woodland.

This soil is poorly suited to corn, soybeans, and small grain, because there is a very severe hazard of further erosion damage. The conservation practices needed to control erosion and prevent excessive soil loss are crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. Including hay or pasture in the cropping sequence so that soil losses are reduced to an acceptable level is also important. More than one of these practices is usually needed. Crop residue and cover crops can reduce runoff and the risk of erosion. They also help in maintaining tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay and pasture is effective in controlling water erosion. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

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

Soil features that affect engineering are the high frost action potential, moderate permeability, poor compaction characteristics of the substratum material, and the severe hazard of erosion during construction.

Limitations are moderate for building sites because of the slope, low strength, and shrink-swell. They are severe for local roads and streets because of frost action and low strength. The base material needs to be strengthened. Limitations are moderate for septic tank absorption fields.

If this soil is used as a building site, foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling and low strength. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction. Grass should be planted as soon as possible. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IVe; woodland subclass 1o.

AfD—Alford silt loam, 12 to 18 percent slopes. This strongly sloping, deep, well drained soil is on side slopes between ridgetops and drainageways of the uplands. Slopes are 100 to 300 feet wide. Areas are small and long and narrow. They are dominantly about 10 acres but range from 2 to 40 acres.

In a typical profile the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 6 inches thick. The subsoil is about 43 inches thick. The upper part is strong brown, firm silty clay loam, and the lower part is strong brown, firm silt loam. The substratum to a depth of 80 inches is brown silt loam.

Included with this soil in mapping are a few small areas of Alford soils that are severely eroded and a few areas where slopes are less than 12 percent. Also included are areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is very high, and permeability is moderate. The organic matter content is moderate. Surface runoff is rapid. Reaction in the surface layer is strongly acid or medium acid. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. Root development is good.

Most of the acreage is woodland. Some areas are used for wheat and grasses and legumes for pasture.

This soil is poorly suited to corn, soybeans, and small grain because of the very severe hazard of erosion. Erosion control is needed in cultivated areas. Minimum tillage, diversions, grassed waterways, and the return of crop residue help prevent excessive soil loss. Crop rotations that include grasses and legumes most of the time are most effective in reducing runoff and controlling erosion.

This soil is well suited to grasses and legumes for hay and pasture, and this is the dominant use. Most areas are narrow bands surrounded by large areas of similar, less sloping soils that are used for row crops. Erosion control is therefore difficult if this strongly sloping soil is cultivated with the surrounding soils. Leaving areas in grass when the surrounding areas are cultivated is effective in preventing erosion. If this soil is used as pasture, overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and most areas are woodland. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled and removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, moderate permeability, poor compaction characteristics of the substratum material, and the severe hazard of erosion during construction.

Limitations are severe for building sites because of the slope. They are severe for local roads and streets because of frost action, the slope, and low strength. The base material needs to be strengthened. Limitations are also severe for septic tank absorption fields because of the slope.

If this soil is used as a building site, foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling and low strength. Roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible after construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IVe; woodland subclass 1o.

AfD3—Alford silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on side slopes between ridgetops and drainageways of the uplands. Slopes are 100 to 200 feet long. Areas are small and in narrow bands. They are dominantly about 10 acres but range from 2 to 30 acres.

In a typical profile the surface layer is yellowish brown heavy silt loam about 5 inches thick. The subsoil is about 36 inches thick. It is strong brown, firm silty clay loam and silt loam. The substratum to a depth of 80 inches is brown silt loam. In some areas the surface layer is light silty clay loam because part of it has been removed by erosion. In a few areas the soil is less than 25 inches thick.

Included with this soil in mapping are a few small areas of less eroded Alford soils and a few areas that have gullies 2 to 4 feet deep. Also included are areas less than 75 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is very high, and permeability is moderate. The organic matter content is low because part of the surface layer has been removed by erosion. Surface runoff is rapid. The surface layer is friable. Tilling within the proper range of moisture content reduces soil compaction and the tendency to clod. Reaction in the surface layer is strongly acid or medium acid. Root development is good.

Some of the acreage is farmed, and some is wooded. Other areas are in grasses and legumes for forage or pasture.

This soil is poorly suited to corn and soybeans because of the very severe hazard of further loss through erosion. Small grain is occasionally grown so that stands of grasses and legumes can be reestablished. Minimum tillage and the return of crop residue are needed to prevent excessive soil loss. Crop rotations that include grasses and legumes most of the time are most effective in reducing runoff and controlling erosion.

This soil is suited to grasses and legumes for forage and pasture. Some areas are often left in grass because of the difficulty in establishing seedings. Some areas have gullies that are difficult to cross with farm machinery. If this soil is used as pasture, overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees, and some areas are woodland. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled and removed by site preparation or by spraying, cutting, or girdling.

Soil features that affect the engineering use of this soil are the high frost action potential, moderate permeability, poor compaction characteristics of the substratum material, and the severe hazard of erosion during construction.

Limitations are severe for building sites because of the slope. They are severe for local roads and streets because of frost action, the slope, and low strength. Roads should be constructed on the contour, and the base material should be strengthened. Limitations are also severe for septic tank absorption fields because of the slope.

If this soil is used as a building site, foundations and footings should be designed to prevent structural damage caused by shrinking and swelling and low strength. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction. Grass should be planted as soon as possible. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass VIe; woodland subclass 1o.

AfE—Alford silt loam, 18 to 25 percent slopes. This moderately steep, deep, well drained soil is on side slopes of the uplands. Slopes are 100 to 175 feet long. Areas are irregular in shape. They are dominantly about 20 acres but range from 2 to 30 acres.

In a typical profile the very dark brown silt loam surface layer and the brown silt loam subsurface layer are about 8 inches thick. The subsoil is about 40 inches thick. It is yellowish brown and strong brown, firm silty clay loam and heavy silt loam. The substratum to a depth of 80 inches is brown silt loam.

Included with this soil in mapping are a few small areas of Alford soils that are severely eroded and some areas where slopes are steeper. Also included are areas less than 75 feet wide of Wellston soils and areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is very high, and permeability is moderate. The organic matter content is low. Surface runoff is rapid. Reaction in the surface layer is strongly acid or medium acid. The surface layer is friable. Root development is good.

Most of the acreage is woodland. A few areas are used for grasses and legumes for forage or pasture.

This soil is generally not suited to corn and soybeans because of the very severe hazard of erosion. Small grain is occasionally grown so that stands of grasses and legumes can be reestablished. The moderately steep slopes hinder the use of farm machinery. Crop rotations that include grasses and legumes most of the time are most effective in controlling erosion and reducing runoff and soil losses.

This soil is suited to grasses and legumes for forage or pasture. Using farm machinery on this moderately steep soil is difficult. If this soil is used as pasture, overgrazing or grazing when the soil is too wet results in surface compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the soil in good condition.

This soil is well suited to trees, and many areas are woodland. Limitations are moderate to the use of equipment. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled and removed by site preparation or by spraying, cutting, or girdling.

Soil features that affect the engineering use of this soil are the slope, the high frost action potential, the moderate permeability, the poor compaction characteristics of the substratum material, and the severe hazard of erosion during construction.

Limitations are severe for building sites, most sanitary facilities, and local roads and streets because of the moderately steep slopes. If this soil is used as a building site, roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction. Grasses sould be planted as soon as possible. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass VIe; woodland subclass 1r.

Ba—Bartle silt loam. This nearly level, deep, somewhat poorly drained soil is on old stream terraces at a slightly higher elevation than the adjoining alluvial soils. It has a fragipan. Areas are large and irregular. They are dominantly about 80 acres but range from 5 to 100 acres.

In a typical profile the surface layer is grayish brown silt loam about 9 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 4 inches thick. The subsoil is about 42 inches thick. The upper part is pale brown, mottled, friable or very firm silt loam. The lower part is a light brownish gray, mottled, very firm heavy silt loam fragipan. The substratum to a depth of 79 inches is brownish yellow, mottled silt loam.

In some areas the fragipan is at a depth of 18 to 24 inches. In a few areas the surface layer is brown.

Included with this soil in mapping are small areas of poorly drained soils. Also included are areas less than 20 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is very slow. The organic matter content is low. Surface runoff from cultivated areas is slow. Reaction in the surface layer is neutral to slightly acid in most cultivated areas as a result of local liming practices. Reaction is generally strongly acid in areas where lime has not been applied. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. This soil has a seasonal high water table at a depth of 1 to 2 feet during a significant part of the year. There is also a very slowly permeable fragipan at a depth of 24 to 36 inches. The water table and the fragipan restrict the depth of root penetration. Artificial drainage is needed for optimum growth of crops.

Most of the acreage is farmed. Most areas are used for corn, soybeans, and small grain. A few areas are used for hay, pasture, and woodland.

This soil is suited to corn, soybeans, and small grain. Wetness and the very slowly permeable fragipan are the major limitations. If adequate drainage is provided, a conservation cropping system that includes row crops most of the time is beneficial. Diversions also help control wetness by reducing runoff. Other conservation practices, such as minimum tillage, crop residue, and cover crops, help maintain and improve the organic matter content and maintain good tilth.

This soil is well suited to grasses for hay and pasture. It is poorly suited to deep rooted legumes, such as alfalfa, because the very slowly permeable fragipan restricts downward movement of roots and water. If this soil is used as pasture, the major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions results in surface compaction and poor tilth. Proper stocking rates, pasture rotations, timely deferment of grazing, and the restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees, but only a few areas are woodland. Plant competition is moderate. Seedlings survive and grow well when competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

Soil features that affect the engineering use of this soil are a seasonal high water table, high frost action potential, very slow permeability in the fragipan, poor compaction characteristics, and susceptibility to piping.

Limitations are severe for building sites because of the seasonal high water table. They are severe for local roads and streets because of frost action and severe for septic tank absorption fields because of the seasonal high water table. The high water table can be lowered if adequate drainage is installed. Septic tank absorption fields function poorly. Much larger fields or sewage treatment plants are needed for effluent disposal. Capability subclass IIw; woodland subclass 3o.

Bd—Birds silt loam. This nearly level, deep, poorly drained soil is on broad, very slightly concave flood plains. Areas are large and long and narrow. They are dominantly about 40 acres but range from 5 to 500 acres.

In a typical profile the surface layer is light brownish gray silt loam about 10 inches thick. The substratum to a depth of 54 inches is light gray, mottled, friable, neutral silt loam. The lower part of the substratum, from a depth of 54 to 80 inches, is light gray, neutral silt loam.

In some places the substratum is dark gray. In others it is dark grayish brown.

Included with this soil in mapping are a few small areas of Evansville and Zipp soils and areas of Wakeland soils on narrow swells and along the stream. These areas are generally less than 75 feet wide. Also included are some areas where a few of the subhorizons are strongly acid.

Available water capacity is very high and permeability is moderately slow. The organic matter content is low. Surface runoff is slow. This soil also has a seasonal high water table at a depth of 0 to 1 foot during a considerable part of the year. It is also subject to frequent flooding for a period of less than a week. Many areas along small drainageways flood for a short time. Reaction in the surface layer is neutral. This soil is friable and has good tilth. Root development is somewhat restricted by the seasonal high water table.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain or for woodland. A few areas are used for hay and pasture.

Unless drained, this soil is poorly suited to corn, soybeans, and small grain. Wetness is a major limitation, and flooding is a hazard. With proper drainage, a conservation cropping system that includes row crops most of the time is beneficial. It is difficult to grow row crops in undrained areas of this soil. Crops are often replanted because flooding and surface water have destroyed stands. Bedding is often used as a management practice when row crops are grown in undrained areas. Other conservation practices, such as minimum tillage, crop residue, and cover crops, help maintain and improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture but is poorly suited to deep rooted legumes, such as alfalfa, because of wetness and damage caused by flooding. Drainage is also necessary for high yields of grasses and legumes for forage or pasture. Overgrazing or grazing when the soil is too wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the soil in good condition.

This soil is suited to trees, and many areas are in hardwoods. Limitations are severe for the use of equipment. Plant competition and the hazard of windthrow are severe, and seedling mortality is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled and removed by site preparation or by spraying, cutting, and girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the seasonal high water table, high frost action potential, and poor compaction characteristics. This soil is also subject to frequent flooding.

Limitations are severe for most uses because of the seasonal high water table and flooding. Limitations are also severe for local roads and streets because of frost action and wetness. Protective levees, surface and subsurface drainage to sufficiently lower the water table, and enlarged septic tank absorption fields can improve the site. Sewage treatment plants are more suitable for effluent disposal. Capability subclass IIIw; woodland subclass 2w.

Bn—Bonnie silt loam. This nearly level, deep, poorly drained soil is on broad, very slightly concave flood plains. Areas are large and long and narrow. They are dominantly about 60 acres but range from 4 to 800 acres.

In a typical profile the surface layer is gray silt loam about 5 inches thick. The upper part of the substratum is gray and light gray, mottled, friable, strongly acid silt loam. The substratum to a depth of 80 inches is light gray, firm, strongly acid silt loam.

In some places the substratum is dark gray. In others it is dark grayish brown.

Included with this soil in mapping are a few areas where part of the substratum is medium acid and areas of soils in which the substratum is yellowish brown. Also included are areas of Stendal silt loam on narrow swells and along the stream.

Available water capacity is very high, and permeability is slow. The organic matter content is low. Surface runoff is slow. This soil also has a seasonal high water table (fig. 9), at a depth of 0 to 1 foot during a considerable part of the year, which restricts roots. It is also subject to frequent flooding for short periods, a week or less. Many areas along small drainageways can be flooded for a few minutes; the floodwater is very shallow. Reaction in the surface layer is medium acid, but in many cultivated areas, it is neutral or slightly acid as a result of local liming practices. The surface layer is friable and has good tilth.

Some of the acreage is farmed. Some is used for corn, soybeans, and small grain. A few areas are used for hay and pasture. Many areas are woodland.

Unless drained, this soil is poorly suited to corn, soybeans, and small grain. Wetness is a major limitation, and flooding is a major hazard in use and management. Adequate drainage is difficult to establish because suitable outlets are not available in many places. With proper drainage a conservation cropping system that includes row crops most of the time can be used. It is difficult to grow row cops in undrained areas of this soil. Crops are often replanted because flooding and surface water have destroyed stands. Bedding is often used as a management practice when row crops are grown in undrained areas. Other conservation practices, such as minimum tillage, crop residue, and cover crops help maintain and improve the organic matter content and maintain good tilth.

This soil is well suited to grasses and legumes for hay and pasture, but is poorly suited to deep rooted legumes, such as alfalfa, because of wetness and damage caused by flooding. Drainage is also needed for high yields of grasses and legumes for forage or pasture. Overgrazing or grazing when the soil is too wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the soil in good condition.

This soil is suited to trees, and many areas are in hardwoods. Limitations are moderate for the use of equipment. Plant competition and the hazard of windthrow are severe, and seedling mortality is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled and removed by site preparation or by spraying, cutting, and girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are a seasonal high water table, high frost action potential, and poor compaction characteristics. This soil is also subject to frequent flooding.

Limitations are severe for all uses because of the high water table, flooding, and slow permeability. Protective levees, surface and subsurface drainage to sufficiently lower the water table, and enlarged septic tank absorption fields can improve the site. Sewage treatment plants are more suitable for effluent disposal. Capability subclass IIIw; woodland subclass 2w.

Ev—Evansville silt loam. This nearly level, deep, poorly drained soil is on broad flats and very slightly concave terraces. Areas are large, broad, long, and irregular. They are dominantly 500 acres but range from 4 to 600 acres.

In a typical profile the surface layer is dark grayish brown heavy silt loam about 10 inches thick. The subsoil is about 32 inches thick. It is olive gray and gray, mottled, friable or firm silty clay loam. The substratum to a depth of 60 inches is gray, mottled, stratified silty clay loam.

In many areas the surface layer is silty clay loam. In some areas the subsoil is silt loam, and in a few it is silty clay. In some areas there is 10 to 20 inches of recent alluvium on the surface.

Included with this soil in mapping are a few dome-shaped areas of Henshaw soils less than 2 acres in size. Also included are areas less than 50 feet wide in drainageways of soils that formed in alluvium.

Available water capacity is very high, and permeability is moderate. The organic matter content is moderate. Surface runoff is slow, and in some areas is ponded. This soil has a high water table at a depth of 0 to 1 foot during a considerable part of the year. Reaction in the surface layer is generally neutral. The soil is friable. Tilling within the proper range of moisture, however, reduces soil compaction and the tendency to clod. Rooting depth is restricted by the high water table. Artificial drainage is needed for optimum growth of crops.

Most of the acreage is farmed. Most areas are used for corn, soybeans, and small grain. Only a few are in hay and pasture or woodland.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Some drainage has been installed in most areas. Wetness is the major limitation in use and management. With proper drainage, a conservation cropping system that includes row crops most of the time can be used. Other conservation practices, such as minimum tillage, crop residue, and green manure crops, help to maintain and improve the organic matter content and good tilth.

This soil is well suited to grasses and legumes for hay and pasture but is poorly suited to deep rooted legumes, such as alfalfa. Drainage is necessary for optimum yields. Only a small acreage is used for pasture because grazing when the soil is wet results in surface compaction and poor tilth. If this soil is used as pasture, proper stocking rates, pasture rotations, and restricted use when the soil is wet help to keep the pasture and the soil in good condition.

This soil is suited to trees, but only a small acreage is woodland. Limitations are severe for the use of equipment. Plant competition is severe, and the hazards of windthrow and seedling mortality are moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the seasonal high water table, frost action, and poor compaction characteristics.

Limitations are severe for building sites because of the seasonal high water table, severe for local roads and streets because of the seasonal high water table and frost action, and severe for septic tank absorption fields because of wetness. The water table can be lowered if adequate drainage is installed. Commercial sewers are needed. Capability subclass IIw; woodland subclass 2w.

GnF—Gilpin silt loam, 25 to 35 percent slopes. This steep, well drained soil is on irregular side slopes on the dissected uplands. It is moderately deep. Slopes are 100 to 250 feet long. Areas are irregular in shape. They are dominantly 10 acres but range from 4 to 60 acres.

In a typical profile the surface layer is dark brown silt loam about 3 inches thick and contains a few shaly fragments. The subsurface layer is pale brown silt loam about 3 inches thick and also contains a few shaly fragments. The subsoil is about 19 inches thick. It is yellowish brown, firm silt loam and strong brown, firm, shaly and very shaly silt loam. The substratum from a depth of 25 to 29 inches is very shaly, strong brown heavy loam that contains channery fragments. Below is interbedded sandstone, siltstone, and shale.

Included with this soil in mapping are some areas of exposed bedrock mostly adjacent to the drainageways on steeper, north-facing slopes. These areas are generally identified by spot symbols on the soil map. Also included are some areas of steeper soils and some shallower soils, a few eroded areas where the surface layer is yellowish brown silt loam or loam, and a few areas of shallow soils where bedrock is at a depth of 15 to 20 inches.

A few gullied areas and areas with less steep slopes are also included.

Available water capacity is moderate, and permeability is moderate. The organic matter content is moderate. Surface runoff is very rapid. Reaction in the surface layer is typically very strongly acid but ranges to slightly acid. Root development is restricted somewhat by the bedrock.

Only a few areas are farmed. A very few areas are used for small grain. A few areas are used for pasture or hay. Most of the acreage is woodland.

This soil is not suited to corn, soybeans, or small grain because of the very severe hazard of erosion. Areas are too steep to be worked with modern farm equipment. This soil is tilled only to reestablish permanent vegetation. Minimum tillage, the return of crop residue, and the reestablishment of seedlings in contour strips help to prevent excessive soil loss. Growing grasses and legumes is effective in controlling erosion and runoff.

This soil has limited use as grass legume pasture. If it is used as pasture, overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees, and most areas are in hardwoods. Most areas that were once cleared have been naturally revegetated to hardwoods. Limitations are moderate for the use of equipment. The erosion hazard and seedling mortality are moderate. Seedlings survive better if competing vegetation is controlled. Unwanted trees and shrubs can be controlled and removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Slopes are too steep for building site development. Bedrock is also a limitation. Limitations are severe for local roads and streets because of the slope and severe for septic tank absorption fields because of the steep slopes and bedrock. If this soil is used as a building site, roads should be constructed on the contour. Diversions, grassed waterways, and structures between lots reduce the erosion hazard. Care should be taken so that soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced and replanted as soon as possible. Development of random lots helps to prevent excessive soil losses. Enlarged septic tank absorption fields or sewage treatment plants are needed. Capability subclass VIe; woodland subclass 3r.

GpD—Gilpin soils, gullied, 12 to 18 percent slopes. These strongly sloping, moderately deep to very shallow soils are on the narrow sides of gullies, just below breaks of the uplands. Slopes are 50 to 125 feet long. Areas are narrow and irregular. They are dominantly 3 acres but range from 2 to 40 acres.

In a typical profile the subsoil is exposed. It is about 10 inches thick. The upper part is strong brown shaly light silty clay loam and channery fragments. The lower part is strong brown very shaly silt loam and channery fragments. The substratum, from a depth of 10 to 15 inches, is strong brown very shaly loam and channery fragments. Below this is bedrock.

In some uneroded areas, as much as 10 feet wide, the surface layer is brown or yellowish brown silt loam. In other areas it is olive silty clay. In places the surface layer is mottled because of inherent colors in the underlying material.

Included with these soils in mapping are areas of steeper soils, areas of exposed bedrock, and areas, generally less than 15 feet wide and 50 feet long and less than 2 acres, of severely eroded and eroded Wellston and Zanesville soils on points between gullies. Also included are a few areas of soils, similar to Alford soils, that formed entirely in silty loess and are less than 20 inches deep over weathered bedrock.

Available water capacity is low, and permeability is moderate. Permeability is slower in the weathered shale. The organic matter content is low because the surface layer has been removed by erosion. Runoff is very rapid. Reaction is generally strongly acid to extremely acid. These soils are firm or friable. Root development is restricted by bedrock.

Some of the acreage is farmed, and some is used for grasses and legumes for forage or pasture. Most of the acreage is abandoned cropland and is reverting to hardwoods.

These soils are very poorly suited to corn, soybeans, and small grain because they are shaly, shallow over bedrock, and low in organic matter content. Also the erosion hazard is very severe. Most of the areas cropped are so small that they are farmed with adjoining soils. The conservation practices needed to prevent excessive erosion and runoff are minimum tillage, diversions, and return of crop residue. Permanent vegetation, such as grasses and legumes for hay or pasture, is most effective in controlling erosion because it reduces soil losses to an acceptable level. The strong slopes and the gullies are hazards to the use of farm equipment.

These soils are poorly suited to grasses and legumes for hay or pasture because they are shaly and are shallow over bedrock. They support very little plant growth. In areas that have been leveled or in areas where there are remnants of deeper soils, fescue and lespedeza are grown. If grasses and legumes are established for pasture, overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper restrictive stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

These soils are poorly suited to trees. Most areas are abandoned cropland that is reverting to hardwoods, mostly low grade hardwoods, such as sassafras. Briers, such as blackberry, wildrose, and grape, also grow on these soils. Lichen is the first plant cover. The limitation is moderate for use of equipment. The soils are moderately limited by the hazards of erosion and seedling mortality. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering are the slope and the depth to bedrock. Limitations are severe for building sites and septic tank absorption fields because of the slope and depth to bedrock and are severe for roads and streets because of the slope. If the soils are leveled, fill may be needed to support vegetation and cover on septic tank absorption fields. Roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce further loss through erosion.

Care should be taken so that the soils are disturbed as little as possible during construction. Soil material should be stockpiled and replaced as soon as possible after construction. Revegetation should be started as soon as possible to prevent further erosion. Capability subclass VIIe; woodland subclass 3r.

HeA—Henshaw silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on broad, very slightly convex terraces. Areas are generally small, long, and irregular. They are dominantly about 20 acres but range from 3 to 60 acres. They generally are on the flats adjacent to a break along a drainageway that has dissected the terrace.

In a typical profile the surface layer is grayish brown, mottled silt loam about 7 inches thick. The subsoil is about 41 inches thick. It is yellowish brown and light brownish yellow, mottled, firm silty clay loam. The substratum to a depth of 70 inches is yellowish brown, light brownish gray, and gray, mottled, stratified silt loam, silty clay, and silty clay loam.

In some areas the subsoil is mottled grayish brown, gray, or brownish gray. In some areas the subsoil is friable and can contain carbonates. In a few areas the lower part of the subsoil is silty clay.

Included with this soil in mapping are some soils in higher areas on the lacustrine terrace, small narrow areas of nearly level Uniontown soils and small areas, less than 75 feet wide, of Uniontown or Markland soils on side slopes. Also included are areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is high, and permeability is moderately slow. The organic matter content is low. Surface runoff is slow. Reaction in the surface layer is slightly acid or neutral as a result of past liming practices. Unless limed, it is generally medium acid. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. This soil has a seasonal high water table that is at a depth of 1 to 3 feet during a significant part of the year and somewhat limits root development. Artificial surface and subsurface drainage is needed for optimum growth of crops.

Most of the acreage is farmed. Most areas are used for corn and soybeans. Some are used for small grain. A few are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major limitation in use and management. If adequate drainage is provided, a conservation cropping system that includes row crops most of the time can be used. Surface drainage and subsurface drainage help to lower the water table. Diversions can divert runoff in areas adjacent to the uplands. Other conservation practices, such as minimum tillage, crop residue, and cover crops, help to maintain tilth and improve the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. It is also suited to deeper rooted legumes that are tolerant of a seasonal high water table. If this soil is used as pasture, the major concerns of management are overgrazing and grazing when the soil is too wet. Grazing under wet conditions results in surface compaction and poor tilth. Proper stocking rates, pasture rotations, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in excellent condition.

This soil is suited to trees. Limitations are moderate for the use of equipment. The hazards of windthrow and plant competition are moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering uses of this soil are the seasonal high water table, rare flooding, high frost action potential, moderately slow permeability, and poor compaction characteristics.

Limitations are severe for building sites because of the seasonal high water table and flooding and severe for septic tank absorption fields because of wetness and moderately slow permeability. Limitations are moderate for local roads and streets because of low strength. The base material needs to be strengthened. The high water table can be lowered if an adequate drainage system is installed. Large septic tank absorption fields are needed in addition to adequate drainage. Capability subclass IIw; woodland subclass 1w.

HoA—Hosmer silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on broad and narrow, meandering ridgetops and a few narrow toe slopes on the uplands. Areas are long and irregular. They are dominantly about 15 acres but range from 3 to 50 acres.

In a typical profile the surface layer is dark brown silt loam about 9 inches thick. The subsurface layer is yellowish brown silt loam about 3 inches thick. The subsoil is about 60 inches thick. The upper part is light yellowish brown or yellowish brown, firm silt loam or silty clay loam; the middle part is yellowish brown, mottled, firm silty clay loam; and the lower part is a brown, very firm, brittle silt loam fragipan. The substratum to a depth of 85 inches is strong brown silt loam.

In some areas the fragipan is silty clay loam. In a few areas this soil is eroded and a small amount of subsoil material is mixed with the surface layer. In some areas on toe slopes the surface layer is dark grayish brown or very dark grayish brown. In a few small areas of Hosmer soils, the subsoil is brownish yellow.

Included with this soil in mapping are a few areas where mottles are at a depth of about 23 inches and a few areas, 1/2 to 1 acre, of sodium spots. Also included are areas less than 75 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate and permeability is very slow. The organic matter content is low to moderate. Surface runoff is slow. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. This soil has a very slowly permeable fragipan that is at a depth of about 36 inches and restricts the depth to which roots penetrate. The water table is perched above the fragipan early in spring and the soil is wet. The soil tends to be droughty late in summer. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. Some areas are in hay or pasture, and a few are woodland.

This soil is well suited to corn, soybeans, and small grain. The very slowly permeable fragipan is a limitation. Areas tend to be wet and seepy in spring and droughty late in summer. Crop residue and cover crops improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. It is poorly suited to deep rooted legumes because the very slowly permeable fragipan restricts downward movement of roots. If this soil is used as pasture, the major concerns of management are overgrazing and grazing when the soil is too wet, which causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

The soil is suited to trees, but only a few areas remain in woodland. Abandoned farmland naturally revegetates to hardwoods. The hazard of windthrow is moderate, and plant competition is slight. Seedlings survive and grow well when competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding wildlife, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential and the very slow permeability of the fragipan.

Limitations are severe for dwellings with basements because of wetness. They are severe for local roads and streets because of frost action. Drainage ditches are needed. Limitations are severe for septic tank absorption fields because of the very slow permeability in the fragipan.

If this soil is used as a building site, subsurface drainage is needed around the building to cut off seepage on the fragipan. Septic tank absorption fields function poorly. Larger fields or sewage treatment plants are needed. Capability subclass IIs; woodland subclass 2o.

HoB—Hosmer silt loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on broad and narrow, meandering ridgetops and a few narrow toe slopes on the uplands. Slopes are 100 to 600 feet long. Areas are long and irregular. They are dominantly about 30 acres but range from 3 to 200 acres.

In a typical profile the surface layer is brown silt loam about 9 inches thick. The subsoil is about 56 inches thick. The upper part is yellowish brown, strong brown, and brown, firm silt loam or silty clay loam. The lower part is a brown, very firm, brittle heavy silt loam and silty clay loam fragipan. The substratum to a depth of 75 inches is strong brown silt loam.

In many places this soil has been eroded and the surface layer is a mixture of surface layer, subsurface layer, and subsoil material. In some areas on toe slopes this soil has a very dark grayish brown or dark brown surface layer and a brown or pale brown subsurface layer 4 to 14 inches thick. In some areas the subsoil has brownish gray and pale brown mottles just above the fragipan. In some areas the plowed surface layer is very dark grayish brown and about 10 inches thick and the subsurface layer is pale brown and about 8 inches thick.

Included with this soil in mapping are a few small areas of Hosmer soil where slopes are less than 2 percent and some small, severely eroded areas of less than 2 acres. Also included are a few areas of Muren or Hosmer soils commonly on concave toe slopes where the fragipan is poorly expressed and a few sodium spot areas of 1/2 acre to 2 acres, which are identified by spot symbols on the soil map. Areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium and narrow escarpments less than 50 feet wide are also included.

Available water capacity is moderate, and permeability is very slow. The organic matter content is low because part of the surface layer has been removed by erosion. Surface runoff is medium in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. The soil has a very slowly permeable fragipan that is at a depth of about 35 inches and restricts the depth to which roots penetrate. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. Erosion is a major hazard. The fragipan is also a limitation. Conservation practices are needed to control erosion and runoff in cultivated areas. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Crop residue and cover crops also help to control erosion and improve and maintain tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay or pasture is effective in controlling water erosion. This soil is poorly suited to deep rooted legumes, such as alfalfa, because the very slowly permeable fragipan restricts downward movement of roots. If this soil is used as pasture, the major concerns of management are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees, but only a few areas remain in woodland. Abandoned farmland naturally revegetates to hardwoods. Limitations are slight for the use of equipment. The hazard of windthrow is moderate, and plant competition is slight. Seedlings survive and grow well when competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes livestock exclusion, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, wetness, very slow permeability in the fragipan, and slope.

Limitations are moderate or severe for building sites because of wetness and severe for local roads and streets because of frost action. Good drainage ditches are needed for roads.

Limitations are severe for septic tank absorption fields because of the very slow permeability.

If this soil is used as a building site, subsurface drainage is needed adjacent to the uphill side of the building to cut off seepage on the fragipan. Septic tank filter fields function poorly. Larger fields or sewage treatment plants are needed. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IIe; woodland subclass 2o.

HoB3—Hosmer silt loam, 2 to 6 percent slopes, severely eroded. This gently sloping, deep, well drained soil is on convex breaks of the ridgetops on uplands. Slopes are 50 to 125 feet long. Areas are irregular in shape. They are dominantly about 4 acres but range from 2 to 6 acres.

In a typical profile the surface layer is brown heavy silt loam about 7 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown or brown, firm silty clay loam or silt loam. The lower part is a brown, very firm, brittle silt loam fragipan. The substratum to a depth of 62 inches is strong brown silt loam.

In some areas the surface layer is yellowish brown light silty clay loam. Light brownish gray or pale brown mottles are directly above the fragipan in some areas. In many areas the mottles are at a depth of 17 to 23 inches.

Included with this soil in mapping are a few areas of steeper Hosmer soils and a few areas of less eroded Hosmer soils, each less than 2 acres. Also included are a few areas, 1/2 acre to 2 acres, of sodium spots and areas less than 75 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is very slow. The organic matter content is low because part of the surface layer has been removed by erosion. Surface runoff is rapid in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. This soil has a very slowly permeable fragipan that is at a depth of about 27 inches and restricts the depth to which roots penetrate. The surface layer is friable. Tilling within the proper moisture content reduces soil compaction and the tendency to clod.

Most of the acreage is farmed. Some areas are used for corn, soybeans, and small grain and some for hay or pasture. A few areas are woodland.

This soil is suited to small grain but is poorly suited to corn and soybeans. The hazard of further loss through erosion is severe. The very slowly permeable fragipan is a major limitation. Erosion is a major hazard in use and management. Because each area is narrow, it is farmed with the surrounding soils. Conservation practices are needed to control erosion and runoff in cultivated areas. Care is needed so that the very slowly permeable fragipan is not exposed. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. No till farming is probably the most effective way of controlling erosion. Crop residue helps to control erosion and improve tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay or pasture is effective in controlling water erosion. This soil is poorly suited to deep rooted legumes, such as alfalfa, because the very slowly permeable fragipan restricts downward movement of roots. If this soil is used as pasture, the major concerns of management are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees, but only a few areas remain in woodland. Abandoned farmland naturally revegetates to hardwoods. The hazard of windthrow is moderate, and plant competition is slight. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desirable seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, wetness, the very slow permeability in the fragipan, and slope.

Limitations are severe for buildings with basements because of wetness and moderate for houses without basements. Limitations are severe for local roads and streets because of frost action. Good drainage ditches are needed to divert water from the roads. Limitations are severe for septic tank absorption fields because of the very slow permeability. Larger absorption fields are needed.

If this soil is used as a building site, roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IIIe; woodland subclass 2o.

HoC—Hosmer silt loam, 6 to 12 percent slopes. This moderately sloping, deep, well drained soil is on upland side slopes adjacent to meandering drainageways. Slopes are 100 to 175 feet long. Areas are irregular in shape. They are dominantly about 12 acres but range from 2 to 15 acres.

In a typical profile the surface layer is dark brown silt loam about 5 inches thick. The subsurface layer is yellowish brown silt loam about 6 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, strong brown, or brown, firm or very firm silty clay loam or silt loam. The lower part is a brown, very firm, brittle silt loam fragipan. The substratum to a depth of 65 inches is strong brown silt loam.

In some areas the surface layer contains some of the lighter colored subsoil. In most areas the subsurface layer is pale brown. Some Hosmer soils have grayish brown and pale brown mottles directly above the fragipan.

Included with this soil in mapping are a few areas less than 2 acres of severely eroded Hosmer soils, small areas less than 2 acres in size, where slopes are less than 6 percent, and areas of steeper soils, on escarpments less than 75 feet wide.

Also included are areas less than 75 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is very slow. The organic matter content is moderate. Surface runoff is generally medium, but in cultivated areas it is rapid. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. The soil has a very slowly permeable fragipan that is at a depth of about 32 inches and restricts the depth to which roots and air penetrate. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content.

Some areas are in corn, soybeans, and small grain. Some are used for hay or pasture. Most of the acreage is woodland.

This soil is suited to corn, soybeans, and small grain. Erosion is the major hazard. The very slowly permeable fragipan is a limitation for some crops. If this soil is cultivated, the hazard of erosion is severe. Conservation practices, such as crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures are needed to control erosion and runoff in cultivated areas and to prevent excessive soil loss. Crop residue and cover crops help reduce runoff and control erosion. They also help in maintaining tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. Such crops are effective in controlling water erosion. This soil is poorly suited to deep rooted legumes, such as alfalfa, because the very slowly permeable fragipan restricts downward movement of their tap roots. If this soil is used as pasture, the major concerns of management are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

The soil is suited to trees, and most areas remain in woodland. The hazard of windthrow is moderate, and plant competition is slight. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

Soil features that affect the engineering use of this soil are the high frost action potential, the very slow permeability in the fragipan, and the slope.

Limitations are severe for buildings with basements because of wetness. Foundations and footings should be properly designed, and tile should be installed around foundations to overcome wetness and the frost action. Limitations are severe for local roads and streets because of frost action and severe for septic tank absorption fields because of a very slowly permeable fragipan. Large filter fields are needed. Commercial sewers work best.

If this soil is used as a building site, roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard and wetness. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IIIe; woodland subclass 2o.

HoC3—Hosmer silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on upland side slopes adjacent to meandering drainageways. Slopes are 100 to 400 feet long. Areas are irregular in shape. They are dominantly 12 acres but range from 3 to 20 acres.

In a typical profile the surface layer is brown heavy silt loam about 7 inches thick. The subsoil is about 40 inches thick. The upper part is brown or strong brown, firm or very firm silty clay loam or silt loam. The lower part is a brown, very firm, brittle silt loam fragipan. The substratum to a depth of 62 inches is strong brown silt loam. It has a few siltstone and shale fragments in the lower part.

In many areas the brittle layer at a depth of 14 to 25 inches is altered by frost action. In some areas the surface layer is yellowish brown silty clay loam. Some Hosmer soils have grayish brown and pale brown mottles directly above the fragipan. In a few areas the solum is 33 to 42 inches thick.

Included with this soil in mapping are areas less than 2 acres of gullied Hosmer soils. Some gullies are as deep as 4 feet. Also included are areas of severely eroded soils that formed partly in material weathered from bedrock but are at least 4 feet thick, a few areas of very severely eroded Hosmer soils, areas of steeper Hosmer soils, areas of steeper soils on escarpments, and areas less than 75 feet wide along drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is very slow. The organic matter content is low because part of the surface layer has been removed by erosion. Surface runoff is rapid in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. The soil has a very slowly permeable fragipan at a depth of about 25 inches, which restricts the depth to which roots penetrate. The surface layer is friable. Tilling within the proper moisture content reduces soil compaction and the tendency to clod.

Some areas are used for corn, soybeans, and small grain, and some for hay or pasture. A few areas are woodland.

This soil is poorly suited to corn, soybeans, and small grain because the hazard of further loss through erosion is very severe. The very slowly permeable fragipan is a major limitation, and erosion is a major hazard. The conservation practices needed to control erosion and runoff and to prevent excessive soil loss are crop rotations, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures. More than one of these practices usually is needed. Crop residue and cover crops help to reduce runoff and erosion. They also help in maintaining tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. Such crops are effective in controlling water erosion. This soil is poorly suited to deep rooted legumes, such as alfalfa, because the very slowly permeable fragipan restricts downward movement of roots. If this soil is used as pasture, the major concerns of management are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees, but very few areas remain in woodland. Abandoned cropland naturally revegetates to hardwoods. Limitations are slight for the use of equipment. The hazard of windthrow is moderate, and plant competition is slight. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering uses of this soil are the high frost action potential, the very slow permeability in the fragipan, and the slope.

Limitations are severe for buildings with basements because of wetness. Foundations and footings for any building should be properly designed and tile installed to prevent structural damage caused by frost action. Limitations are also severe for local roads and streets because of frost action. Good drainage ditches are needed. Limitations are severe for septic tank absorption fields because of very slow permeability in the fragipan. Large filter fields are needed. Commercial sewers work best.

If this soil is used as a building site, roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IVe; woodland subclass 2o.

HoD—Hosmer silt loam, 12 to 18 percent slopes. This strongly sloping, deep, well drained soil is on upland side slopes adjacent to meandering drainageways. Slopes are 100 to 175 feet long. Areas are irregular in shape. They are dominantly 6 acres but range from 2 to 10 acres.

In a typical profile the surface layer is dark brown silt loam about 4 inches thick. The subsurface layer is yellowish brown silt loam about 5 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown or strong brown, firm silty clay loam or heavy silt loam. The lower part is a brown, very firm, brittle silt loam fragipan. The substratum to a depth of 65 inches is strong brown silt loam. It has a few siltstone, shale, and sandstone fragments in the lower part. Bedrock is below.

In some areas tilled Hosmer soils have a brown silt loam surface layer 5 to 10 inches thick. In most areas the subsurface layer is pale brown. Some Hosmer soils have grayish brown and pale brown mottles directly above the fragipan. In some areas the fragipan is at a depth of 18 inches.

Included with this soil in mapping are a few areas less than 2 acres of Wellston soils. Also included are areas less than 75 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is very slow. The organic matter content is moderate. Surface runoff is generally rapid, but in cultivated areas, it is very rapid. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. This soil has a very slowly permeable fragipan at a depth of about 28 inches, which restricts the depth to which roots and air penetrate. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content.

Some areas are farmed. A few are used for corn, soybeans, and small grain. Some are used for hay or pasture. Most of the acreage is woodland.

This soil is very poorly suited to corn, soybeans, and small grain. Most row crops and small grain are grown so that stands of grasses and legumes can be reestablished. The very slowly permeable fragipan is a major limitation, and erosion is a major hazard. If this soil is cultivated, the hazard of erosion is severe. Conservation practices, such as minimum tillage, diversions, and grassed waterways, are needed to control runoff in cultivated areas and to help prevent excessive soil losses. Crop residue and cover crops help to reduce runoff and control erosion. They also help in maintaining tilth and the organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Such crops are effective in controlling water erosion. This soil is poorly suited to deep rooted legumes, such as alfalfa, because the very slowly permeable fragipan restricts downward movement of roots. If this soil is used as pasture, the major concerns of management are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees, and most areas remain in woodland. The hazard of windthrow is moderate, and plant competition is slight. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering uses of this soil are the high frost action potential, the very slow permeability in the fragipan, the slope, and wetness.

Limitations are severe for building sites because of the slope. Foundations and footings should be properly designed and foundation drain tile installed to prevent structural damage caused by frost action. Limitations are also severe for local roads and streets because of frost action and severe for septic tank absorption fields because of very slow permeability. Large absorption fields are needed. Commercial sewers work best.

If this soil is used as a building site, roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IVe; woodland subclass 2r.

HoD3—Hosmer silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on upland side slopes adjacent to meandering drainageways. Slopes are 100 to 175 feet long. Areas are irregular in shape. They are dominantly about 4 acres but range from 2 to 10 acres.

In a typical profile the surface layer is brown silt loam about 7 inches thick. The subsoil is about 43 inches thick. The upper part is brown or strong brown, firm or very firm silty clay loam or silt loam. The lower part is a brown, firm, brittle silt loam fragipan. The substratum to a depth of 60 inches is strong brown silt loam. It has a few fragments of siltstone, shale, or sandstone in the lower part. Bedrock is below. The fragipan is generally at a depth of 23 to 25 inches.

In many areas the brittle layer is at a depth of 10 to 25 inches. In some areas the surface layer is yellowish brown silty clay loam. Some Hosmer soils have grayish brown or pale brown mottles directly above the fragipan. In a few areas the solum is 30 to 42 inches thick.

Included with this soil in mapping are a few small areas of Wellston and Zanesville soils. Also included are very severely eroded soils, areas of deep gullies, and areas less than 75 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is very slow. The organic matter content is low because part of the surface layer has been removed by erosion. Surface runoff is very rapid. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. The soil has a very slowly permeable fragipan at a depth of about 23 inches, which restricts the depth to which roots penetrate. The surface layer is friable. Tilling within the proper range of moisture content reduces soil compaction and the tendency to clod.

Some areas are farmed. A few are used for corn, soybeans, and small grain. A few areas are woodland. Most of the acreage is used for hay or pasture.

This soil is poorly suited to corn, soybeans, and small grain, because the hazard of further loss through erosion is very severe. Because areas are narrow, they are farmed with adjoining soils on the uplands. This soil is occasionally used for small grain, corn, or soybeans in order to reestablish grasses and legumes. The very slowly permeable fragipan is a major limitation, and erosion is a major hazard. Minimum tillage and crop residue are needed to prevent excessive soil loss. Crop rotations that include grass most of the time are most effective in reducing runoff and in controlling erosion. They also help in maintaining tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay or pasture is effective in controlling water erosion. This soil is very poorly suited to deep rooted legumes, such as alfalfa, because the very slowly permeable fragipan restricts downward movement of tap roots and air. If this soil is used as pasture, the major concerns of management are overgrazing or grazing when the soil is wet, which causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Many areas are abandoned cropland. Some areas still have stands of trees. The hazards of windthrow and erosion are moderate, and plant competition is slight. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desirable seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, the very slow permeability in the fragipan, slope, and wetness.

Limitations are severe for building sites because of the slope. Foundations and footings should be properly designed to prevent structural damage caused by frost action. Foundation drain tile is needed. Limitations are also severe for local roads and streets because of frost action and the slope. Roads should be constructed on the contour and adequate drainage ditches provided. Limitations are severe for septic tank absorption fields. A large absorption field is needed but is difficult to construct on these slopes. A commercial sewer system works best.

If this soil is used as a building site, roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass VIe; woodland subclass 2r.

Hu—Huntington silt loam. This nearly level, deep, well drained soil is on broad, very slight swells on the ripplelike flood plain. Areas are wide and very long. They are dominantly about 150 acres but range from 10 to 600 acres.

In a typical profile the surface layer is dark brown heavy silt loam about 11 inches thick. The subsoil is about 33 inches thick. It is dark brown or brown, firm heavy silt loam. The substratum to a depth of 60 inches is brown silt loam.

In some small areas the soil is light silty clay loam or silt loam throughout. In some areas this soil has a redder subsoil at a depth of 30 to 40 inches.

Included with this soil in mapping are some narrow, long areas less than 40 feet wide of Woodmere silty clay loam on convex slopes above the swales. Also included in lower concave, flatter, narrow areas are Newark soils.

Available water capacity is very high, and permeability is moderate. The organic matter content is moderate. Surface runoff is slow. The soil floods annually during winter and spring for 5 to 15 days. The surface layer is friable, has good tilth, and can be easily tilled throughout a moderate range of moisture content. Reaction is neutral. Root development is good.

Most of the acreage is farmed. Most areas are used for corn and soybeans. Some areas are woodland.

This soil is suited to corn and soybeans. Flooding in spring and winter is a major hazard. Levees protect crops from flooding. Conservation practices, such as minimum tillage, use of crop residue, and green manure crops help to maintain and improve the organic matter content and the tilth.

This soil is poorly suited to grasses and legumes for hay and pasture unless it is protected from flooding. Normally, it is flooded for too long for hay or pasture. If this soil is used as pasture, overgrazing or grazing when the soil is too wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is moderate. Unwanted trees and shrubs can be controlled and removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering use of this soil are flooding, frost action, and fair compaction characteristics.

Limitations are severe for building sites and sanitary facilities because of flooding. They are severe for local roads and streets because of frost action. If this soil is used as a building site, levees must be built to prevent flooding. Capability subclass IIw; woodland subclass 1o.

IvA—Iva silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil occupies upland ridgetops, swales, and slightly concave toe slopes. Areas are irregular in shape. They are dominantly 10 acres but range from 2 to 50 acres.

In a typical profile the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 6 inches thick. The subsoil is about 43 inches thick. The upper part is yellowish brown, mottled, friable silt loam; the middle part is light brownish gray and yellowish brown, mottled, firm, light silty clay loam; and the lower part is yellowish brown, mottled, friable silt loam. The substratum to a depth of 71 inches is yellowish brown, mottled silt loam.

In some areas there are similar soils that are somewhat brittle in the subsoil. In some small areas Iva soils are neutral or mildly alkaline in the lower part of the subsoil and upper part of the substratum and are generally 36 to 45 inches thick. In a few areas the surface layer and subsoil combined are as much as 70 inches thick.

Included with this soil in mapping are some narrow areas of Muren soils and some narrow areas of the moderately well drained Hosmer soils on concave toe slopes. Also included are areas less than 75 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is very high, and permeability is slow. The organic matter content is moderate. Surface runoff is slow. Reaction in the surface layer is slightly acid or neutral as a result of past liming practices. It is generally medium acid in unlimed areas. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. This soil has a seasonal high water table at a depth of 1 to 3 feet during a significant part of the year, which somewhat restricts root development. Artificial surface and subsurface drainage is needed for optimum growth of crops.

Most of the acreage is farmed. Most areas are used for corn and soybeans. Some are used for small grain. A few are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major limitation. If adequate drainage is provided, a conservation cropping system that includes row crops most of the time can be used. Surface drainage and subsurface drainage help to lower the water table. Diversions help in controlling wetness. They divert runoff from adjacent upland soils. Other conservation practices, such as minimum tillage, crop residue utilization, and cover crops help in maintaining and improving the organic matter content and maintaining good tilth.

This soil is well suited to grasses and legumes for hay and pasture. It is suited to deeper rooted legumes that are tolerant of a seasonal high water table. If this soil is used as pasture, the major concerns of management are overgrazing and grazing when the soil is too wet. Grazing under wet conditions results in surface compaction and poor tilth. Proper stocking rates, pasture rotations, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in excellent condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the seasonal high water table, high frost action potential, slow permeability, and poor compaction characteristics.

Limitations are severe for houses with basements because of wetness. Foundation drain tile is needed around all buildings to reduce structural damage caused by frost action. Limitations are also severe for local roads and streets because of the high frost action potential and low strength. Good drainage ditches are needed, and the base should be strengthened with material that is more suitable. Limitations are severe for septic tank absorption fields because of wetness and slow permeability.

With adequate subsurface and surface drainage and diversions to remove surface water, this soil could be used as a building site. Enlarged septic tank absorption fields or sewage treatment plants are needed. Capability subclass IIw; woodland subclass 3o.

JoA—Johnsburg silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on very slightly convex and concave ridgetops and some concave toe slopes on the uplands. Areas are irregular in shape and 125 to 400 feet wide on the ridgetops and long and narrow and 75 to 125 feet wide on the toe slopes. They are dominantly 12 acres on the ridgetops but range from 2 to 30 acres.

In a typical profile the surface layer is grayish brown silt loam about 9 inches thick. The subsoil is about 45 inches thick. The upper part is pale brown and light yellowish brown, mottled, friable silt loam; the middle layer is gray and light brownish gray, mottled, firm or very firm silt loam; and the lower part is a yellowish brown, mottled, very firm, brittle heavy silt loam fragipan. The substratum to a depth of 80 inches is yellowish brown, mottled silt loam. Bedrock is below.

In some areas this soil formed in loess. In some areas the subsurface layer is light brownish gray or gray.

Included with this soil in mapping are a few areas of Tilsit soils generally on narrow breaks. Also included are areas less than 75 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is very slow. The organic matter content is low. Surface runoff is slow. Reaction in the surface layer is slightly acid or neutral in most cultivated areas as a result of past liming practices. Reaction is generally strongly acid or very strongly acid in unlimed areas. The surface layer is friable and is easily tilled throughout a fairly wide range of moisture content. This soil has a seasonal high water table at a depth of 1 to 3 feet during a significant part of the year. The very slowly permeable fragipan is at a depth of 24 to 36 inches. The water table and the fragipan restrict the depth to which roots penetrate. Artificial drainage is needed for optimum growth of crops.

Most of the acreage is farmed. Most areas are used for corn or soybeans. Some are used for small grain. A few are used for hay, pasture, and woodland.

This soil is suited to corn, soybeans, and small grain. Wetness and the very slowly permeable fragipan are the major limitations. If adequate drainage is provided, a conservation cropping system that includes row crops most of the time can be used. Diversions help in controlling wetness by diverting the surface runoff from adjacent soils. Other conservation practices, such as minimum tillage, use of crop residue, and cover crops, help maintain and improve the organic matter content and tilth.

This soil is well suited to grasses for hay and pasture. It is poorly suited to deep rooted legumes, such as alfalfa, because the very slowly permeable fragipan restricts downward movement of roots, water, and air. If this soil is used as pasture, the major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions results in surface compaction and poor tilth. Proper stocking rates, pasture rotations, additions of lime and fertilizer according to the results of soil tests and plant needs, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees, but only a few areas are woodland. Limitations are moderate for the use of equipment. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the seasonal high water table, high frost action potential, very slow permeability in the fragipan, and moderate compaction characteristics.

Limitations are severe for building sites because of the seasonal high water table. Limitations are severe for local roads and streets because of frost action. Good drainage ditches are needed. Limitations are severe for septic tank absorption fields because of the seasonal high water table. The water table can be lowered if an adequate drainage system is installed. If the soil is adequately drained, large septic tank absorption fields can function. Sewage treatment plants, however, are more suitable. Capability subclass IIw; woodland subclass 3o.

MkB2—Markland silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on side slopes of the broad, flat, lacustrine terraces. Slopes are 50 to 200 feet long. Areas are usually irregular and long. They are dominantly about 6 acres but range from 2 to 15 acres.

In a typical profile the surface layer is brown heavy silt loam about 8 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown, firm silty clay loam; the middle part is yellowish brown, dark yellowish brown, or olive brown, firm silty clay; and the lower part is light olive brown and yellowish brown, mottled, firm silty clay. The substratum to a depth of 60 inches is yellowish brown and light olive brown, mottled, stratified silty clay and silty clay loam. In some places there are mottles in the subsoil at a depth of 18 inches.

Included with this soil in mapping are small areas of Markland soils on narrow steep escarpments and areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium. Also included are a few very severely eroded areas where the calcareous substratum is exposed, a few areas of nearly level Markland soils, and a few areas less than 100 feet wide of wetter McGary soils.

Available water capacity is moderate, and permeability is slow. The organic matter content is low because part of the surface layer has been removed by erosion. Surface runoff is medium. Reaction in the surface layer varies widely as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. Root development is good.

Some areas are farmed. A few are used for corn, soybeans, and small grain. Some are used for hay or pasture. Most of the acreage is woodland.

This soil is suited to corn, soybeans, and small grain. If it is cultivated, erosion is a hazard. This soil is very clayey in the subsoil. Because each area is narrow, the soil is generally farmed with adjoining terrace soils or it is left untilled. The conservation practices needed to control erosion and runoff and to prevent excessive soil loss in cultivated areas are crop rotation, minimum tillage, diversions, contour farming, grassed waterways, and grade stabilization structures. Because of the clayey subsoil, these practices also help in maintaining tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. Such crops are effective in controlling soil blowing and water erosion. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and most areas are in hardwoods. Plant competition is moderate. Seedlings survive well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering use of the soil are the high shrink-swell potential, low strength, slow permeability, and slope.

Limitations are severe for local streets and roads because of the high shrink-swell potential and low strength. They are severe for septic tank absorption fields because of slow permeability.

If this soil is used as a building site, enlarged septic tank absorption fields or sewage treatment plants should be used. Roads should be constructed on the contour and the base strengthened with more suitable material. Diversion terraces and grassed waterways between lots help control the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. Care should be taken to keep this soil from uneven shrinking and swelling around foundations. Capability subclass IIIe; woodland subclass 2c.

MkC—Markland silt loam, 6 to 18 percent slopes. This moderately sloping, deep, well drained soil is on the escarpments of broad, flat lacustrine terraces. Areas are generally long and irregular. They are dominantly 5 acres but range from 2 to 12 acres.

In a typical profile the surface layer is brown silt loam about 3 inches thick. The subsurface layer is pale brown silt loam about 4 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, firm silty clay loam; the middle part is light olive brown, firm silty clay; and the lower part is olive brown, mottled, firm silty clay. The substratum to a depth of 60 inches is light olive brown and yellowish brown, mottled, stratified clay, silty clay, and silty clay loam.

On about 60 percent of the acreage, slopes are 6 to 12 percent, and on the rest 12 to 18 percent. In places this Markland soil is less than 20 inches deep.

Included with this soil in mapping are some small areas, less than 2 acres, of very severely eroded Markland soils and areas where slopes are short and steep. Also included are areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is slow. The organic matter content is moderate or low because part of the original surface layer has been removed by erosion. Runoff is medium. Reaction in the surface layer varies widely because of local liming practices. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. Root development is good.

Most of the acreage is woodland. Some is farmed. A few areas are used for corn, soybeans, and small grain. Some are used for hay or pasture.

This soil is poorly suited to corn, soybeans, and small grain. If it is cultivated, the hazard of erosion is severe. The subsoil is very clayey. Because areas are narrow, they are generally farmed with adjoining terrace soils. Some are untilled. Conservation practices, such as crop rotation, minimum tillage, diversions, contour farming, grassed waterways, and grade stabilization structures, are needed to control erosion and runoff and to prevent excessive soil loss. Crop residue and cover crops reduce runoff and control erosion. They also help in maintaining tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay or pasture is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees, and most areas are in hardwoods. Plant competition is moderate. Seedlings survive well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering are the high shrink-swell potential, low strength, slow permeability, and slope. Because areas are narrow, the use of this soil for engineering structures may not be practical.

Limitations are severe for local streets and roads because of the high shrink-swell potential and low strength and severe for septic tank absorption fields because of slow permeability.

If the soil is used as a building site, an enlarged septic tank absorption field or sewage treatment plant should be used. Roads should be constructed on the contour, and the base strengthened with more suitable material. Diversion terraces and grassed waterways between lots help in controlling the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and grass planted as soon as possible after construction. Care should be taken to prevent uneven shrinking and swelling around foundations. Capability subclass IIIe; woodland subclass 2c.

MoC3—Markland silty clay loam, 6 to 18 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on escarpmentlike side slopes of the broad, flat lacustrine terraces. Areas are generally long and irregular and 50 to 200 feet wide. They are adjacent to drainageways that cut into the terraces. They are dominantly about 5 acres but range from 2 to 12 acres.

In a typical profile the surface layer is brown silty clay loam about 4 inches thick. The subsoil is about 20 inches thick. It is light olive brown, firm silty clay that is mottled in the lower part. The substratum to a depth of 60 inches is light olive brown and yellowish brown, mottled, stratified clay, silty clay, and silty clay loam.

In some places the surface layer is brown or yellowish brown silt loam. About 60 percent of this soil has slopes of 6 to 12 percent, and the rest has slopes of 12 to 18 percent. Some areas of Markland soil are less than 20 inches thick.

Included with this soil in mapping are some areas less than 2 acres of gullied Markland soils and areas with short steep slopes. Also included are areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is slow. The organic matter content is low because part of the surface layer has been removed by erosion. Surface runoff is rapid. Reaction in the surface layer varies widely as a result of local liming practices. The surface layer is clayey but friable. It can be tilled within only a fairly narrow range of moisture content to reduce soil compaction and the tendency to clod. Root development is good.

Some areas are farmed. A few are used for corn, soybeans, and small grain. Some are used for hay or pasture. Most of the acreage is woodland.

This soil is clayey and is very poorly suited to corn, soybeans, and small grain. The hazard of erosion is very severe in cultivated areas. Because each area is narrow, the soil generally is farmed with adjoining soils on terraces. Some areas are abandoned as cropland. The conservation practices needed to control erosion and runoff and to prevent excessive soil loss are crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these practices usually is needed. Crop residue and cover crops help to reduce surface runoff and control erosion. They also help in maintaining and improving tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay and pasture is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and most areas are in hardwoods. Plant competition is moderate. Seedlings survive well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering are the high shrink-swell potential, low strength, slow permeability, and slope. Areas of this soil are too narrow to be considered for engineering structures.

Limitations are severe for local streets and roads because of the high shrink-swell potential and low strength. They are severe for septic tank absorption fields because of slow permeability. Filter fields should be enlarged because of the slow permeability of the soil.

Foundations and footings for buildings should be properly designed to prevent structural damage caused by shrinking and swelling and by low strength. Roads should be constructed on the contour and the base material should be strengthened with more suitable material. Diversion terraces and grassed waterways between lots help control the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. Care should be taken to keep this soil from uneven shrinking and swelling around foundations. Capability subclass VIe; woodland subclass 2c.

MrA—McGary silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on broad, flat, and very slightly convex terraces. Areas are generally large and irregular in shape. The smaller areas are long and are adjacent to a break along a drainageway that dissected the terrace. Areas are dominantly about 150 acres but range from 3 to 350 acres.

In a typical profile the surface layer is dark gray silt loam about 2 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 7 inches thick. The subsoil is about 27 inches thick. The upper part is light brownish gray, mottled, firm silty clay, and the lower part is yellowish brown, brown, and light olive brown, mottled, firm silty clay. The substratum to a depth of 60 inches is light olive brown, mottled, stratified silty clay and silty clay loam.

In some areas this soil is 40 to 48 inches thick. In places, it is wetter and is grayer throughout the subsoil. In some areas the soil material is yellowish brown below the surface layer. In some areas the upper part of the substratum is not calcareous.

Included with this soil in mapping are a few small areas of Henshaw soils and a few, small, narrow areas adjacent to the breaks of a moderately well drained, nearly level Markland soil. Also included are narrow areas less than 75 feet wide of Markland soils on side slopes, and areas less than 50 feet wide in drainageways of soils that formed in alluvium.

Available water capacity is moderate, and permeability is slow. The organic matter content is moderate. Surface runoff is slow. Reaction in the surface layer is slightly acid or neutral as a result of past liming practices. It is generally medium acid in unlimed areas. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. The soil has a seasonal high water table at a depth of 1 to 3 feet during a significant part of the year. Artificial surface and subsurface drainage is needed for optimum growth of crops. Root development is somewhat restricted by the seasonal high water table.

About half the acreage is farmed. These areas are used for corn, soybeans, and small grain. A few areas are used for hay or pasture. The rest is woodland.

This soil is suited to corn, soybeans, and small grain. Wetness and the clayey subsoil are major limitations. If adequate drainage is provided, a conservation cropping system that includes row crops most of the time can be used. Surface and subsurface drainage is needed to lower the water table. The soil is somewhat droughty in dry years because of the clayey subsoil. Diversions protect this soil from runoff in areas adjacent to the uplands. Other conservation practices, such as minimum tillage, use of crop residue, and cover crops help in maintaining and improving the organic matter content and in maintaining good tilth.

This soil is suited to grasses and legumes for hay and pasture. It is also suited to deeper rooted legumes that are tolerant of a seasonal high water table. The major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions results in surface compaction and poor tilth. Proper stocking rates, pasture rotations, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in excellent condition.

This soil is suited to trees, dominantly post oak, hickory, maple, and red and white oak. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the seasonal high water table, high potential for frost action, clayeyness, high shrink-swell potential, slow permeability, and poor compaction characteristics.

Limitations are severe for building sites because of the seasonal high water table, shrinking and swelling, and low strength. Houses should be constructed without basements. Foundations and footings of buildings should be designed to prevent structural damage caused by shrinking and swelling and low strength. Foundation drain tile should be installed. Limitations are severe for local roads and streets because of low strength and high shrink-swell potential. The base material needs to be strengthened. Limitations are also severe for septic tank absorption fields because of wetness and slow permeability.

If this soil is used as a building site, adequate subsurface and surface drainage is needed to lower the water table. An enlarged septic tank absorption field or a sewage treatment plant is needed. Capability subclass IIIw; woodland subclass 3o.

MuA—Muren silt loam, 0 to 2 percent slopes. This nearly sloping, deep, moderately well drained soil is on meandering ridgetops and concave side slopes and toe slopes on the uplands. Areas are irregular in shape and are 150 to 700 feet wide. They are dominantly about 12 acres but range from 3 to 26 acres.

In a typical profile the surface layer is brown silt loam about 6 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is yellowish brown, mottled, firm silty clay loam or silt loam. The substratum to a depth of 82 inches is mottled yellowish brown silt loam.

In wooded areas the surface layer is very dark grayish brown silt loam about 4 inches thick, and the subsurface layer is pale brown silt loam about 6 inches thick.

In most areas the subsurface layer is pale brown silt loam. There are a few areas where the subsoil is brittle and a few areas where the lower part of the subsoil and the substratum are neutral or mildly alkaline. The substratum in these areas is at a depth of 40 to 50 inches.

Included with this soil in mapping are small areas of Muren soils where slopes exceed 2 percent. Also included are areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is very high, and permeability is moderately slow. The organic matter content is low. Surface runoff is slow in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. This soil has a seasonal high water table at a depth of 3 to 6 feet. Root development is good.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. A few are used for hay or pasture, and a few are woodland.

This soil is well suited to corn, soybeans, and small grain. Crop residue and cover crops help to control erosion and improve and maintain tilth and the organic matter content.

This soil is well suited to hay or pasture. The major concerns of management are overgrazing or grazing when the soil is too wet, both of which cause surface compaction, surface runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees, and a few areas are in hardwoods. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, moderately slow permeability, and wetness.

Limitations are moderate for building sites because of wetness and low strength. Foundations for buildings should be designed to prevent structural damage caused by low strength. Drain tile around foundations reduces wetness. Limitations are severe for local roads and streets. Good road ditches are needed. The base material should be strengthened with more suitable material. Limitations are also severe for septic tank absorption fields. Commercial sewers usually are needed. In drained areas enlarged absorption fields are needed. Capability class I; woodland subclass 1o.

MuB2—Muren silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on meandering ridgetops and concave side slopes and toe slopes on the uplands. Areas are irregular in shape and are 100 to 250 feet wide. They are dominantly about 6 acres but range from 3 to 30 acres.

In a typical profile the surface layer is brown silt loam about 8 inches thick. The subsoil is about 38 inches thick. It is yellowish brown, firm silty clay loam that is mottled in the lower part. The substratum to a depth of 66 inches is yellowish brown, mottled silt loam.

In wooded areas the surface layer is very dark grayish brown silt loam about 4 inches thick, and the subsurface layer is pale brown silt loam about 6 inches thick. There are a few areas where the subsoil is brittle and a few areas where the lower part of the subsoil and the substratum are neutral or mildly alkaline. The substratum in these areas is at a depth of 40 to 50 inches. In some small areas where the subsoil has been mixed with the surface layer through plowing, the surface layer is silt loam or silty clay loam.

Included with this soil in mapping are small areas of soils where slopes are less than 2 percent. Also included are areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is very high, and permeability is moderately slow. The organic matter content is low because part of the surface layer has been removed by erosion. Surface runoff is medium in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. This soil has a seasonal high water table at a depth of 3 to 6 feet. Root development is good.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. A few areas are used for hay or pasture, and a few are woodland.

This soil is well suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and runoff in cultivated areas. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Crop residue and cover crops also help in controlling erosion and improving and maintaining tilth and the organic matter content.

Keeping the soil in grasses and legumes for hay or pasture is effective in controlling water erosion. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and a few areas are in hardwoods. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, moderately slow permeability, wetness, and slope.

Limitations are moderate for building sites because of wetness. Limitations are severe for local roads and streets because of the high frost action potential and severe for septic tank absorption fields because of the moderately slow permeability.

If this soil is used as a building site, roads should be constructed on the contour. Wetness can be overcome by adequate subsurface drainage. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capabiity subclass IIe; woodland subclass 1o.

Ne—Newark silty clay loam. This nearly level, deep, somewhat poorly drained soil is in broad, long swales in the ripplelike, nearly level flood plain. Most areas are about 200 to 800 feet wide and 1/4 to 1 mile long. They are dominantly about 20 acres but range from 4 to 200 acres.

In a typical profile the surface layer is dark grayish brown silty clay loam about 10 inches thick. The subsoil is about 20 inches thick. It is grayish brown and dark grayish brown mottled, firm silty clay loam. The substratum to a depth of 60 inches is light brownish gray, mottled silty clay.

In some areas the subsoil is strongly acid or very strongly acid below 20 to 40 inches. Some areas are wetter and grayer, mostly in the extreme lower part of the swales.

Included with this soil in mapping are a few areas less than 50 feet wide of Woodmere and Huntington soils on convex breaks.

Available water capacity is high, and permeability is moderate. The organic matter content is high. Surface runoff is slow. This soil floods annually during winter and spring for a period of 6 to 16 days. The surface layer is friable, has good tilth, and can be easily tilled throughout a moderate range of moisture content. Reaction in the surface layer is neutral. The seasonal high water table is at a depth of 1 to 3 feet during winter and spring. Root development is good.

Most of the acreage is farmed. Most areas are used for corn and soybeans. Some areas are woodland.

This soil is suited to corn and soybeans. Wetness is a major limitation, and flooding in winter and spring is a major hazard. Levees would protect the soil from flooding. Artificial drainage is needed for optimum growth on this soil. Adequate drainage is difficult because the swales have no defined outlets. Only downward permeability can remove the excess water. Conservation practices, such as minimum tillage, crop residue, and green manure crops, help maintain and improve tilth and the organic matter content. Root development is good but is somewhat restricted by the seasonal high water table.

Unless protected from flooding, this soil is poorly suited to grasses and legumes for hay and pasture. Normally the soil is flooded too long. If protected from flooding and adequately drained, it is well suited to grasses and legumes. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and some areas are in hardwoods. Limitations are moderate for the use of equipment. The hazards of windthrow and plant competition are moderate. Unwanted trees and shrubs can be controlled and removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, flooding, wetness, and fair compaction characteristics.

Limitations are severe for building sites, sanitary facilities, and roads and streets because of flooding and wetness. Adequate drainage and levees to protect the soil from flooding are needed for site development. Capability subclass IIw; woodland subclass 1w.

OrB—Orthents, 0 to 8 percent slopes. This gently sloping, deep, well drained soil is leveled strip mined land on uplands. It consists of mixed broken bedrock and overlying upland soil material. Most of the bedrock is shale and siltstone. There is a small amount of sandstone. The underlying consolidated bedrock is 10 to 120 feet thick. The soil material is loess and residuum from bedrock. In most places the loess is as much as 10 feet thick. Areas are long. They range from 5 to 300 acres but are dominantly about 30 acres.

No one profile represents this map unit. Commonly the surface layer is brown silty clay loam that is about 3 inches thick and is 10 percent shale fragments less than 1 inch long. The substratum from a depth of 3 to 30 inches is mixed dark gray, gray, and brown, firm, neutral shaly and stony silty clay loam. To a depth of 60 inches it is gray, black, and brown, stony and channery silty clay loam.

Extremely acid "hot spots" high in sulfur make up about 10 percent of this unit. Part of the substratum has weak fine granular structure. In spots are brown and yellowish brown layers of silt loam or silty clay loam, which are remnants of the original surface layer, subsoil, or substratum. There are also strata of coal and fire clay.

Included with this soil in mapping are a few areas where slopes exceed 8 percent and a few steeper breaks where the spoil has not been leveled and is bouldery or very bouldery. Also included are a few areas where shale fragments less than 5 inches long cover more than half the surface layer. A few shallow pits of water are also included.

Available water capacity is moderate, and permeability is moderately slow or slow. The organic matter content is low. It is derived only from coal dust or from plants grown on this soil since it was mined. Surface runoff is medium. Reaction in the surface layer is neutral to medium acid. It varies within a distance of an inch or two. Reaction in the gray shale is generally neutral or alkaline. The surface layer is firm and can be easily tilled within only a fairly narrow range of moisture content. The amount of fragments within the surface layer interferes with tillage. Root development is good.

Some areas are farmed. Some are used for small grain. A few areas are used for hay or pasture or woodland. Many areas are used for housing.

This soil is poorly suited to corn and soybeans, but it is suited to small grain. If it is cultivated, the hazard of erosion is moderate. This soil is clayey in the surface layer and substratum. Conservation practices are needed to control erosion and runoff. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Crop residue and cover crops also help in erosion control and are needed to improve tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay or pasture is effective in controlling water erosion. Deep rooted legumes, such as alfalfa and sweetclover, are well suited. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees, and most wooded areas are in planted pines or hardwoods. Seedling mortality and plant competition are moderate. Seedlings survive well if competing vegetation is controlled, assuming that they are not set directly on rock. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering use of the soil are the moderate frost action potential, moderately slow permeability, high shrink-swell potential, seepage, poor compaction characteristics, subsidence, and slope.

Limitations are severe for building sites because of large stones and subsidence. They are severe for local streets and roads because of uneven compaction characteristics and high shrink-swell potential. Limitations are severe for septic tank absorption fields because of the moderately slow permeability.

If the soil is used as a building site, material below the footings for buildings, roads, and streets should be recompacted or pilings should be used. Roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Grass should be planted as soon as possible. When large areas are developed at once, soil erosion becomes a serious problem. Sediment-settling basins can control silting. Capability subclass IIIe; woodland subclass 4o.

OrD—Orthents, 8 to 25 percent slopes. This moderately sloping to moderately steep, deep, well drained soil is somewhat leveled strip mined land on uplands. It consists of mixed broken bedrock and overlying upland soil material. Most of the bedrock is shale, siltstone, and sandstone. The unconsolidated material is 10 to 120 feet thick. The upland soil material is loess and residuum weathered from bedrock. In most places the loess is no more than 10 feet thick. Slopes are 8 to 15 percent. Areas are irregular in shape. They range from 40 to 1,000 acres but are dominantly about 400 acres.

No one profile represents this map unit. Commonly the surface layer is brown and dark gray silty clay loam that is about 14 percent shaly fragments less than 3 inches long and is about 3 inches thick. The substratum from a depth of 3 to 6 inches is dark gray, gray, and brown, firm, neutral channery and shaly silty clay loam. To a depth of 60 inches it is dark gray, gray, and brown, channery, flaggy, stony and bouldery silty clay loam. Sandstone tends to be more blocky. Reaction is mainly neutral to medium acid.

Extremely acid "hot spots" high in sulfur make up about 5 percent of this unit. They are throughout the subhorizons and substratum. Gravel, cobbles, and shale fragments 4 to 6 inches across are about 10 to 30 feet apart on less than 1 percent of the surface layer. In spots there are yellowish brown and brown silt loam and silty clay loam from the original soil material. Some subhorizons have weak fine granular structure. There are some strata of coal and fire clay.

Included with this soil in mapping are vertical high walls and adjacent pits of water and small shallow water impoundments of 1 to 3 acres. Also included is mine spoil of the final cut between pits and the somewhat leveled spoil. Most of the mine spoil is very stony or bouldery silty clay loam, on slopes of about 70 percent. Small areas where slopes are 0 to 8 percent and a 20-acre pit mined for cherty limestone east of Lynnville are also included.

Available water capacity is moderate, and permeability is moderately slow and slow. The organic matter content is moderate or low and is derived only from coal mine dust or from plants grown on this soil since it was mined. Surface runoff is rapid. Reaction in the surface layer is neutral to medium acid. It varies within a distance of an inch or two. The gray shale is generally neutral or alkaline. The surface layer is firm and can be easily tilled within only a fairly narrow range of moisture content. The amount of fragments within the surface layer interferes with tillage. Root development is good.

Most areas are used for pasture or hay. Some are used for small grain.

This soil is very poorly suited to corn and soybeans but is suited to small grain. If it is cultivated, the hazard of erosion is severe. Conservation practices are needed to control erosion and runoff. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures are needed to prevent excessive soil loss. Crop residue and cover crops help in erosion control and are needed to improve tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay or pasture is effective in controlling water erosion. Deep rooted legumes, such as alfalfa and sweetclover, are well suited. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The equipment limitation is moderate. Plant competition and seedling mortality are also moderate. Seedlings survive well if competing vegetation is controlled, assuming that they are not set directly on rock. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering use of the soil are moderate frost action potential, moderately slow permeability, high shrink-swell potential, seepage, poor compaction characteristics, and slope.

Limitations are severe for building sites because of large rocks, subsidence, and slope. They are severe for local streets and roads because of uneven compaction characteristics, high shrink-swell potential, and slope. Limitations are severe for septic tank absorption fields because of moderately slow permeability and slope.

If this soil is used as a building site, material below the footings for buildings, roads, and streets should be recompacted or pilings should be used. Roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Grass should be planted as soon as possible. When large areas are developed, soil erosion is a serious problem. Sediment-settling basins can control silting. Capability subclass IVe; woodland subclass 4c.

OrG—Orthents, 33 to 90 percent slopes. This very steep, deep, well drained soil is unleveled, topped strip mined land on uplands. It appears as a mold-board plowed field, consisting of the side slope, the topped, flattened ridgetop about 10 feet wide, and the valley also about 10 feet wide. The peaks are about 50 to 75 feet apart. The difference in elevation between the peaks and valleys is 20 to 50 feet. The material is a mixture of broken bedrock and overlying upland soil material. Most of the bedrock is shale, siltstone, and sandstone. The unconsolidated material is 10 to 120 feet thick. The soil material is loess and residuum weathered from bedrock. In most places the loess is no more than 10 feet thick. Areas are dominantly about 2,000 acres but range from 40 to 5,000 acres.

No one profile represents this map unit. Commonly on the ridgetop is a layer about 3 inches thick of very dark brown and dark gray silty clay loam that is less than 15 percent shaly fragments dominantly less than 2 inches long. The substratum from a depth of 3 to 6 inches is dark gray, firm, medium acid, shaly silty clay loam. To a depth of 60 inches, it is gray, dark gray, and brown shaly silty clay loam that is very stony and bouldery.

Commonly the material on the side slope is similar to that on the ridgetop but is as much as 15 percent exposed stones and boulders. Many stones 1 to 6 feet across are on the steep slopes.

In the valley the surface layer is commonly very dark gray silty clay loam about 7 inches thick and 10 percent boulders, stones, and cobbles. The substratum, from a depth of 7 to 17 inches, is dark gray, firm silty clay. To a depth of 60 inches, it is gray, dark gray, or brown, shaly or stony silty clay loam that is stony and bouldery.

Extremely acid "hot spots" high in sulfur make up about 5 percent of this unit. Some areas are shaly silt loam and loam to silty clay. In spots is yellowish brown and brown silt loam or silty clay loam from the original surface layer, subsoil, or substratum. There are some strata of coal and fire clay.

Included with this soil in mapping are some areas where more than 15 percent of the surface layer is covered with shaly fragments and some areas where the material is dominantly shaly and channery or gravelly and cobbly silty clay loam or silt loam. Also included are vertical high walls, adjacent pits of water, and the final cut spoil wall, which has a slope of about 70 percent. The final cut is dominantly very stony or very bouldery. Also in the valleys are small shallow impoundments of water less than 4 acres.

Available water capacity is moderate, and permeability is moderately slow or slow. The organic matter content is moderate and is derived only from coal dust or from plants grown on the soil since it was mined. Surface runoff is very rapid. Reaction in the surface layer is slightly acid to strongly acid. It varies within a distance of an inch or two. The gray shale is generally neutral or alkaline. The surface layer is friable or firm and is not easily tilled because of steepness. Root development is good.

Few areas are farmed. These are grazed woodland. Most of the acreage is planted pine woodland.

This soil is not suited to corn, soybeans, and small grain. It is too steep for modern tillage equipment. Permanent vegetation is needed to prevent excessive soil loss. Trees or permanent pasture helps in erosion control and is needed to improve tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay or pasture is effective in controlling water erosion. Deep rooted legumes, such as alfalfa and sweetclover, are suited. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

This soil is suited to trees. The equipment limitation is severe. The erosion hazard is severe. Seedling mortality is severe, and the hazard of windthrow is slight. Most seedlings survive if competing vegetation is controlled, assuming that they are not set directly on rock or on the eroded, hot, southfacing slopes. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock.

Soil features that affect engineering use of the soil are the slope, stoniness, moderate frost action potential, moderately slow permeability, high shrink-swell potential, seepage, poor compaction characteristics and subsidence.

Limitations are severe for building sites because of the slope, large stones, and subsidence. They are severe for local streets and roads because of the slope, stoniness, and uneven compaction characteristics. Limitations are severe for septic tank absorption fields because of the slope, moderately slow permeability, and seepage into ground water.

If the soil is used as a building site, material below the footings for buildings, roads, and streets should be recompacted or pilings should be used. Roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Grass should be planted as soon as possible. Structures and sediment-settling basins help to control silting. Capability subclass VIIe; woodland subclass 4c.

OsF—Orthents stony, 8 to 33 percent slopes. This moderately sloping to steep, deep, well drained soil is undulating, graded strip mined land on uplands. It consists of mixed broken bedrock and overlying upland soil material. Most of the bedrock is sandstone, shale, or siltstone. The unconsolidated material is 5 to 120 feet thick. The soil material is loess and residuum from bedrock. In most places the loess is as much as 10 feet thick. Areas are long and follow the general contour of the original, undulating landscape. Slopes are mainly 8 to 20 percent. Cobbles, stones, flagstones, or boulders cover about 15 percent of the surface area. Areas are 200 to 6,000 feet wide. They range from 40 to 4,000 acres but are dominantly about 1,000 acres.

No one profile represents this map unit. Commonly the surface layer is brown and dark gray shaly silty clay loam that is about 3 inches thick and is 30 percent shaly fragments. The substratum, from a depth of 3 to 30 inches, is mixed dark gray, gray, and brown, firm, neutral, very shaly and very stony silty clay loam. To a depth of 60 inches it is gray, black, and brown very stony and very channery silty clay loam. Cobbles, flagstones, and stones cover about 7 percent of the surface area. Sandstone boulders, which do not disintegrate easily, make up about 40 percent of the substratum.

Extremely acid "hot spots" high in sulfur make up about 5 percent of this unit. In some areas the texture ranges from very shaly silt loam and loam to silty clay. Fragments are generally less than 3 inches long. In spots are yellowish brown and brown layers of silt loam or silty clay loam, which are remnants of the original surface layer, subsoil, or substratum. There are also strata of coal and fire clay.

Included with this soil in mapping are some areas where the surface layer is not 15 percent shaly fragments and some areas that are dominantly shaly and channery or gravelly and cobbly silty clay loam or silt loam. Also included are vertical high walls, adjacent pits of water, and the final cut spoil wall, which has a slope of about 70 percent. The final cut is dominantly very stony or very bouldery. Small, shallow impoundments of water less than 5 acres in size and small areas of Orthents stony on slopes of less than 8 percent are also included.

Available water capacity is moderate, and permeability is moderately slow or slow. The organic matter content is moderate or low and is derived only from coal dust or from plants grown on this soil since it was mined. Runoff is rapid. Reaction in the surface layer is neutral to medium acid. It varies within a distance of an inch or two. The gray shale is generally neutral or alkaline. The surface layer is firm and shaly and is not easily tilled because of the large number of fragments. This soil can be tilled within only a fairly narrow range of moisture content. Root development is good.

Few areas are farmed. A few are used for small grain. Most areas are used for hay or pasture or woodland.

This soil is very poorly suited to corn, soybeans, and small grain. If it is cultivated, the hazard of erosion is very severe. The soil is too stony for most modern tillage equipment. Management is needed that controls erosion and runoff and removes stony fragments 6 inches or more long. Crop rotation, minimum tillage, diversions, contour farming, grassed waterways, and grade stabilization structures are needed to prevent excessive soil loss. Crop residue and permanent pasture help in erosion control and are needed to improve tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay or pasture is effective in controlling water erosion. Deep rooted legumes, such as alfalfa and sweetclover, are suited. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition. Equipment is limited because of the slope and stones.

This soil is suited to trees but is moderately limited by the hazards of erosion and seedling mortality. Seedlings survive well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of the soil are slope, stoniness, moderate frost action potential, moderately slow permeability, high shrink-swell potential, seepage, poor compaction characteristics, and subsidence.

This soil has severe limitations for building sites because of slope, large stones, and subsidence. It has severe limitations for local streets and roads because of slope, stoniness, and uneven compaction characteristics. It has severe limitations for septic tank absorption fields because of slope and moderately slow permeability. If it is used as a building site, material below footings for buildings, roads, and streets should be recompacted or pilings should be used. Roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Grass should be replanted as soon as possible. Structures and sediment-settling basins control silting. Capability subclass VIs; woodland subclass 4x.

OsG—Orthents stony, 33 to 90 percent slopes. This very steep, deep, well drained soil is unleveled, topped strip mined land on the uplands. It appears as a moldboard plowed field, consisting of the side slope, the topped flattened ridgetop about 10 feet wide, and the valley also about 10 feet wide. Many stones and boulders, mostly from sandstone, are on the surface. The peaks are about 50 to 75 feet apart. The difference in elevation between the peaks and the valleys is about 20 to 50 feet. The material is a mixture of broken bedrock and overlying upland soil material. Most of the bedrock is shale, siltstone, and sandstone. The consolidated bedrock is at a depth of 10 to 120 feet. The soil material is loess or residuum weathered from bedrock. In most places the loess is no more than 5 feet thick. Areas are uniform in width. They are dominantly about 3,000 acres but range from 40 to 6,000 acres.

No one profile represents this map unit. Commonly on the ridgetop the surface layer, about 3 inches thick, is very dark brown and dark gray shaly silty clay loam that is about 30 percent shaly fragments dominantly less than 2 inches long. Boulders, stones, flagstones, and cobbles cover about 15 percent of the surface layer. The substratum from a depth of 3 to 6 inches is dark gray, firm, medium acid, very shaly heavy silty clay loam. To a depth of 60 inches, it is gray, dark gray, or brown, very shaly silty clay loam and is very stony and bouldery.

Commonly, the material on the side slopes is similar to that on the ridgetops but is as much as 25 percent exposed stones and boulders. In many areas 1 to 6 feet wide the surface layer has slipped downslope. In the valley the surface layer is commonly very dark gray shaly silty clay about 5 inches thick. About 30 percent of it is covered with boulders, stones, and cobbles. The substratum from a depth of 5 to 15 inches is dark gray, firm very shaly silty clay. To a depth of 60 inches, it is gray, dark gray, or brown, very shaly or very stony silty clay loam that is very stony and bouldery.

Extremely acid "hot spots" high in sulfur make up about 5 percent of this unit. Some areas are very shaly silt loam and loam to silty clay. In spots is yellowish brown and brown silt loam or silty clay loam, which is a remnant of the original surface layer, subsoil, or substratum. There are some strata of coal and fire clay.

Included with this soil in mapping are very acid, coal "gob" piles and tailings. Also included are some small areas where less than 15 percent of the surface layer is covered with shaly fragments; areas that are dominantly shale and channery fragments, gravel, cobbles, and boulders; vertical high walls and adjacent pits of water; and small shallow impoundments of water less than 4 acres in size. These impoundments are in the valleys.

Available water capacity is moderate, and permeability is moderately slow and slow. The organic matter content is moderate. It is derived only from coal dust or from plants grown on the soil since it was mined. Surface runoff is very rapid. Reaction in the surface layer is slightly acid to strongly acid. It varies within a distance of an inch or two. The gray shale is generally neutral or alkaline. The surface layer is friable or firm. Tillage is difficult because of the stoniness and steepness. This soil could possibly be tilled within only a fairly narrow range of moisture content if fragments were removed. Root development is good.

Few areas are farmed. These are grazed woodland. Most areas are in planted pines (fig. 10). These areas are used by wildlife.

This soil is not suited or very poorly suited to corn, soybeans, and small grain. The hazard of erosion is very severe in cultivated areas. Tillage equipment is not practical because the soil is too steep and stony. Conservation practices are needed to control erosion and runoff. Permanent vegetation is needed to prevent excessive soil loss. Trees or permanent pasture helps in erosion control and is needed to improve tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay or pasture is effective in controlling water erosion. Deep rooted legumes, such as alfalfa and sweetclover, are suited. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. Equipment is severely limited because of stoniness and the very steep slope.

This soil is suited to trees. The equipment limitation is severe. The hazard of erosion and seedling mortality is severe. Most seedlings survive if competing vegetation is controlled, assuming that they are not set directly on rock or on the eroded, hot, south-facing slopes. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, and girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering use of the soil are the slope, stoniness, moderate frost action potential, moderately slow permeability, high shrink-swell potential, seepage, poor compaction characteristics, and subsidence.

Limitations are severe for building sites because of large stones, the slope, and subsidence. They are severe for local streets and roads because of the slope, stoniness, and uneven compaction characteristics. Limitations are severe for septic tank absorption fields because of the slope and moderately slow permeability.

If this soil is used as a building site, material below the footings for buildings, roads, and streets should be recompacted or pilings should be used. Roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Grass should be planted as soon as possible. Structures and sediment-settling basins can control silting. Capability subclass VIIs; woodland subclass 4x.

Pa—Patton silty clay loam. This nearly level, deep, poorly drained soil is on broad flats and very slightly concave terraces. Areas are very broad and irregular and generally are near the toe slopes of the uplands. They are dominantly 50 acres but range from 5 to 220 acres.

In a typical profile the surface layer is very dark gray light silty clay loam about 10 inches thick. The subsoil is dark gray and gray, mottled silty clay loam about 32 inches thick. The substratum to a depth of 60 inches is gray, mottled, stratified silty clay loam with a few strata of clay.

Included with this soil in mapping are small areas of Evansville soils.

Available water capacity is very high, and permeability is moderate. The organic matter content is high. Surface runoff is slow and in some areas is ponded. The seasonal high water table is at a depth of 0 to 1 foot during a considerable part of the year. Reaction in the surface layer is usually neutral. This soil is friable. Tilling within the proper range of moisture content reduces soil compaction and the tendency to clod. Rooting depth is restricted by the high water table. Artificial drainage is needed for optimum growth of crops.

Most of the acreage is farmed. Most areas are used for corn, soybeans, and small grain. Only a few areas are in hay, pasture, and woodland.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Artificial drainage has been installed on nearly all the acreage. Wetness is the major limitation. If drainage is adequate, a conservation cropping system that includes row crops most of the time can be used. Minimum tillage, crop residue, and green manure crops help in maintaining and improving tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. It is poorly suited, however, to deep rooted legumes, such as alfalfa. Drainage is necessary for high yields. Only a small acreage is used for pasture because grazing under wet conditions results in surface compaction and poor tilth. Proper stocking rates, pasture rotations, and restricted use when the soil is wet help to keep the pasture and the soil in good condition.

This soil is suited to trees. The equipment limitation is severe. Plant competition and seedling mortality are severe, and the hazard of windthrow is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are a seasonal high water table and frost action.

Limitations are severe for building sites because of the seasonal high water table, which is at or near the surface during wet periods. Some areas are ponded. Limitations are also severe for local roads and streets because of the seasonal high water table and frost action. Drainage ditches are needed for roads to reduce the frost action potential. The water table can be lowered if an adequate subsurface and surface drainage system is installed. The use of commercial sewer systems is suggested. Selecting another site for an engineering structure is suggested also. Capability unit subclass IIw; woodland subclass 2w.

PeB2—Pekin silt loam, 1 to 4 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on old stream terraces, which are slightly higher in elevation than the adjoining alluvial soils. This soil has a fragipan. Areas are small, long, and irregular and are generally on the breaks at the edges of the terraces. They are 50 to 200 feet wide. They are dominantly 6 acres but range from 2 to 10 acres.

In a typical profile the surface layer is brown silt loam about 7 inches thick. The subsoil is about 51 inches thick. In sequence downward it is yellowish brown, firm silt loam; yellowish brown, mottled, firm silt loam; a yellowish brown and brownish yellow, mottled, very firm, brittle silt loam fragipan; and brownish yellow and light yellowish brown, mottled, firm heavy silt loam. The substratum to a depth of 66 inches is brownish yellow and light yellowish brown, stratified silt loam.

In a few wooded areas the surface layer is dark grayish brown or dark brown and the subsurface layer is pale brown. In a few areas there are no mottles above the fragipan.

Included with this soil in mapping are a few areas of severely eroded Pekin soils and some steeper Pekin soils. Also included are a few areas where the fragipan is weakly defined and small areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is very slow. The organic matter content is low because part of the surface layer has been removed by erosion. Surface runoff is medium in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. This soil has a perched seasonal high water table. It also has a very slowly permeable fragipan at a depth of about 24 inches, which restricts the depth to which roots and air penetrate. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content.

Most of the acreage is farmed. Most areas are used for corn, soybeans, and small grain. A few are used for hay, pasture, and woodland.

This soil is suited to corn, soybeans, and small grain. Because each area is narrow, it is farmed with adjoining soils. Erosion is the major hazard, and the very slowly permeable fragipan the major limitation. Conservation practices are needed to control erosion and runoff in cultivated areas. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Crop residue and cover crops also help in controlling erosion and improving and maintaining tilth and the organic matter content.

This soil is well suited to grasses or legumes for hay or pasture, which is effective in controlling water erosion. It is poorly suited, however, to deep rooted legumes, such as alfalfa, because the very slowly permeable fragipan restricts the downward movement of roots and air. The major concerns are overgrazing and grazing when the soil is too wet, both of which cause surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. The equipment limitation is slight. The hazard of windthrow is moderate. Plant competition is slight. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desirable seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, very slow permeability in the fragipan, the slope, wetness, and rare flooding.

Limitations are severe for building sites because of flooding. Limitations are severe for local roads and streets because of frost action. Good drainage ditches are needed. Limitations are severe for septic tank absorption fields because of the very slow permeability and the flooding.

Subsurface drainage is needed adjacent to the uphill side of the buildings to cut off seepage on the fragipan. Septic tank filter fields function poorly. Larger fields or sewage treatment plants are needed. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grasses should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IIe; woodland subclass 3d.

Pg—Peoga silt loam. This nearly level, deep, poorly drained soil is on broad flat stream terraces, which are very slightly higher in elevation than the adjoining alluvial soils. The alluvium washed from nearby loess-capped uplands. Areas are broad and irregular to elliptical. They are dominantly about 20 acres but range from 6 to 55 acres.

In a typical profile the surface layer is grayish brown silt loam about 8 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 7 inches thick. The subsoil is about 45 inches thick. The upper part is light brownish gray, mottled, friable silt loam; the middle part is gray, firm silty clay loam; and the lower part is strong brown, stratified silty clay loam and silt loam. The substratum to a depth of 80 inches is strong brown and gray, stratified silty clay loam and silt loam.

In some profiles there is a fragipanlike subsoil at a depth of about 32 inches. Some soils have a solum more than 80 inches thick. Some are medium acid to neutral in the lower part of the subsoil and the substratum.

Included with this soil in mapping are small areas of some Bonnie silt loam and Bartle silt loam. They are less than 2 acres. Also included are small areas less than 75 feet wide in drainageways of soils that formed in alluvium.

Available water capacity is high, and permeability is slow. The organic matter content is low. Surface runoff is slow. Reaction in the surface layer is neutral or slightly acid in most cultivated areas as a result of local liming practices. It is generally strongly acid or medium acid in unlimed areas. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. This soil has a seasonal high water table at a depth of 0 to 1 foot during a considerable part of the year, which restricts the depth to which most plant roots penetrate. Artificial drainage is needed for best growth of crops.

Most of the acreage is farmed. A few areas are in hay or pasture. Some are woodland.

This soil is well suited to corn and soybeans and is suited to small grain. Wetness is a major limitation in use and management. If the soil is adequately drained, a conservation cropping system that includes row crops most of the year can be used. Conservation practices, such as minimum tillage, crop residue, and cover crops help in maintaining and improving the organic matter content and in maintaining good tilth.

This soil is well suited to grasses for hay or pasture. It is poorly suited to deep rooted legumes, such as alfalfa. Drainage is necessary for high yields. Only a small acreage is used as pasture because grazing the soil when wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use when the soil is wet keep the pasture and the soil in good condition.

This soil is poorly suited to trees. The equipment limitation is severe. Plant competition is severe. Seedling mortality and windthrow are moderate. The erosion hazard is slight. Seedlings can survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, wetness, and slow permeability.

Limitations are severe for building sites because of wetness. They are severe for local streets and roads because of frost action. Good drainage ditches are needed. Limitations are severe for septic tank absorption fields because of wetness and slow permeability.

Adequate subsurface and surface drainage to sufficiently lower the water table and enlarged septic tank absorption fields can improve the site. Sewage treatment plants are needed for effluent disposal. The building sites selected should be on better drained soils. Capability subclass IIIw; woodland subclass 2w.

ScA—Sciotoville silt loam, 1 to 3 percent slopes. This nearly level, deep, moderately well drained soil is on broad, long, convex swells of the terraces along the Ohio River. These terraces are higher in elevation than the adjoining alluvial soils. Areas are long and generally narrow and are parallel to the old river channel. They are dominantly 17 acres but range from 4 to 25 acres.

This soil has a fragipan. In a typical profile the surface layer is brown silt loam about 8 inches thick. The subsoil is about 52 inches thick. In sequence downward it is yellowish brown, firm silty clay loam; yellowish brown, mottled, very firm silty clay loam; a brown and yellowish brown, mottled, very firm, brittle silty clay loam fragipan; and yellowish brown, mottled, firm silty clay loam. The substratum to a depth of 80 inches is stratified silty clay loam and silt loam.

Less eroded areas have a pale brown or yellowish brown subsurface layer 2 to 6 inches thick. Many areas have a silt loam, heavy loam, or clay loam subsoil.

Included with this soil in mapping are a few small areas of Wheeling soils. Also included are a few areas that have 10 to 20 inches of recent alluvium on the surface and areas of narrow escarpments less than 25 feet wide.

Available water capacity is moderate, and permeability is slow. The organic matter content is low. Surface runoff is slow. Reaction is neutral or slightly acid in most cultivated areas as a result of local liming practices. It is generally strongly acid in unlimed areas. This soil has a perched seasonal high water table at a depth of 1.5 to 2.5 feet for a short period. It has a slowly permeable fragipan at a depth of about 24 inches, which restricts the depth to which roots penetrate. The water table is perched by the fragipan early in spring. Consequently, the soil is wet in spring. It tends to be droughty late in summer. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content.

Some of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. Some are used for hay or pasture, and a few are woodland.

This soil is well suited to corn, soybeans, and small grain. The slowly permeable fragipan is a major limitation. Crop residue and cover crops improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. It is poorly suited, however, to deep rooted legumes because the slowly permeable fragipan restricts the downward movement of roots and air. The major concerns of management are overgrazing and grazing when the soil is too wet, which results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Limitations are slight. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential and the slow permeability in the fragipan.

Limitations are severe for building sites because of flooding and wetness. Flooding is rare, but the selection of an alternate site is suggested. Limitations are also severe for local roads and streets because of frost action. Limitations are severe for septic tank absorption fields because of the slow permeability.

If this soil is used as a building site, subsurface drainage is needed around the building to cut off seepage on the fragipan. Septic tank absorption fields function poorly. Larger filter fields or sewage treatment plants are needed. Capability subclass IIw; woodland subclass 2o.

Se—Steff silt loam. This nearly level, deep, moderately well drained soil is on broad, long, very slight swells of the flood plains. Areas are long and narrow and are dominantly nearest to the stream channel. They are dominantly about 10 acres but range from 2 to 20 acres.

In a typical profile the surface layer is dark brown silt loam about 9 inches thick. The subsoil is about 24 inches thick. It is brown, friable, strongly acid silt loam that is mottled in the lower part. The substratum to a depth of 60 inches is pale brown and light brownish gray, mottled silt loam.

Some profiles lack gray mottles, and many are slightly less clayey. In a few small areas bedrock is at a depth of 30 to 60 inches. Some profiles are as much as 10 percent shaly and channery fragments. These profiles are generally in the narrow upper reaches into the steeper, severely eroded residual soils. Some areas that are more sandy throughout are generally directly downstream from the steeper, severely eroded residual soils derived from sandstone.

Included with this soil in mapping are small areas of Stendal soils, generally in the crossable drainageways. These areas are less than 75 feet wide. Also included are the associated soils on uplands and terraces where drainageways flair outward and are less than 75 feet wide.

Available water capacity is very high, and permeability is moderate. The organic matter content is moderate. Surface runoff is slow. This soil has a seasonal high water table at a depth of 3 to 6 feet, and is subject to frequent flooding. Flooding lasts for a few hours except along major streams where it lasts for as long as 4 or 5 days. The surface layer is neutral to medium acid, is friable, has good tilth, and can be easily tilled throughout a fairly wide range of moisture content. Root development is good.

Most of the acreage is farmed. Most areas are used for corn, soybeans, and small grain. A few are used for hay or pasture. Some are woodland.

If protected from flooding, this soil is well suited to corn, soybeans, and small grain. Flooding is a major hazard. Levees are needed. Flooding generally lasts for less than a day and is not permanently damaging to most crops. Conservation practices, such as minimum tillage, crop residue, and green manure crops, help in maintaining and improving tilth and the organic matter content.

This soil is suited to grasses and legumes for hay and pasture. If protected from flooding, it is well suited to grasses and legumes. Overgrazing or grazing where the soil is flooded or is too wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and some areas are in hardwoods. Plant competition is moderate. Seedlings survive and grow if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering are the high frost action potential, low strength, fair compaction characteristics, and frequent flooding.

Limitations are severe for building sites and septic tank absorption fields because of flooding and wetness. They are severe for local roads and streets because of the high frost action potential and flooding. Protective levees and surface and subsurface drainage to sufficiently lower the water table are needed. Sewage treatment plants are needed for effluent disposal. Selecting an alternate building site is suggested. Capability class I; woodland subclass 1w.

Sn—Stendal silt loam. This nearly level, deep, somewhat poorly drained soil is in broad, long, very slight swales of the flood plains. Areas are dominantly about 20 acres but range from 2 to 170 acres.

In a typical profile the surface layer is grayish brown silt loam about 6 inches thick. The substratum to a depth of 40 inches is brown, grayish brown, and light gray, mottled, friable, strongly acid silt loam. To a depth of 60 inches it is brown, mottled silt loam.

Many areas are less clayey. Some are more sandy, and some are shaly or channery. All are associated with the steeper, more severely eroded residual soils on uplands. Some areas have a compacted subhorizon and substratum. In some areas the upper part of the subhorizon is neutral to medium acid because of past liming practices.

Included with this soil in mapping are a few areas of Wilbur soils generally along streams. Most areas are dredge spoil. Some are in narrow, slight swells, less than 75 feet wide. Also included are a few small areas of Bonnie soils, in the lower part of poorly defined drainageways. These areas are less than 75 feet wide.

Available water capacity is very high, and permeability is moderate. The organic matter content is low. Surface runoff is slow. This soil has a seasonal high water table at a depth of 1 to 3 feet and is subject to frequent flooding. Flooding lasts for a few hours to a day or two except along major streams where it can last for as long as a week. The surface layer is strongly acid to neutral, depending upon past liming practices. It is friable, has good tilth, and can be easily tilled throughout a fairly wide range of moisture content. Root development is good but is somewhat restricted by the seasonal high water table.

Most of the acreage is farmed. Most areas are used for corn and soybeans. Some are used for small grain. A few are used for hay and pasture. Some are woodland.

If adequately drained and protected from prolonged flooding, this soil is well suited to corn, soybeans, and small grain. Flooding is the major hazard, and wetness the major limitation. Adequate drainage is generally possible because outlets are available. Levees are needed. Flooding is not permanently damaging to crops except along the major streams. If the soil is adequately drained, a conservation cropping system that includes row crops most of the time can be used. Growing row crops in undrained areas is difficult. Occasionally crops have to be replanted because of flooding. Bedding is sometimes used where row crops are grown in undrained areas. Other conservation practices, such as minimum tillage, crop residue, and cover crops, help in maintaining and improving the organic matter content and in maintaining good tilth.

This soil is well suited to grasses and legumes for hay and pasture. It is poorly suited, however, to deep rooted legumes, such as alfalfa, because of wetness and damage during flooding. Drainage is necessary for high yields. Overgrazing or grazing when the soil is too wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the soil in good condition.

This soil is well suited to trees, and some areas are in hardwoods. Plant competition is moderate. Seedlings survive and grow if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering are a seasonal high water table, high frost action potential, and fair compaction characteristics. This soil is subject to frequent flooding.

Limitations are severe for building sites and septic tank absorption fields because of flooding and wetness. They are severe for local roads and streets because of the high potential for frost action and flooding. If this soil is used as a building site, levees to protect the soil from flooding and adequate subsurface and surface drainage to sufficiently lower the water table are needed. Sewage treatment plants are needed for effluent disposal. Selecting an alternate building site is suggested. Capability subclass IIw; woodland subclass 2w.

TtA—Tilsit silt loam, 0 to 2 percent slopes. This nearly level, deep, moderately well drained soil is on broad, irregularly shaped ridgetops on the uplands. Areas are small, irregular in shape, and nearly circular to 4 times as long as they are wide. They are dominantly about 10 acres but range from 2 to 20 acres.

In a typical profile the surface layer is brown silt loam about 8 inches thick. The subsurface layer is pale brown silt loam about 3 inches thick. The subsoil is about 52 inches thick. In sequence downward, it is light yellowish brown, firm silt loam; mottled light yellowish brown, firm silt loam; a mottled yellowish brown very firm, brittle silt loam fragipan; and a mottled yellowish brown, very firm, brittle silt loam fragipan with a few silty clay loam strata. The substratum to a depth of 65 inches is light yellowish brown silty clay loam. Shale, siltstone, and sandstone bedrock is below.

In some areas the fragipan is at a depth of about 28 to 36 inches. In some, gray mottles are 7 to 10 inches below the top of the subsoil. Some profiles are not mottled. Some areas have a strong brown or dark brown fragipan and a very dark grayish brown plow layer.

Included with this soil in mapping are some small areas of severely eroded Tilsit soils on steeper slopes and areas with short, steep slopes. Also included are some areas of Johnsburg soils, generally nearer the center of map units; small areas of Zanesville soils on the narrower breaks where lateral drainage is better; and small areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is very slow. The organic matter content is moderate. Surface runoff is slow. Reaction in the surface layer is neutral or slightly acid in most cultivated areas as a result of past liming practices. It is generally strongly acid or medium acid in unlimed areas. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. This soil has a perched seasonal high water table at a depth of 2 to 35 feet. It has a very slowly permeable fragipan at a depth of about 24 to 28 inches, which restricts the depth to which roots penetrate. The water table is perched above the fragipan early in spring. Consequently, the soil is wet in spring. It tends to be droughty late in summer.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. Some areas are in hay or pasture, and a few areas remain in woodland.

This soil is well suited to corn, soybeans, and small grain. The very slowly permeable fragipan is a major limitation. Some areas tend to be wet and seepy in spring, and some tend to be droughty late in summer. Crop residue and cover crops improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. It is poorly suited to deep rooted legumes because the very slowly permeable fragipan restricts the downward movement of roots and air. The major concerns of management are overgrazing and grazing when the soil is too wet, both of which result in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

The soil is suited to trees, but only a few areas remain in woodland. Abandoned farmland naturally revegetates to hardwoods. The main limitation is plant competition. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding wildlife, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering are the high frost action potential, very slow permeability in the fragipan, depth to bedrock, wetness, and medium compaction characteristics.

Limitations are severe for buildings with basements and moderate for other buildings because of wetness. Limitations are moderate for local roads and streets because of frost action and low strength. The base material needs to be strengthened, and good road ditches should be provided.

If this soil is used as a building site, subsurface drainage is needed around the building to cut off seepage on the fragipan. Septic tank absorption fields function poorly. Larger filter fields or sewage treatment plants are needed. In places removal of bedrock is necessary. Capability subclass IIw; woodland subclass 3o.

TtB2—Tilsit silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on broad, irregularly shaped meandering ridgetops and concave toe slopes on the uplands. Areas are dominantly about 15 acres but range from 2 to 35 acres.

In a typical profile the surface layer is brown silt loam about 7 inches thick. The subsoil is about 51 inches thick. In sequence downward it is yellowish brown, firm silt loam; yellowish brown, light yellowish brown, and pale brown, mottled, firm silt loam; a yellowish brown, mottled, very firm, brittle silt loam fragipan; a light yellowish brown, mottled, very firm, brittle silty clay loam fragipan; and light yellowish brown, mottled silty clay loam. The substratum to a depth of 80 inches is light yellowish brown silty clay loam. Siltstone, shale, and sandstone bedrock is below.

In some areas the fragipan is at a depth of about 28 to 32 inches. In small areas on concave toe slopes, the surface layer is very dark grayish brown.

In some areas mottles are within the top 7 to 10 inches of the subsoil.

Included with this soil in mapping are some small areas of Tilsit soils that have slopes of 0 to 2 percent, generally on the highest part of the ridgetops, and small areas of severely eroded soils. Also included are some Johnsburg silt loams, generally on the concave part of toe slopes; small areas of Zanesville soils that have 0 to 6 percent slopes, on the narrow breaks where lateral drainage is better; and areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is very slow. The organic matter content is moderate. Surface runoff is medium. Reaction in the surface layer is neutral or slightly acid in most cultivated areas as a result of past liming practices. It is generally strongly acid or medium acid in unlimed areas. This soil has a perched seasonal high water table at a depth of 1.5 to 2.5 feet. It has a very slowly permeable fragipan at a depth of 20 to 28 inches, which restricts the depth to which roots penetrate. The water table is perched above the fragipan early in spring. Consequently, the soil is wet in spring. It tends to be droughty late in summer. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. Some areas are in hay or pasture, and some are in woodland.

This soil is well suited to corn, soybeans, and small grain. The very slowly permeable fragipan is a major limitation, and erosion is the major hazard. This soil tends to have wet seepy areas in spring and droughty areas late in summer. Conservation practices are needed to control erosion and runoff in cultivated areas. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Crop residue and cover crops improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. It is poorly suited to deep rooted legumes, because the very slowly permeable fragipan restricts the downward movement of roots and air. The major concerns of management are overgrazing and grazing when the soil is too wet, both of which result in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help keep the pasture and the soil in good condition.

This soil is suited to trees, but only a few areas remain in woodland. Some abandoned farmland has naturally revegetated to hardwoods. The hazard of windthrow is moderate. Plant competition is slight. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding wildlife, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering are the high frost action potential, very slow permeability in the fragipan, depth to bedrock, wetness, and medium compaction characteristics.

Limitations are severe for buildings with basements and moderate for other buildings because of wetness. Limitations are also severe for local roads and streets because of frost action and low strength. The base material needs to be strengthened, and good road ditches should be provided. Limitations are severe for septic tank absorption fields because of the very slow permeability and wetness.

If this soil is used as a building site, subsurface drainage is needed adjacent to the uphill side of the building to cut off seepage on the fragipan. Septic tank filter fields function poorly. Larger filter fields or sewage treatment plants are needed. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grasses should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. In places removal of bedrock is necessary. Capability subclass IIe; woodland subclass 3o.

UnB2—Uniontown silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on convex ridgetops and side slopes of the broad, flat lacustrine terraces. Areas are typically irregular to elliptical. They are dominantly about 4 acres but range from 2 to 20 acres.

In a typical profile the surface layer is brown silt loam about 9 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown and light olive brown, firm silty clay loam, and the lower part is light olive brown, mottled, friable silt loam. The substratum to a depth of 60 inches is light yellowish brown, mottled, stratified silt loam.

In some small areas slopes are less than 2 percent. In some areas the solum is 40 to 50 inches thick.

Included in mapping are some soils that are redder in the upper part of the subsoil. Also included are escarpments less than 50 feet wide of Uniontown and Markland soils along drainageways and areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is high, and permeability is moderate. The organic matter content is low because part of the surface layer has been removed by erosion. Surface runoff is medium in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. Root development is good.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and some for woodland.

This soil is well suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and runoff in cultivated areas. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Crop residue and cover crops also help in erosion control and improving and maintaining tilth and the organic matter content.

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

This soil is well suited to trees, and some areas are in hardwoods. Plant competition is moderate. Seedlings survive well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering use of the soil are the high frost action potential, moderately slow permeability of the substratum, and seepage.

Limitations are moderate for buildings because of low strength. Foundations and footings should be properly designed. Limitations are also severe for local streets and roads because of low strength. The base material should be strengthened. Limitations are moderate for septic tank absorption fields because of the moderately slow permeability in the substratum. Larger filter fields are needed if systems are to function properly.

If this soil is used as a building site, roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IIe; woodland subclass 2o.

UnC—Uniontown silt loam, 6 to 12 percent slopes. This moderately sloping, deep, well drained soil is on the sides of the broad, flat lacustrine terraces. Areas, typically irregular and long, parallel the adjacent drainageways. They are dominantly about 5 acres but range from 2 to 10 acres.

In a typical profile the surface layer is dark grayish brown silt loam about 4 inches thick. The subsurface layer is pale brown silt loam about 2 inches thick. The subsoil is about 29 inches thick. The upper part is yellowish brown, firm silt loam; the middle part is yellowish brown and light olive brown, firm silty clay loam, and the lower part is light olive brown, mottled, friable silt loam. The substratum to a depth of 60 inches is light yellowish brown, mottled, stratified silt loam and silty clay loam.

In some areas the subsoil is as thick as 50 inches. In some areas the surface layer is yellowish brown or brown because part of the original layer as been removed by erosion.

Included with this soil in mapping are some soils that are redder in the upper part of the subsoil. Also included are escarpments less than 50 feet wide of Uniontown or Markland soils along the drainageways and areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate because part of the surface layer has been removed by erosion. Surface runoff is medium in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. Root development is good.

Some areas are farmed. Some are used for corn, soybeans, and small grain, and some for hay and pasture. Most of the acreage is woodland.

This soil is suited to corn, soybeans, and small grain. If this soil is cultivated, the hazard of erosion is severe. Conservation practices, such as crop rotations, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures control erosion and runoff and help prevent excessive soil loss. Crop residue and cover crops reduce runoff and help to control erosion. They also help in maintaining tilth and the organic matter content.

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

This soil is well suited to trees, and some areas are in hardwoods. Plant competition is moderate. Seedlings survive if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, moderately slow permeability of the substratum, seepage, and the slope.

Limitations are severe for local streets and roads because of low strength. The base material should be strengthened, and good drainage ditches are needed. Limitations are moderate for septic tank absorption fields because of the moderately slow permeability of the substratum. Larger filter fields are needed.

Slope and low strength are limitations if this soil is used as a building site. Frost action can become a problem if footings are not placed below the level of frost penetration. Foundations and footings should be properly designed. Roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IIIe; woodland subclass 2o.

UnD—Uniontown silt loam, 12 to 18 percent slopes. This strongly sloping, deep, well drained soil is on the sides of the broad, flat lacustrine terraces. Areas are long and parallel the adjacent drainageways. They are dominantly about 5 acres but range from 2 to 8 acres.

In a typical profile the surface layer is dark grayish brown silt loam about 3 inches thick. The subsurface layer is pale brown silt loam about 5 inches thick. The subsoil is about 23 inches thick. The upper part is yellowish brown and light olive brown, firm silty clay loam, and the lower part is light olive brown, mottled, friable silt loam. The substratum to a depth of 60 inches is light olive brown, yellowish brown, and light yellowish brown, mottled, stratified silt loam and silty clay loam.

In some areas the surface layer is brown and yellowish brown. In places the subsoil contains carbonates. In some areas the surface layer is silty clay loam because part of the original layer has been removed by erosion.

Included with this soil in mapping are some areas less than 2 acres where the substratum has been exposed by erosion and steeper escarpments less than 50 feet wide of Uniontown or Markland soils. Also included are areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is high, and permeability is moderate. The organic matter content is low because part of the original surface layer has been removed by erosion. Surface runoff is rapid. Reaction in the surface layer varies widely as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. Root development is good.

Some areas are farmed. Few areas are used for corn, soybeans, and small grain. Some are used for hay or pasture. Most of the acreage is woodland.

This soil is poorly suited to corn, soybeans, and small grain because of the very severe hazard of erosion. Because each area is narrow, it is farmed with the adjoining soils on terraces. Most row crops are grown so that stands of grasses and legumes can be reestablished. Conservation practices are needed to control erosion and runoff if this soil is cultivated. Minimum tillage, diversions, grassed waterways, and crop residue help prevent excessive soil loss. Crop rotations that include grasses and legumes for hay and pasture most of the time are most effective in reducing runoff and controlling erosion.

Keeping this soil in grasses and legumes for hay and pasture is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and some areas are in hardwoods. Plant competition is moderate. Seedlings survive if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering use are the high frost action potential, low strength, moderately slow permeability of the substratum, and seepage.

Limitations are severe for local streets and roads because of low strength. The base material should be strengthened. Limitations are moderate for septic tank absorption fields because of the moderately slow permeability of the substratum.

Slope is the main limitation if this soil is used as a building site. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IVe; woodland subclass 2o.

UtC3—Uniontown silty clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on the sides of the broad, flat lacustrine terraces. Areas are typically long and are parallel to the adjacent drainageways. They are dominantly about 8 acres but range from 2 to 12 acres.

In a typical profile the surface layer is brown silty clay loam about 5 inches thick. The subsoil is about 25 inches thick. The upper part is light olive brown, firm silty clay loam, and the lower part is olive brown, mottled, friable silt loam. The substratum to a depth of 60 inches is light olive brown, yellowish brown, and light yellowish brown, mottled, stratified silt loam and silty clay loam.

In some areas the soil is much thinner because of past erosion. In places the subsoil contains carbonates.

Included with this soil in mapping are a few areas where the substratum is exposed, small areas of Markland soils where slopes are 6 to 12 percent, and some escarpments of Uniontown or Markland soils that are less than 50 feet wide. Also included are small areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is high, and permeability is moderate. The organic matter content is low because part of the original surface layer has been removed by erosion. Surface runoff is rapid in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. The surface layer is friable. Tilling within the proper range of moisture reduces soil compaction and the tendency to clod. Root development is good.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. Some are used for hay or pasture, and some are woodland.

This soil is poorly suited to corn, soybeans, and small grain, because the hazard of damage from further erosion is very severe. Because each area is narrow, it is farmed with the adjoining soils on terraces. Conservation practices needed to control erosion and runoff and prevent excessive soil loss are crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures. More than one of these practices is usually needed. Crop residue and cover crops reduce runoff and help to control erosion. They also help in maintaining tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay and pasture is effective in controlling soil blowing and water erosion. Overgrazing or grazing when the soil is too wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and most areas are in hardwoods. Plant competition is moderate. Seedlings survive if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, the low strength, the moderately slow permeability of the substratum, the seepage, and the slope.

This soil has limitations for building sites because of the slope and the low strength. Footings should be properly designed and placed below the level of frost penetration. Limitations are severe for local streets and roads because of low strength. The base material should be strengthened. Good drainage ditches are needed. Limitations are moderate for septic tank absorption fields because of the moderately slow permeability of the substratum. Larger filter fields are needed for systems to function properly.

If this soil is used as a building site, roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grasses should be planted. Development of random lots is preferable. Sediment-settling basins can control silting. Capability subclass IVe; woodland subclass 2o.

Wa—Wakeland silt loam. This nearly level, deep, somewhat poorly drained soil is in broad, long, very slight swales of the flood plains. Areas are large and about 300 feet wide. They are dominantly 20 acres but range from 2 to 400 acres.

In a typical profile the surface layer is grayish brown silt loam about 10 inches thick. The substratum to a depth of 30 inches is grayish brown and brown, mottled, friable, neutral and slightly acid silt loam. To a depth of 60 inches, it is gray, mottled silt loam. In some small areas the substratum is slightly more clayey. In some areas 20 to 40 inches of this soil is deposited on other soils. This uneven deposition does not affect agricultural use except for spacing of subsurface drains. In a few areas the lower part of the subhorizon or the substratum is strongly acid.

Included with this soil in mapping are a few areas less than 75 feet wide of Birds soils. These soils are in the lower part of poorly defined drainageways or against the bluff of the uplands or terraces. Also included are a few small areas of Wilbur soils on very slight swells generally along the streams or as dredge spoil. These areas and the upper end of drainageways, which are adjoining soils on uplands and terraces, are less than 75 feet wide.

Available water capacity is very high, and permeability is moderate. The organic matter content is low. Surface runoff is slow. This soil has a seasonal high water table at a depth of 1 to 3 feet and is subject to frequent flooding. Flooding lasts for a few hours to a day or two except along the major streams, which are flooded for more than a week. The surface layer is neutral to medium acid. It is friable, has good tilth, and can be easily tilled throughout a fairly wide range of moisture content. Root development is good but is somewhat restricted by the seasonal high water table.

Most of the acreage is farmed. Most areas are used for corn and soybeans. A few are used for small grain, hay or pasture. Few areas are used for woodland.

If adequately drained and protected from flooding, this soil is well suited to corn, soybeans, and small grain.

Flooding is a major hazard, and wetness is a major limitation. Establishing adequate drainage is generally possible because outlets are available. Levees are needed to protect the soil from flooding. Most flooding is not permanently damaging to crops except along major streams. If the soil is adequately drained, a conservation cropping system that includes row crops most of the time can be used. Growing row crops in undrained areas is difficult. Crops occasionally have to be replanted because of flooding. Bedding is sometimes used as a management practice where row crops are grown in undrained areas. Minimum tillage, crop residue, and cover crops help in maintaining and improving the organic matter content and in maintaining good tilth.

This soil is well suited to grasses and legumes for hay and pasture but poorly suited to deep rooted legumes, such as alfalfa, because of wetness and damage during periods of flooding. Drainage is necessary for high yields. Overgrazing or grazing when the soil is too wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the soil in good condition.

This soil is suited to trees, and a few areas are in hardwoods. The equipment limitation is moderate. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering are the high water table, the high frost action potential, and the fair compaction characteristics. This soil is subject to frequent flooding.

Limitations are severe for building sites and septic tank absorption fields because of flooding and wetness. They are severe for local roads and streets because of high frost action potential and flooding.

If this soil is used as a building site, levees to protect it from flooding and adequate subsurface and surface drainage to sufficiently lower the water table are needed. Sewage treatment plants are needed for effluent disposal. Capability subclass IIw; woodland subclass 2w.

WbA—Weinbach silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is in broad, slightly concave swales of the terraces along the Ohio River. The terraces are higher than the adjoining alluvial soils. Areas are long and generally narrow and are parallel with the old river channel. They are dominantly about 15 acres but range from 4 to 20 acres.

In a typical profile the surface layer is grayish brown silt loam about 8 inches thick. The subsurface layer is mottled light brownish gray and pale brown silt loam about 3 inches thick. The subsoil is about 47 inches thick. The upper part is mottled, light brownish gray and pale brown, firm silt loam; the middle part is a light brownish gray and brown, mottled, very firm, brittle, light silty clay loam fragipan; and the lower part is yellowish brown and brown, mottled, friable silt loam. The substratum to a depth of 80 inches is mottled yellowish brown and brown, stratified silt loam. In some areas the fragipan is strong brown.

Included with this soil in mapping are small areas, generally in the lower part of the swales, of gray, poorly drained soils that have a fragipan. Also included are a few narrow escarpments, less than 40 feet wide, and areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is very slow. The organic matter content is low. Surface runoff is slow in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. This soil has a seasonal high water table at a depth of 1 to 3 feet during a significant part of the year. It has a very slowly permeable fragipan at a depth of 18 to 30 inches, which restricts the depth to which roots penetrate. The water table is perched above the fragipan early in spring. Consequently, the soil is wet and seepy in spring. It tends to be droughty late in summer. Artificial drainage is needed for optimum growth of crops. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content.

Most of the acreage is farmed. Most areas are used for corn, soybeans, and small grain. A few areas are used for hay and pasture and some areas are woodland.

This soil is suited to corn, soybeans, and small grain. Wetness and the very slowly permeable fragipan are the major limitations. If adequate drainage is provided, a conservation cropping system that includes row crops most of the time can be used. Diversions also help in controlling wetness by keeping runoff off this soil. Minimum tillage, crop residue, and cover crops help to maintain and improve the organic matter content and to maintain good tilth.

This soil is well suited to grasses for hay and pasture. It is poorly suited to deep rooted legumes, such as alfalfa, because the very slowly permeable fragipan restricts downward movement of roots and water. The major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions results in surface compaction and poor tilth. Proper stocking rates, pasture rotations, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees, and some areas are woodland. The equipment limitation is moderate. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

Soil features that affect the engineering use of this soil are the seasonal high water table, rare flooding, the high frost action potential, and the very slow permeability in the fragipan.

Limitations are severe for buildings with basements because of the high water table (fig. 11) and rare flooding. They are severe for local roads and streets because of frost action. Good drainage ditches are needed. Limitations are severe for septic tank absorption fields because of wetness and the very slow permeability. The water table can be lowered if an adequate drainage system is installed.

Septic tank absorption fields function poorly. If this soil is used as a building site, much larger filter fields are needed. Sewage treatment plants are needed for effluent disposal. Capability subclass IIw; woodland subclass 2w.

WeD—Wellston silt loam, 12 to 18 percent slopes. This strongly sloping, deep, well drained soil is on meandering side slopes on the uplands. Areas are narrow and irregular. They are dominantly about 10 acres but range from 2 to 23 acres.

In a typical profile the surface layer is dark brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 6 inches thick. It is 4 to 6 inches thick in most of the area. The subsoil is about 30 inches thick. The upper part is yellowish brown, friable and firm silt loam and shaly silt loam that contains many sandstone, siltstone, and shale fragments. The substratum from a depth of 40 to 44 inches is yellowish brown very shaly loam. Weathering sandstone, shale, and siltstone are below.

In plowed areas the surface layer is brown or yellowish brown silt loam about 8 inches thick. In a few areas this soil is 60 inches thick. In some areas the subsoil is yellowish brown to olive. It weathered from silty clay shale.

Included with this soil in mapping are a few areas of Alford, Gilpin, and Zanesville soils. Also included are a few steep areas where bedrock crops out and a few areas of severely eroded Wellston soils, generally adjacent to the drainageway.

Available water capacity is moderate, and permeability is moderate. The organic matter content is moderate or low because part of the original surface layer has been removed by erosion. Surface runoff is rapid. Reaction in the surface layer is usually strongly acid to extremely acid. It varies widely in cultivated areas as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. Root development is good but is somewhat restricted by bedrock.

Some areas are farmed. Very few areas are used for corn or soybeans. A few areas are used for small grain and grasses and legumes for hay or pasture. Most of the acreage is woodland.

This soil is very poorly suited to corn, soybeans, and small grain because of the very severe hazard of erosion. Most row crops are grown so that stands of grasses and legumes can be reestablished. Conservation practices are needed to control erosion and runoff if this soil is cultivated. Minimum tillage and crop residue help prevent excessive soil loss. Crop rotations that include growing grasses and legumes for hay and pasture most of the time are most effective in reducing runoff and controlling erosion.

This soil is well suited to grasses and legumes for hay or pasture. They generally are not tilled with the adjoining soils on ridgetops but are left in grasses, which is effective in preventing erosion. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees, and most areas are in hardwoods. Most areas have remained in woodland. Some areas that were once cleared and planted to grass or small grain are naturally reverting to hardwoods. The equipment limitation is moderate. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the slope and depth to bedrock.

Limitations are severe for building sites, local roads and streets, and septic tank absorption fields because of the slope. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Structures and benching can also be used. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. In places it is necessary to remove bedrock for basements, footings, septic tank absorption fields, and landfill. Capability subclass IVe; woodland subclass 2r.

WeD3—Wellston silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on meandering side slopes on the uplands. Areas are narrow, long, and irregular. They are dominantly about 12 acres but range from 2 to 30 acres.

In a typical profile the surface layer is brown silt loam about 7 inches thick. The subsoil is about 25 inches thick. It is yellowish brown or brown, firm silt loam and loam. The lower part contains many sandstone, siltstone, and shale fragments. The substratum to a depth of 43 inches is yellowish brown loam and many shale fragments. Weathering siltstone is below.

In some areas Wellston soils are very severely eroded and generally have a silty clay loam surface layer. In a few areas they are not so sandy in the lower part of the subsoil. In spots the subsoil is yellowish brown to olive. It weathered from silty clay shale.

Included with this soil in mapping are a few small areas of severely eroded Gilpin and Zanesville soils, small steep areas where bedrock crops out, and a few areas of less eroded Wellston soils.

Available water capacity is moderate, and permeability is moderate. The organic matter content is low. Surface runoff is very rapid. Reaction in the surface layer is usually strongly acid to extremely acid. It varies widely in cultivated areas as a result of local liming practices. The surface layer is friable, but it must be tilled within the proper range of moisture content to reduce soil compaction and the tendency to clod. Root development is good but is somewhat restricted by bedrock.

Some areas are farmed. Some are used for corn or soybeans and small grain. Most are used for grasses and legumes for hay or pasture. Some are woodland.

This soil is very poorly suited to corn, soybeans, and small grain because of the very severe hazard of erosion. Most row crops are grown so that stands of grasses and legumes can be reestablished. Conservation practices help to control erosion and runoff in cultivated areas. Minimum tillage, diversions, grassed waterways, and crop residue help to prevent excessive soil loss. Crop rotations that include grasses and legumes most of the time are most effective in reducing runoff and controlling erosion.

This soil is suited to grasses and legumes for hay or pasture. It has been clean tilled in the past, but now much of the acreage is in grasses and legumes. Some areas have gullies that are difficult to cross with farm machinery. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees, and some areas are in hardwoods. Most areas were once cleared and planted to grass or small grain. Most have reverted to hardwoods. The equipment limitation is moderate. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled and removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the slope and depth to bedrock.

Limitations are severe for building sites, local roads and streets, and septic tank absorption fields because of the slope.

If this soil is used as a building site, roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Structures and benching can also be used. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. In places it is necessary to remove bedrock for basements, footings, septic tank absorption fields, and landfill. Capability subclass VIe; woodland suitability 2r.

WeE2—Wellston silt loam, 18 to 25 percent slopes, eroded. This moderately steep, deep, well drained soil is on meandering side slopes on the uplands. Areas are narrow and irregular. They are dominantly about 8 acres but range from 2 to 15 acres.

In a typical profile the surface layer is dark grayish brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The subsoil is about 27 inches thick. It is brown and yellowish brown, friable and firm silt loam and loam. It has many shaly sandstone, siltstone, and shale fragments in the lower part. The substratum to a depth of 41 inches is yellowish brown loam with many shaly siltstone and shale fragments. Weathered siltstone is below.

In a few areas that were once plowed, the surface layer is brown or yellowish brown silt loam about 6 inches thick. In a few areas bedrock is at a depth of 25 to 40 inches. In some areas the subsoil is yellowish brown to olive. It weathered from silty clay shale.

Included with this soil in mapping are areas of severely eroded Wellston soils and a few areas of Gilpin soils. Also included are small areas of Wellston soils on slopes of 25 to 50 percent adjacent to the drainageways, steep areas where bedrock crops out, and small gullied areas.

Available water capacity is moderate, and permeability is moderate. The organic matter content is moderate or low because part of the original surface layer has been removed by erosion. Surface runoff is rapid. Reaction in the surface layer is usually strongly acid to extremely acid. It varies widely in cultivated areas as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content. Root development is good but is somewhat restricted by bedrock.

Some of the acreage is or has been farmed. A few areas have been used for small grain. Many areas are used for grasses and legumes for hay or pasture. Many remain in woodland.

This soil is not suited to corn, soybeans, or small grain because of the very severe hazard of erosion. It should be tilled only to reestablish permanent vegetation. The moderately steep slopes limit the use of modern farm machinery. The conservation practices needed to prevent excessive soil loss when the soil is cultivated are minimum tillage, diversions, and the return of crop residue. Keeping the soil in grasses and legumes is effective in controlling and in reducing runoff.

This soil is suited to grasses and legumes for hay or pasture. Generally it is not tilled with adjoining soils on ridgetops but is left in grasses, which is effective in preventing erosion. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and most areas are in hardwoods. Most areas have remained in woodland. Some areas that were once cleared and planted to grass or small grain have reverted to hardwoods. The equipment limitation is moderate. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled and removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the slope and the depth to bedrock.

Limitations are severe for building sites, local roads and streets, and septic tank absorption fields because of the slope.

If this soil is used as a building site, roads should be constructed on the contour. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Structures and benching can also be used. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. In places it is necessary to remove bedrock for basements, footings, and septic tank absorption fields. Capability subclass VIe; woodland subclass 2r.

WhA—Wheeling silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on broad, convex swells that were beach ridges on terraces along the Ohio River. The terraces are higher in elevation than the adjacent alluvial soils. Areas are long and are generally parallel with the old river channel. They are slightly higher than the adjoining terrace soils. Areas are dominantly about 20 acres but range from 4 to 50 acres.

In a typical profile the surface layer is brown silt loam about 8 inches thick. The subsoil is about 42 inches thick. The upper part is strong brown and yellowish brown, firm silt loam or silty clay loam, and the lower part is yellowish brown, firm clay loam. The substratum to a depth of 60 inches is brown loamy sand.

On about 33 percent of the acreage, the surface layer is loam. On 10 percent it is fine sandy loam. In some areas the subsoil is loam. Many areas contain less sand. In some areas the substratum is silty clay loam.

Included with this soil in mapping are three higher, wind-reworked areas similar to Wheeling soils. Also included are a few narrow areas less than 75 feet wide of Sciotoville soils.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate. Surface runoff is slow. Reaction is neutral or slightly acid in most cultivated areas. It is generally strongly acid in unlimed areas. The surface layer is friable and can be easily tilled throughout a wide range of moisture content. Root development is good.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. Some areas are in hay or pasture, and a few remain in woodland. Many areas are used for building site development.

This soil is well suited to corn, soybeans, and small grain. Crop residue and cover crops help maintain tilth and the organic matter content.

This soil is well suited to hay or pasture. Overgrazing or grazing when the soil is too wet results in surface compaction, surface runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering use of this soil are the moderate frost action potential, rapid permeability of the substratum, and fair compaction characteristics.

Limitations are slight for building sites. They are moderate for local roads and streets because of the moderate frost action potential and low strength. The base material needs to be strengthened with more suitable material. Good drainage ditches are needed. Limitations are also moderate for septic tank absorption fields because of wetness. There may be some seepage of leachates into ground water supplies. Capability class I; woodland subclass 1o.

WhB2—Wheeling silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on broad, convex swells that were beach ridges on terraces along the Ohio River. The terraces are higher in elevation than the adjacent alluvial soils. Areas are long and are generally parallel with the old river channel. They are slightly higher than the adjoining soils on terraces. They are dominantly about 7 acres but range from 3 to 15 acres.

In a typical profile the surface layer is brown silt loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown and strong brown, firm silt loam or silty clay loam, and the lower part is yellowish brown, firm clay loam. The substratum to a depth of 60 inches is brown loam.

On about 25 percent of the acreage, the surface layer is loam. On 15 percent it is fine sandy loam. In some areas the subsoil is loam and sandy clay loam. Many areas contain less very fine sand.

Included with this soil in mapping are areas of Wheeling soils on slopes of 6 to 18 percent, which are long, escarpmentlike breaks 10 to 80 feet wide. Also included are areas where the substratum is silty clay loam, a few areas of steeper Woodmere soils, and a few areas less than 75 feet wide of Sciotoville soils that have slopes of 1 to 6 percent.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate. Surface runoff is medium. Reaction is neutral or slightly acid in most cultivated areas. It is generally strongly acid in unlimed areas. The surface layer is friable and can be easily tilled throughout a wide range of moisture content. Root development is good.

Most of the acreage is farmed. Many areas, however, are used as building sites. Many are in corn, soybeans, and small grain. Some are in hay or pasture, and a few are in woodland.

This soil is very well suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and runoff in cultivated areas. Crop rotation, minimum tillage, terraces, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Crop residue and cover crops also help in maintaining tilth and the organic matter content.

This soil is well suited to hay or pasture. Keeping this soil in grasses and legumes for hay or pasture is effective in controlling water erosion. Overgrazing or grazing when the soil is wet results in surface compaction, surface runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the moderate frost action potential, rapid permeability of the substratum, and fair compaction characteristics.

Limitations are slight for building sites. Limitations are moderate for local roads and streets because of the moderate frost action potential and low strength. The base material for roads should be strengthened with more suitable material. Leachates from septic tank absorption fields can enter ground water supplies. Capability subclass IIe; woodland subclass 1o.

Wm—Wilbur silt loam. This nearly level, deep, moderately well drained soil is on broad, very slight swells of the flood plains. Areas are long and narrow and are dominantly those nearest the stream channel. They are dominantly about 15 acres but range from 3 to 60 acres.

In a typical profile the surface layer is dark brown silt loam about 10 inches thick. The substratum between 10 and 44 inches is dark brown and brown, friable, medium acid silt loam. It is mottled in the lower part. To a depth of 60 inches, it is gray, mottled silt loam.

In a few areas this soil is not mottled. In some areas the subhorizons are strongly acid. In a few areas the soil is slightly more clayey throughout.

Included with this soil in mapping are areas less than 75 feet wide of Wakeland soils in drainageways. Also included are small areas of Zipp, Evansville, or Patton soils that are covered with 20 to 40 inches of alluvial material. The alluvium does not affect the use of the soil for crops.

Available water capacity is very high, and permeability is moderate. The organic matter content is moderate. Surface runoff is slow. This soil has a seasonal high water table at a depth of 3 to 6 feet. It is subject to frequent flooding. Flooding lasts only a few hours except along major streams where it can last for as long as 5 or 6 days. Reaction in the surface layer is neutral to medium acid. The surface layer is friable, has good tilth, and can be easily tilled throughout a fairly wide range of moisture content. Root development is good.

Most of the acreage is farmed. Most areas are used for corn, soybeans, and small grain. A few are in hay or pasture, and a few are in woodland.

If protected from flooding, this soil is well suited to corn, soybeans, and small grain. Flooding is a major hazard. Levees are needed. Most flooding is for less than a day and does not permanently damage most crops. Conservation practices, such as minimum tillage, use of crop residue, and green manure crops, help maintain and improve the organic matter content and tilth.

This soil is suited to grasses and legumes for hay and pasture. If protected from flooding, it is well suited to grasses and legumes. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and a few areas are in hardwoods. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect engineering are the high frost action potential and poor compaction characteristics. This soil is subject to frequent flooding.

Limitations are severe for building sites and septic tank absorption fields because of flooding. They are severe for local roads and streets because of the high frost action potential and flooding.

If this soil is used as a building site, levees to protect it from flooding and adequate subsurface drainage to sufficiently lower the water table are needed. Sewage treatment plants are needed for effluent disposal. Selecting a building site that is not subject to flooding is suggested. Capability class I; woodland subclass 1o.

Wo—Woodmere silty clay loam. This nearly level, deep, well drained soil occupies broad swells and swales on the ripplelike, nearly level flood plain. Areas are narrow and long. They are dominantly about 20 acres but range from 5 to 80 acres.

In a typical profile the surface layer is dark brown, silty clay loam about 10 inches thick. The subsoil is about 66 inches thick. The upper part is dark brown, firm, neutral silty clay loam; the next part is brown and yellowish brown, firm, very strongly acid silty clay loam and silty clay; and the lower part is brown, firm, very strongly acid silty clay loam. The substratum to a depth of 84 inches is brown, strongly acid light silty clay loam. In some areas gray mottles are at a depth of 30 inches or more.

Included with this soil in mapping are small narrow areas less than 50 feet wide of Huntington and Newark soils.

Available water capacity is high, and permeability is moderately slow. The organic matter content is moderate. Surface runoff is slow. This soil is flooded annually during winter and spring for a period of 4 to 14 days. Reaction in the surface layer is neutral. The surface layer is friable, has good tilth, and can be easily tilled throughout a wide range of moisture content. Root development is good.

Most of the acreage is farmed. Most areas are used for corn and soybeans. Only a few areas are woodland.

This soil is well suited to corn and soybeans. If protected from flooding in winter and spring, it is suited to small grain. Flooding is a major hazard. Levees are needed. Conservation practices, such as minimum tillage, use of crop residue, and green manure crops, help to maintain and improve the organic matter content and tilth.

Unless protected from flooding, this soil is poorly suited to grasses and legumes for hay and pasture. If protected, it is well suited. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

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

Soil features that affect the engineering use of this soil are low strength, shrinking and swelling, frost action potential, and moderately slow permeability. The soil is subject to frequent flooding.

Limitations are severe for building sites and septic tank absorption fields because of flooding. Also, they are severe for building sites because of low strength and shrinking and swelling. They are severe for local roads and streets because of frost action, flooding, and low strength.

If this soil is used as a building site, levees must be built to prevent flooding. Selecting an alternate site that is not subject to flooding is suggested. Capability class I; woodland subclass 1o.

ZaB2—Zanesville silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on narrow convex ridgetops and side slopes on the uplands. It has a fragipan. Areas are long and irregular. They are dominantly about 12 acres but range from 3 to 80 acres.

In a typical profile the surface layer is dark brown silt loam about 7 inches thick. The subsoil is about 52 inches thick. The upper part is strong brown, firm silty clay loam and heavy silt loam; the middle part is a brown, very firm, brittle heavy silt loam fragipan; and the lower part is yellowish brown, friable loam. The substratum from a depth of 59 to 68 inches is yellowish brown loam. Siltstone and sandstone are below.

In some areas the fragipan is at a depth of 33 to 36 inches, and in some it is mottled. In some areas bedrock is below a depth of 80 inches.

Included with this soil in mapping are a few areas of Tilsit soils, a few areas of Zanesville soils where slopes are 0 to 2 percent, and a few areas each less than 2 acres of more severely eroded Zanesville soils. Also included are areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is slow. The organic matter content is moderate. Surface runoff is medium in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. The soil has a slowly permeable fragipan at a depth of about 27 to 33 inches. The pan restricts the depth to which roots and air penetrate. The water table is perched above the fragipan early in spring for a short time. Thus, the soil is wet in spring. It tends to be droughty late in summer. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content.

Most of the acreage is farmed. Many areas are used for corn, soybeans, and small grain. Some are used for hay or pasture, and a few are in woodland.

This soil is well suited to corn, soybeans, and small grain. The slowly permeable fragipan is a major limitation, and erosion is a major hazard. Conservation practices are needed to control erosion and runoff in cultivated areas. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Crop residue and cover crops also help to control erosion and to improve and maintain tilth and the organic matter content.

Keeping this soil in grasses and legumes for hay or pasture is effective in controlling water erosion. This soil is poorly suited to deep rooted legumes, such as alfalfa, because the slowly permeable fragipan restricts downward movement of roots and air. Overgrazing and grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees, but only a few areas remain in woodland. Much abandoned farmland has naturally revegetated to hardwoods. The equipment limitation is slight. The hazard of windthrow is moderate, and plant competition is slight. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

Soil features that affect the engineering use of this soil are the high frost action potential, slow permeability in the fragipan, and depth to bedrock.

Limitations are severe for building sites because of wetness. They are severe for local roads and streets because of frost action. Good drainage ditches are needed. Limitations are severe for septic tank absorption fields because of slow permeability.

If this soil is used as a building site, subsurface drainage adjacent to the uphill side of the building can cut off seepage on the fragipan. Septic tank filter fields function poorly. Larger fields or sewage treatment plants are needed. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. In places bedrock has to be removed. Capability subclass IIe; woodland subclass 3o.

ZaC—Zanesville silt loam, 6 to 12 percent slopes. This sloping, deep, well drained soil is on side slopes on the uplands. Areas are long and narrow and irregular. They are dominantly about 10 acres but range from 3 to 12 acres.

In a typical profile the surface layer is dark grayish brown silt loam about 3 inches thick. The subsurface layer is yellowish brown silt loam about 6 inches thick. The subsoil is about 46 inches thick. In sequence downward it is strong brown, firm silt loam and silty clay loam; a brown, very firm, brittle silt loam and loam fragipan; and yellowish brown, friable loam. The substratum to a depth of 60 inches is yellowish brown loam. Siltstone and sandstone are below. In a few plowed areas the surface layer is brown.

Included with this soil in mapping are a few areas less than 2 acres of severely eroded Zanesville soil; small areas less than 20 feet wide of Johnsburg and Tilsit soils that have a dark grayish brown or dark gray surface layer; and a few areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is slow. The organic matter content is moderate or low because part of the original surface layer has been removed by erosion. Surface runoff is rapid in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. The slowly permeable fragipan at a depth of about 27 to 32 inches restricts the depth to which roots and air penetrate. The water table is perched above the fragipan early in spring for short periods. Thus, the soil is wet in spring. It tends to be droughty late in summer. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content.

Some of the acreage is farmed. Some areas are used for corn, soybeans, and small grain. Some are used for hay or pasture. Most areas are in woodland.

This soil is suited to corn, soybeans, and small grain. The slowly permeable fragipan is a major limitation, and erosion is a major hazard. The hazard of erosion is severe in cultivated areas. To control erosion and reduce runoff in cultivated areas, conservation practices are needed. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures are needed to prevent excessive soil loss. Crop residue and cover crops reduce runoff and control erosion. They also help in maintaining tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture, which is effective in controlling water erosion. This soil is poorly suited to deep rooted legumes, such as alfalfa, because the slowly permeable fragipan restricts downward movement of roots and air. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods keep the pasture or hay and the soil in good condition.

This soil is suited to trees, and most areas remain in woodland. The equipment limitation is slight. The hazard of windthrow is moderate, and plant competition is slight. Seedlings survive and grow well when competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, slow permeability in the fragipan, the slope, and the depth to bedrock.

Limitations are severe for building sites because of wetness. They are severe for local roads and streets because of frost action. Good drainage ditches are needed. Limitations are severe for septic tank absorption fields because of slow permeability.

If this soil is used as a building site, subsurface drainage adjacent to the uphill side of the building can cut off seepage on the fragipan. Septic tank filter fields function poorly. Larger fields or sewage treatment plants are needed. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Bedrock has to be removed in places. Capability subclass IIIe; woodland subclass 3o.

ZaC3—Zanesville silt loam, 6 to 12 percent slopes, severely eroded. This sloping, deep, well drained soil is on side slopes on the uplands. It has a fragipan. Areas are long and narrow and irregular. They are dominantly about 10 acres but range from 3 to 12 acres.

In a typical profile the surface layer is yellowish brown silt loam about 7 inches thick. The subsoil is about 32 inches thick. In sequence downward it is strong brown, firm and very firm silt loam or silty clay loam; a brown, very firm, brittle silt loam and loam fragipan; and yellowish brown, friable loam. The substratum from 39 to 45 inches is yellowish brown loam. Siltstone and sandstone are below.

In many areas the brittle layer is at a depth of about 17 to 23 inches, and in some areas the fragipan is poorly expressed.

Included with this soil in mapping are areas of Johnsburg and Tilsit soils on toe slopes, which are a few feet wide, and some areas of Wellston soils where slopes are 10 to 15 percent. Also included are a few areas in which gullies are as much as 4 feet deep; small areas of Zanesville soils that have a thin alluvium deposit; and small areas less than 50 feet wide in drainageways of wetter soils that formed in alluvium.

Available water capacity is moderate, and permeability is slow. The organic matter content is low because part of the original surface layer has been removed by erosion. Surface runoff is rapid. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. The slowly permeable fragipan at a depth of about 23 to 25 inches restricts the depth to which roots and air penetrate. The water table is perched above the fragipan for short periods early in spring. Thus, the soil is wet in spring. It tends to be droughty late in spring. The surface layer is friable. Tilling within the proper range of moisture content reduces soil compaction and the tendency to clod.

Some of the acreage is farmed. Some areas are used for corn, soybeans, and small grain, and some are used for hay or pasture (fig. 12). A few areas are woodland.

This soil is poorly suited to corn, soybeans, and small grain, because the hazard of further loss through erosion is very severe. The slowly permeable fragipan is a major limitation, and erosion is a major hazard. The conservation practices needed to control erosion, reduce runoff, and prevent excessive soil loss are crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures. Crop residue and cover crops help to reduce runoff and control erosion. They also help in maintaining tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. This use is effective in controlling water erosion. This soil is poorly suited to deep rooted legumes, such as alfalfa, because the slowly permeable fragipan restricts downward movement of roots and air. Overgrazing and grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, additions of lime and fertilizer according to the results of soil tests and plant needs, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Most areas were abandoned cropland, which naturally revegetated to hardwoods. Some areas remain in woodland. The hazard of windthrow and plant competition is slight. Seedlings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, slow permeability in the fragipan, the slope, and depth to bedrock.

Limitations are severe for building sites because of wetness. They are severe for local roads and streets because of frost action. Good drainage ditches are needed. Limitations are severe for septic tank absorption fields because of slow permeability.

If this soil is used as a building site, subsurface drainage adjacent to the uphill side of the building can cut off seepage on the fragipan. Septic tank filter fields function poorly. Larger fields or sewage treatment plants are needed. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. Bedrock has to be removed in some areas. Capability subclass IVe; woodland subclass 3o.

ZaD—Zanesville silt loam, 12 to 18 percent slopes. This sloping, deep, well drained soil is on narrow side slopes on the uplands. It has a fragipan. Areas are long, narrow, and irregular. They are dominantly about 8 acres but range from 2 to 14 acres.

In a typical profile the surface layer is dark grayish brown silt loam about 3 inches thick. The subsurface layer is yellowish brown silt loam about 4 inches thick. The subsoil is about 38 inches thick. The upper part is strong brown, firm silt loam and silty clay loam; the middle part is a brown, very firm, brittle loam and silt loam fragipan; and the lower part is yellowish brown, friable loam. The substratum to a depth of 50 inches is yellowish brown loam. Siltstone and sandstone are below.

In a few areas the entire fragipan is loam. In plowed areas the surface layer is yellowish brown or brown and is about 7 inches thick.

Included with this soil in mapping are small areas of Wellston soils, small areas of Tilsit and Johnsburg soils at the base of 1 to 6 percent slopes, and a few areas of gullies that are as much as 4 feet deep.

Available water capacity is moderate, and permeability is slow. The organic matter content is typically moderate. In cultivated areas it is low because part of the original surface layer has been removed by erosion. Surface runoff is typically rapid. In cultivated areas it is very rapid. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. The slowly permeable fragipan at a depth of about 23 to 29 inches restricts the depth to which roots and air penetrate. The soil is wet in spring and tends to be droughty late in summer. The surface layer is friable and can be easily tilled throughout a fairly wide range of moisture content.

Some of the acreage is farmed. Some areas are used for corn, soybeans, and small grain. Some are in hay or pasture. Most of the acreage is woodland.

This soil is very poorly suited to corn, soybeans, and small grain. Most row crops and small grain are grown so that stands of grasses and legumes can be reestablished. The slowly permeable fragipan is a major limitation, and erosion is a major hazard. If this soil is cultivated, the hazard of erosion is severe. Conservation practices are needed to control erosion and runoff. Minimum tillage, diversions, and grassed waterways help to prevent excessive soil losses. Crop residue and cover crops help to reduce runoff and control erosion. They also help in maintaining tilth and the organic matter content.

This soil is suited to grasses and legumes for hay or pasture, and this use is effective in controlling water erosion. This soil is poorly suited to deep rooted legumes, such as alfalfa, because the slowly permeable fragipan restricts downward movement of roots. Overgrazing and grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, or restricted use during wet periods keep the pasture and the soil in good condition.

The soil is suited to trees, and most areas remain in woodland. The equipment limitation is moderate. The hazard of windthrow is moderate, and plant competition is slight. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, slow permeability in the fragipan, the slope, and depth to bedrock.

Limitations are severe for building sites because of the slope and wetness. They are severe for local roads and streets because of the slope and frost action. Good drainage ditches are needed. Limitations are severe for septic tank absorption fields because of slow permeability.

If this soil is used as a building site, subsurface drainage adjacent to the uphill side of the building can cut off seepage on the fragipan. Septic tank filter fields function poorly. Larger fields or sewage treatment plants are needed. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. In some places bedrock has to be removed. Capability subclass IVe; woodland subclass 3r.

ZaD3—Zanesville silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on narrow side slopes on the uplands. Areas are long and irregular. They are dominantly about 7 acres but range from 3 to 10 acres.

In a typical profile the surface layer is yellowish brown silt loam about 7 inches thick. The subsoil is about 29 inches thick. The upper part is strong brown, firm silty clay loam and silt loam; the middle part is a brown, very firm, brittle loam fragipan; and the lower part is yellowish brown, friable loam. The substratum to a depth of 44 inches is yellowish brown loam. Siltstone and sandstone are below. The fragipan is at a depth of 23 to 24 inches.

In many areas the brittle layer is at a depth of about 7 to 23 inches. In places the fragipan is poorly expressed.

Included with this soil in mapping are small areas of Johnsburg and Tilsit soils on toe slopes of 1 to 6 percent. Also included are some small areas of Wellston soils and a few areas in which gullies are as much as 5 feet deep.

Available water capacity is moderate, and permeability is slow. The organic matter content is low because part of the original surface layer has been removed by erosion. Surface runoff is very rapid in cultivated areas. Reaction in the surface layer varies widely as a result of local liming practices. It is generally strongly acid in unlimed areas. The slowly permeable fragipan at a depth of about 23 inches and the brittle subsoil at a depth of 3 to 7 inches restrict the depth to which roots and air penetrate. This soil is wet in spring and tends to be droughty late in summer. The surface layer is friable. Tilling within the proper range of moisture content reduces soil compaction and the tendency to clod.

Some of the acreage is farmed. A few areas are used for corn, soybeans, and small grain. A few are in woodland. Most of the acreage is in hay or pasture.

This soil is poorly suited to corn, soybeans, and small grain because the hazard of further loss through erosion is very severe. Because each area is narrow, it is farmed with the adjoining soils on uplands. It is occasionally used for small grain, corn, or soybeans to reestablish grasses and legumes. The slowly permeable fragipan is a major limitation, and erosion is a major hazard. This soil is wet in spring and tends to be droughty late in summer. Conservation practices, such as minimum tillage and the return of crop residue, are needed to prevent excessive soil loss. Crop rotations that include grass most of the time are most effective in reducing surface runoff and controlling erosion. They also help in maintaining tilth and the organic matter content.

This soil is suited to grasses and legumes for hay or pasture. This use is effective in controlling water erosion. This soil is very poorly suited to deep rooted legumes, such as alfalfa, because the slowly permeable fragipan restricts downward movement of roots. Overgrazing and grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, additions of lime and fertilizer according to soil test results and plant needs, timely deferment of grazing, or restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Most areas are abandoned cropland, but some remain in woodland. The equipment limitation is moderate. The hazard of windthrow is moderate, and plant competition is slight. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Other management includes excluding livestock, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are the high frost action potential, slow permeability in the fragipan, the slope, and depth to bedrock.

Limitations are severe for building sites because of the slope and wetness. They are severe for local roads and streets because of the slope and frost action. Good drainage ditches are needed. Limitations are severe for septic tank absorption fields because of slow permeability.

If this soil is used as a building site, subsurface drainage adjacent to the uphill side of the building can cut off seepage on the fragipan. Septic tank filter fields function poorly. Larger fields or sewage treatment plants are needed. Diversion terraces and grassed waterways between lots reduce the erosion hazard. Care should be taken so that the soil is disturbed as little as possible during construction. Topsoil should be stockpiled and replaced as soon as possible after construction, and grass should be planted. When large areas are developed at once, soil erosion becomes a serious problem. Development of random lots is preferable. Sediment-settling basins can control silting. In places bedrock has to be removed. Capability subclass VIe; woodland subclass 3r.

Zp—Zipp silty clay loam. This nearly level, deep, very poorly drained soil is on broad flats or very slightly concave terraces. Areas are very large, very broad, long, and irregular. They are dominantly about 2,000 acres but range from 50 to 5,000 acres.

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

In many areas the surface layer is silty clay. In some areas 10 to 20 inches of recent alluvium is on the surface. In some the surface layer is very dark gray.

Included with this soil in mapping are a few small dome-shaped areas of McGary soils.

Available water capacity is moderate, and permeability is slow. The organic matter content is moderate. Surface runoff is very slow, and in some areas is ponded (fig. 13, top). This soil has a high water table that is at a depth of 0 to 1 foot during a considerable part of the year. Reaction in the surface layer is usually neutral. The surface layer has a high percentage of clay and tends to clod (fig. 13, bottom) unless it is tilled within only a narrow range of moisture content. Rooting depth is restricted by the high water table. Artificial drainage is needed for optimum growth of crops.

Most of the acreage is farmed. Most areas are used for corn, soybeans, and small grain. Only a few areas are in hay and pasture and woodland.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Drainage has been installed on nearly all the acreage. Wetness is the major limitation on this clayey soil. With proper drainage, a conservation cropping system that includes row crops most of the time can be used. Other conservation practices, such as minimum tillage, crop residue, and green manure crops, help to maintain and improve the organic matter content and tilth.

This soil is well suited to grasses and legumes for hay and pasture but is poorly suited to deep rooted legumes, such as alfalfa. Drainage is necessary for high yields. Only a small acreage is used as pasture because grazing under wet conditions results in surface compaction and poor tilth. Proper stocking rates, pasture rotations, and restricted use when the soil is wet help to keep the pasture and the soil in good condition.

This soil is suited to trees, but only a few scattered areas are in woodland. The equipment limitation is severe. Plant competition, seedling mortality, and the hazard of windthrow are severe. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Additional management includes excluding wildlife, harvesting mature trees, and saving desired seed trees.

Soil features that affect the engineering use of this soil are a seasonal high water table, fair to poor stability and compaction characteristics, high shrink-swell potential, a high clay content, and slow permeability.

Limitations are severe for building sites because of a high water table, high shrink-swell potential, and flooding. They are severe for local roads and streets because of high shrink-swell potential, wetness, and low strength. The base material needs to be strengthened. Limitations are severe for septic tank absorption fields because of wetness or flooding. Slow permeability and a high clay content also cause severe limitations.

The high water table can be lowered if an adequate drainage system is installed. If this soil is used as a building site, adequate subsurface and surface drainage to sufficiently lower the water table is needed. Care should be taken to maintain a constant moisture content to reduce shrinking and swelling. Larger septic tank absorption fields or sewage treatment plants are needed. Capability subclass IIIw; woodland subclass 2w.

Use and management of the soils

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

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

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

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

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

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

Crops and pasture

RUSSEL MCCORMICK, extension agent, county extension coordinator, helped prepare this section.

The pages that follow describe major management concerns in using the soil for crops and pasture. They provide information on the crops and pasture plants best suited to the soil, including some not commonly grown in the survey area; explain the system of land capability classification used by the Soil Conservation Service; and list the predicted yields of the main crops, hay, and pasture.

This part of the survey also provides information on the overall agricultural potential and on needed practices for those in the agri-business sector—equipment dealers, drainage contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information on management is presented under the heading "Soil maps for detailed planning." In planning management systems for individual fields or farms, check the detailed information in the description of each soil.

More than 114,000 of the 250,240 acres in Warrick County was in crops and pasture in 1967, according to the Conservation Needs Inventory (*3*). Of this, 60,380 acres was row crops; 12,500 acres, close grown crops; 15,000 acres, rotational hay and pasture; and 16,030 acres, permanent pasture. In 1973, about 31,600 acres of corn produced an average of more than 86 bushels per acre and 30,700 acres of soybeans produced an average of more than 22 bushels per acre. In a normal year 4 years earlier, yields were 95 bushels per acre of corn and 34 bushels per acre of soybeans. Each crop produced about one quarter of the total farm income.

Almost all of the acreage in close grown crops is in soft red winter wheat. A few acres are in grain sorghum, barley, and winter oats. In 1973, the winter wheat yield was 29 bushels per acre. Four years earlier, it was 38 bushels per acre. Double-cropped soybeans in wheat stubble produce one-half to two-thirds the yield of full-season soybeans. The hay yield was 1.6 tons per acre in 1969 and 2.0 tons per acre in 1973. It is expected to be 2.4 tons per acre in 1980 and 2.65 tons per acre in 1985 (*3*).

The potential of soils in Warrick County for increased production of food is good. Production on the better soils, generally in the southwestern part of the county, will continue to increase as technology and crop varieties improve. Production on the poorer soils, generally in the northeastern part, will increase more slowly. Land is being taken out of food production for urban expansion in the Newburgh, Chandler, and Boonville area and for surface mining of coal in the uplands throughout the county. Surface mine lands are being returned to pasture and cropland. The potential is good for hayland and pasture. Many erodible areas in clean tilled row crops would be better used as fescue pasture. No-till planting of row crops is a major method of using erodible soils while keeping soil loss within tolerable limits. The use of double-crop no-till winter wheat and soybeans provides cover to reduce erosion. Double cropping after hay and wheat is profitable in most years. If the soil is too dry, the second crop should not be planted.

There will be a small increase in the acreage farmed if surface mined areas are returned to pasture and grain crops. Information in this survey can help land use decisions that will influence the future role of farming in the county. Refer to the section "General soil map for broad land use planning."

Soil erosion is a major hazard on about 45 percent of the cropland, hayland, and pasture, where slopes are more than 2 percent. These areas are the Alford, Gilpin, Hosmer, Markland, Muren, Pekin, Sciotoville, Tilsit, Uniontown, Wellston, Wheeling, and Zanesville soils and Orthents.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the plow layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging to soils that have a clayey subsoil, such as Markland soils; to soils that have a fragipan, which limits the depth of root penetration, such as Hosmer, Pekin, Sciotoville, Tilsit and Zanesville soils; and to soils that are shallower to bedrock, such as the Gilpin and Wellston soils. Second, soil erosion plugs ditches, streams, and rivers and spreads sediment on the flood plains. Erosion control minimizes the pollution of streams and rivers by sediment and chemicals, thus improving water quality for drinking, industry, recreation, and aquatic life.

Severely eroded soils are more difficult to till and have poorer seed germination and plant growth than less eroded soils. The fragipan or an altered fragipan layer is near the plow layer in many severely eroded areas of Hosmer and Zanesville soils.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. Vegetative cover on the soil controls losses of soil through erosion. Grasses and legumes for hay and pasture reduce almost all erosion and provide improved tilth and nitrogen from the legumes. No-till planted row crops in hay or pasture or in wheat stubble or corn fodder reduce soil loss through erosion to a tolerable level on many sloping soils that would be severely damaged by clean tillage.

There are some narrow steeper slopes on which farming is impractical. These areas are better suited to permanent grass. Markland soils are an example of such areas.

Minimum tillage is beneficial for all soils. Leaving crop residue on the surface helps to increase infiltration, improve tilth, and reduce the hazard of erosion. On wet soils, minimum tillage includes chisel plowing, no-till planting of soybeans in wheat stubble, and working the seedbed fewer times. In well drained and moderately well drained areas the soils are sloping and erosion is a hazard. Minimum tillage in these areas includes no-till planting of corn or soybeans in wheat stubble and chisel plowing on the contour.

Terraces and diversions shorten the length of slopes and thus reduce surface runoff and erosion. They are effective on most soils that could be grain cropped occasionally. On the Hosmer, Tilsit, and Zanesville soils, which have a fragipan, it is best to rip the fragipan in those areas where cuts have been made during construction and add lime and fertilizer. These soils may be seepy on the fragipan when they are wet.

Although contour tillage is effective in erosion control, it is seldom used.

Grassed waterways are used to restrict meandering runoff to a channel and filter out sediment. These areas, which are usually wetter than the surrounding soils, are generally less than 40 feet wide. They impede tillage.

Information on erosion control practices is available at the local Soil Conservation Service office.

Soil drainage is the major management limitation on about 48 percent of the cropland, hayland, and pasture in Warrick County. These areas are the Bartle, Birds, Bonnie, Evansville, Henshaw, Iva, Johnsburg, McGary, Newark, Peoga, Stendal, Wakeland, Weinbach, and Zipp soils. The clayey subsoil of the McGary and Zipp soils restricts permeability in the subsoil. The fragipan in the Bartle and Johnsburg soils restricts permeability, and surface drainage is the only practical method of water removal. Flooding is an additional hazard on the Birds, Bonnie, Newark, Stendal, and Wakeland soils. It is a hazard on the well drained and moderately well drained Huntington, Steff, Wilbur, and Woodmere soils also.

The design of surface and subsurface drainage systems varies with the kind of soil. It depends on permeability, lateral movement, and availability of an outlet.

Soil fertility is basically low except in the soils of the Ohio River flood plain and in the poorly drained and very poorly drained soils of the lake plains. The flood plain soils are Huntington, Newark, and Woodmere soils, and the lake plain soils are Evansville, Patton, and Zipp soils. These soils do not require liming; however, fertilizers should be applied to all soils in the county for maximum yields. On all soils the addition of fertilizer and lime should be based on the results of soil tests, crop needs, and expected yields. Purdue University Experiment Station can help determine fertilizer and lime needs.

Soil tilth is an important factor in seed germination and surface water infiltration. In areas of poor tilth, poor germination and uneven stands are common. Generally, tilth is poor or fair. In severely eroded areas it is poor. Structure is destroyed by mismanagement, such as plowing when the soil is too wet. Puddling at the surface produces a crust, which is nearly impermeable and which increases surface runoff. Incorporating crop residue and manure into the surface layer improves tilth.

Fall plowing on the clayey Zipp soil improves structure. This soil is wet in spring, and if plowed wet it becomes cloddy when dry. The upland soils, the soils on stream flood plains, and the somewhat poorly drained to well drained soils on terrace plains are very silty. These soils puddle, flow, and pack so that structure is destroyed. They have to be replowed in spring.

Field crops suited to the soils and climate include many that are not currently grown in the county. The main grain crops are corn, soybeans, and soft red winter wheat.

Minor grain crops include grain sorghum, barley, winter oats, rye, and buckwheat. They are grown as feed for livestock. White corn and popcorn are raised as specialty crops.

The main grasses are fescue, orchardgrass, ryegrass, bromegrass, timothy, and bluegrass. The main legumes are red clover and lespedeza, and there are small areas of alfalfa and sweetclover for dairy cattle hay.

Specialty crops include 10 acres of burley and dark tobacco and 120 acres of apple and peach orchards. Some nursery stock farms are in the county. Tobacco is grown on the Hosmer soils. If restrictions were lifted, the tobacco would be better suited to the Wheeling soils, where it is grown in nearby Spencer County. The acreage of apple and peach orchards could be greatly increased. The well drained Alford soils are suitable. The hazard of frost is common. It is explained under the heading "Climate."

Latest information and suggestions for growing specialty crops are available through the Purdue University Experiment Station or local offices of the Cooperative Extension Service or Soil Conservation Service.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or is not commonly grown on the soil.

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

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

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

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

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

In the capability system, all kinds of soil are grouped at two levels: capability class and subclass. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

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

Woodland management and productivity

MITCHELL G. HASSLER, forester, Soil Conservation Service, assisted in preparing this section.

Table 5 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 5 the soils are also rated for a number of factors to be considered in management. *Slight*, *moderate*, and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

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

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* (fig. 14). 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. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Engineering

MAX L. EVANS, State conservation engineer, Soil Conservation Service, assisted in preparing this section.

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

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

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

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

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

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

The information is presented mainly in tables. Table 6 shows, for each kind of soil, the degree and kind of limitations for building site development; table 7, for sanitary facilities. Table 9 shows the kind of limitations for water management. Table 8 shows the suitability of each kind of soil as a source of construction materials.

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

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

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 6. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

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

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

Dwellings and *small commercial buildings* referred to in table 6 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

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

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

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 7 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

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

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

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

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

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

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

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

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

Unless otherwise stated, the limitations in table 7 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

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

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

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

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 8 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

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

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 12 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

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

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 12.

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

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

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

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

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

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

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 9 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

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

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

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 9 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

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

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

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

Recreation

Warrick County is the eastern part of the rapidly expanding urban industrial area of southwestern Indiana. Many recreational facilities have been established, for example, the Angel Mounds State Park, Scales Lake, Lynnville Park, Yellow Banks, Potaka Fish and Game area, and two golf courses. Other facilities are needed. Most of the soils are suitable for additional facilities.

Surface mined lands are used for the type of recreational facilities where water is required, for example, Scales Lake, Lynnville Park, and Potaka Fish and Game Area. Many ponds, about 1 acre in size, and stripper pits, about 15 acres, provide excellent fishing.

Much abandoned cropland is reverting to hardwoods, broomsedge, and other flora. These areas provide many good primitive camping sites, trails, paths, and picnic areas. A historical trail is the tow path of the Wabash and Erie Canal. Many trails have been reestablished by motorcycles, for example, those on Little and Big Ditney Hills. The ridgetops, which appear as meanders throughout the uplands, are excellent trail sites. The unleveled surface mined lands that have been topped are also used for motorcycle trails.

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

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

The information in table 10 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 7, and interpretations for dwellings without basements and for local roads and streets, given in table 6.

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

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

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

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

Wildlife habitat

JAMES D. MCCALL, wildlife biologist, Soil Conservation Service, helped in preparing this section.

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

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

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

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

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

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

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

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

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

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

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

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

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of 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, deer, and bear.

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

Soil properties

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

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

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

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

Engineering properties

Table 12 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 12 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 12 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

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

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

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 12. Also in table 12 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

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

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

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

Physical and chemical properties

Table 13 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

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

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

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

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

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

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

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

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

Soil and water features

Table 14 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

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

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

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 14 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

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

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

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

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

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*6*). Unless otherwise noted, colors described are for moist soil.

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

Alford series

The Alford series consists of deep, well drained, moderately permeable soils on loess covered uplands. These soils formed in silty loess more than 5 feet deep. Slopes range from 0 to 25 percent.

Alford soils are similar to Hosmer, Wellston, and Wheeling soils and are commonly adjacent to Uniontown soils on the landscape. Hosmer soils have a fragipan at a depth of 25 to 36 inches. Wheeling soils have more sand throughout the solum and formed in alluvium deposited by the Ohio River. The alluvium contains noticeable amounts of very fine mica flakes throughout. Wellston soils have a thinner solum and formed partly in residuum. Uniontown soils have a thinner solum and formed in stratified silt and clay sediments.

Typical pedon of Alford silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 2,320 feet east and 1,140 feet south of northwest corner sec. 6, T. 7 S., R. 8 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

B1—8 to 11 inches; yellowish brown (10YR 5/6) light silty clay loam; moderate medium subangular blocky structure; firm; many very fine pores; few patchy distinct thin brown (10YR 4/3) clay films on faces of peds; slightly acid; clear wavy boundary.

B21t—11 to 16 inches; yellowish brown (10YR 5/6) light silty clay loam; moderate and strong medium subangular blocky structure; firm; many fine and very fine pores; many continuous distinct medium brown (10YR 4/3) clay films on faces of peds; slightly acid; clear wavy boundary.

B22t—16 to 22 inches; strong brown (7.5YR 5/6) light silty clay loam; strong medium subangular blocky structure; firm; common fine and very fine pores; many continuous distinct thin reddish brown (5YR 4/4) and dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B23t—22 to 31 inches; strong brown (7.5YR 5/6) light silty clay loam; moderate coarse subangular blocky structure; firm; common fine and very fine pores; common continuous distinct medium reddish brown (5YR 4/4) and few discontinuous distinct medium dark brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

B24t—31 to 51 inches; strong brown (7.5YR 5/6) light silty clay loam; moderate coarse subangular blocky structure; firm; common very fine pores; common continuous distinct medium reddish brown (5YR 4/3) and few continuous distinct thin dark brown (7.5YR 4/4) and olive brown (2.5Y 3/4) clay films on faces of peds; very strongly acid; gradual wavy boundary.

B3—51 to 60 inches; strong brown (7.5YR 5/6) heavy silt loam; few fine faint pale brown (10YR 6/3) mottles; weak coarse subangular blocky structure; firm; common very fine pores; few discontinuous distinct thin dark brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; gradual wavy boundary.

C—60 to 80 inches; brown (7.5YR 5/4) silt loam; common fine faint pale brown (10YR 6/3) mottles; massive; friable; common very fine pores; strongly acid.

The thickness of the solum ranges from 42 to 60 inches. The thickness of the loess cap ranges from 60 to 360 inches.

The Ap horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2). The A1 horizon, if present, is very dark brown (10YR 3/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). Reaction is strongly acid or very strongly acid unless the soil is limed. An A2 horizon, when present, is brown (10YR 5/3) silt loam that has weak or moderate thin to thick platy structure.

The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 6. It is heavy silt loam or light silty clay loam. Reaction ranges from strongly acid to slightly acid.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silt. Reaction is very strongly acid to neutral.

Bartle series

The Bartle series consists of deep, somewhat poorly drained, slowly permeable soils on old stream terraces. These soils have a fragipan. They formed in silty alluvium. Slopes range from 0 to 1 percent.

Bartle soils are similar to Johnsburg and Weinbach soils and are commonly adjacent to Pekin and Peoga soils on the landscape. Johnsburg soils have a more strongly expressed fragipan and the solum formed in loess and underlying residuum. Weinbach soils have a more strongly expressed fragipan, more sand in the lower part of the solum, and noticeable amounts of very fine mica flakes throughout. They formed in alluvium deposited by the Ohio River. Pekin soils are browner in the upper part of the B2 horizon. Peoga soils are grayer throughout, have low chroma 1 or 2 matrix to a depth of 30 inches or more, and lack a fragipan.

Typical pedon of Bartle silt loam, in a cultivated field, 200 feet west and 1,740 feet south of northeast corner sec. 12, T. 4 S., R. 9 W.

Ap—0 to 9 inches; grayish brown (10YR 5/2) silt loam; moderate medium fine granular structure; friable; neutral; abrupt smooth boundary.

A2—9 to 13 inches; light brownish gray (10YR 6/2) silt loam; many fine distinct pale brown (10YR 6/3) and yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to moderate fine granular; friable; many very fine pores; many fine and very fine dark yellowish brown (10YR 4/4) iron and manganese oxide stains and accumulations; strongly acid; clear wavy boundary.

B1—13 to 18 inches; pale brown (10YR 6/3) silt loam; many fine distinct light brownish gray (2.5Y 6/2) mottles; weak fine subangular structure; friable; many very fine and few fine pores; many fine dark yellowish brown (10YR 4/4) iron and manganese oxide stains and accumulations; strongly acid; clear wavy boundary.

B2t—18 to 29 inches; pale brown (10YR 6/3) heavy silt loam; many fine faint light brownish gray (10YR 6/2) and (2.5Y 6/2) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; very firm; many very fine and fine pores; common discontinuous faint thin gray (10YR 5/1) clay films on faces of prismatic peds and thin distinct dark yellowish brown (10YR 4/4) clay films on faces of subangular blocky peds; many continuous prominent medium light gray (10YR 6/1) silt films on faces of peds; many fine very dark brown (10YR 2/2) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

Bx—29 to 55 inches; light brownish gray (10YR 6/2) heavy silt loam; many fine distinct yellowish brown (10YR 5/6) and pale brown (10YR 6/3) mottles; strong very coarse prismatic structure; very firm; brittle; many very fine discontinuous inped vesicular pores and common fine continuous vertical exped tubular pores; common continuous prominent thin dark gray (10YR 5/1) clay films on faces of peds; common discontinuous thick gray (10YR 6/1) clay films within silt films on faces of prismatic peds; many continuous prominent light gray (10YR 6/1) silt films on faces of prismatic peds and walls of pores; many fine very dark brown (10YR 2/2) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

C—55 to 79 inches; brownish yellow (10YR 6/6) silt loam; common fine distinct light brownish gray (10YR 6/2) mottles; friable; many very fine discontinuous inped vesicular pores; common fine very dark brown (10YR 2/2) iron and manganese oxide accumulations; slightly acid; gradual wavy boundary.

The thickness of the solum ranges from 42 to 60 inches. Depth to the fragipan ranges from 24 to 36 inches.

The Ap horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). Reaction is strongly acid or medium acid unless the soil is limed. An A2 horizon, where present, is gray (10YR 5/1) to light yellowish brown (10YR 6/4) and has weak to moderate thin to thick platy structure.

The B horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 4 and is mottled. It is heavy silt loam or light silty clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 8. It is strongly acid to slightly acid.

Birds series

The Birds series consists of deep, poorly drained, moderately slowly permeable soils on stream flood plains. These soils formed in neutral to medium acid silty alluvium. Slopes range from 0 to 1 percent.

Birds soils are similar to Bonnie and Peoga soils and are commonly adjacent to Wakeland and Wilbur soils on the landscape. Bonnie soils are strongly acid or very strongly acid in the C horizon to a depth of 40 inches. Peoga soils have an argillic horizon and are more acid throughout. Wakeland soils have chroma of 3 or more in one or more subhorizons between the Ap horizon, or a depth of 10 inches, and a depth of 30 inches. Wilbur soils have chroma of 3 or more throughout the upper subhorizons.

Typical pedon of Birds silt loam, in a cultivated field, 680 feet west and 200 feet south of northeast corner sec. 34, T. 5 S., R. 8 W.

Ap—0 to 10 inches; light brownish gray (10YR 6/2) silt loam; weak to weak fine granular structure; friable; neutral; abrupt smooth boundary.

C1g—10 to 18 inches; light gray (10YR 7/1) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak thick platy structure parting to weak fine granular; friable; many very fine pores; neutral; gradual wavy boundary.

C2g—18 to 44 inches; light gray (10YR 7/1) silt loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak thick platy structure parting to weak fine granular; friable; many very fine pores; many very fine dark brown (10YR 4/4) iron and manganese oxide accumulations; neutral; gradual wavy boundary.

C3g—44 to 54 inches; light gray (10YR 7/1) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak thin platy structure; friable; many fine pores; many fine dark brown (10YR 4/4) iron and manganese oxide accumulations; neutral; gradual wavy boundary.

C4g—54 to 80 inches; light gray (10YR 7/1) silt loam; common fine distinct brownish yellow (10YR 6/6) mottles; massive; friable; many very fine pores; many fine and very fine dark brown (10YR 4/4) iron and manganese oxide accumulations; neutral.

The A horizon is gray (10YR 5/1) to light brownish gray (10YR 6/2) and is 3 to 12 inches thick. Reaction is neutral to medium acid unless the soil is limed.

The C horizon to a depth of 30 inches has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1. If mottles are present, chroma is 1 or 2. Mottles of higher chroma and accumulations of iron and manganese oxide range from few to many. Reaction is medium acid to neutral to a depth of 40 inches.

Bonnie series

The Bonnie series consists of deep, poorly drained, slowly permeable soils on flood plains. These soils formed in strongly acid and very strongly acid silty alluvium. Slopes range from 0 to 1 percent.

Bonnie soils are similar to Birds and Peoga soils and are commonly adjacent to Steff and Stendal soils on the landscape. Birds soils are neutral to medium acid in the C horizon to a depth of 40 inches. Peoga soils have an argillic horizon. Steff soils have chroma of 3 throughout the upper subhorizon. Stendal soils have higher chroma in one or more subhorizons between the Ap horizon, or a depth of 10 inches, and a depth of 30 inches.

Typical pedon of Bonnie silt loam, in an abandoned field, 160 feet west and 2,300 feet south of northeast corner sec. 9, T. 5 S., R. 7 W.

Ap—0 to 5 inches; gray (10YR 5/1) silt loam; moderate fine granular structure; friable; many fine yellowish red (5YR 4/6) iron and manganese oxide stains; medium acid; clear smooth boundary.

C1g—5 to 14 inches; gray (10YR 5/1) silt loam; weak very thin platy structure parting to weak fine granular; friable; many very fine discontinuous pores; many fine yellowish red (5YR 4/6) iron and manganese oxide stains; medium acid; gradual wavy boundary.

C2g—14 to 48 inches; light gray (10YR 6/1) silt loam; common fine distinct pale brown (10YR 6/3) and yellowish brown (10YR 5/4) mottles; weak fine granular structure to massive; friable; many very fine discontinuous pores; many fine dark yellowish brown (10YR 4/4) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

C3g—48 to 80 inches; light gray (10YR 6/1) silt loam; massive; firm; many very fine discontinuous pores; strongly acid.

The A horizon is gray (10YR 5/1) to light brownish gray (10YR 6/2) and is 5 to 10 inches thick. Reaction is strongly acid or very strongly acid unless the soil is limed.

The C horizon to a depth of 30 inches has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1. If mottles are present, chroma is 1 or 2. Mottles of higher chroma and accumulations of iron and manganese oxides range from few to many. Reaction is strongly acid or very strongly acid to a depth of 40 inches.

Evansville series

The Evansville series consists of deep, poorly drained, moderately permeable soils on broad, very slightly concave lacustrine terraces. These soils formed in stratified silty and clayey lacustrine sediment. Slopes range from 0 to 1 percent.

Evansville soils are similar to Patton and Zipp soils and are commonly adjacent to Henshaw and Uniontown soils on the landscape. Patton soils have a mollic epipedon. Zipp soils have more clay in the solum and formed in more clayey sediment. Henshaw soils have a lighter colored, less clayey A horizon; an argillic horizon; and a mottled solum that has chroma of 4 to 6. Uniontown soils have browner colors throughout, lack low chroma mottles of 2 or less in the upper part of the solum, and have an argillic B horizon.

Typical pedon of Evansville silt loam, in a cultivated field, 380 feet east and 100 feet north of southwest corner sec. 9, T. 6 S., R. 9 W.

Ap—0 to 10 inches; dark grayish brown (2.5Y 4/2) heavy silt loam; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

B21g—10 to 15 inches; olive gray (5Y 4/2) light silty clay loam; few fine distinct light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; friable; many continuous distinct very thin dark gray (5Y 4/1) pressure films on faces of peds; neutral; clear wavy boundary.

B22g—15 to 42 inches; gray (5Y 5/1) light silty clay loam; common fine distinct light olive brown (2.5Y 5/4 and 5/6) mottles; weak medium prismatic structure parting to moderate and strong subangular and angular blocky; firm; many continuous distinct very thin dark gray (5Y 4/1) pressure films on faces of peds; neutral; gradual wavy boundary.

Cg—42 to 60 inches; gray (5Y 6/1) stratified light silty clay loam; many fine distinct yellowish brown (10YR 5/6), olive gray (5Y 5/2), and olive (5Y 5/3 and 5/4) mottles; massive; firm; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches.

The A horizon is dark grayish brown (2.5Y 4/2 or 10YR 4/2) or dark gray (N 4/0 or 10YR 4/1) heavy silt loam or light silty clay loam. Reaction is neutral or mildly alkaline.

The B2g horizon to a depth of 30 inches has hue of 5Y to 10YR, value of 4 or 5, and chroma of 0 to 2. Below a depth of 30 inches, the Bg horizon has value of 6 and chroma of 3 and 4. It is heavy silt loam to silty clay loam. Reaction is neutral or mildly alkaline. Average clay content is 25 to 35 percent.

The C horizon has hue of 5Y to 10YR, value of 4 to 7, and chroma of 0 to 6 and is mottled. It is stratified silt loam and silty clay loam. Reaction is neutral to moderately alkaline.

Gilpin series

The Gilpin series consists of moderately deep, well drained, moderately permeable soils on loess covered uplands. These soils formed in a very thin layer of silty loess and underlying residuum weathered from siltstone, shale, and sandstone. Slopes range from 12 to 35 percent.

Gilpin soils are similar to Alford, Markland, Uniontown, Wellston, and Wheeling soils. Alford soils have a thicker solum and formed in loess. Markland and Uniontown soils have more clay and less sand in the argillic horizon and formed in stratified silt and clay sediment. Wellston soils have a thicker argillic horizon (more than 18 inches thick), a thicker solum, and are deeper to bedrock. Wheeling soils have a thicker solum and formed in alluvium deposited by the Ohio River. The alluvium contains noticeable amounts of very fine mica flakes throughout.

Typical pedon of Gilpin silt loam, 25 to 35 percent slopes, in woods, 820 feet east and 470 feet south of northwest corner sec. 25, T. 4 S., R. 7 W.

A1—0 to 3 inches; dark brown (10YR 3/3) silt loam; moderate fine granular structure; friable; 5 percent shale fragments, 1 inch or less in length; very strongly acid; abrupt smooth boundary.

A2—3 to 6 inches; pale brown (10YR 6/3) silt loam; moderate thin platy structure parting to moderate fine granular; friable; 5 percent shale fragments, 1 inch or less in length; very strongly acid; abrupt smooth boundary.

B1—6 to 9 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; firm; 5 percent shale fragments; strongly acid; abrupt smooth boundary.

B21t—9 to 15 inches; yellowish brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; firm; common continuous prominent thin dark brown (7.5YR 4/4) clay films on faces of peds; 5 percent shale fragments; strongly acid; clear wavy boundary.

B22t—15 to 22 inches; strong brown (7.5YR 5/6) shaly heavy silt loam; common fine distinct pale olive (5Y 6/3) mottles on weathering fragment surfaces; moderate medium subangular blocky structure; firm; many continuous distinct thin brown (7.5YR 4/4 and 5/4) clay films on faces of peds; 20 percent shale fragments, 1 inch or less in length; strongly acid; clear wavy boundary.

B3—22 to 25 inches; strong brown (7.5YR 5/6) very shaly heavy silt loam; weak thin platy structure parting to weak fine subangular blocky; friable; 50 percent shale fragments; strongly acid; gradual wavy boundary.

C—25 to 29 inches; strong brown (7.5YR 5/6) very shaly light silty clay loam; many fine distinct pale olive (5Y 6/3) mottles on weathering surfaces; weak thin platy structure; friable; common discontinuous distinct thin and medium brown (7.5YR 4/4) clay films on weathering surfaces; 50 percent shale fragments, 2 inches or less in length; strongly acid; gradual wavy boundary.

R—29 to 60 inches; stratified sandstone, siltstone, and shale.

Thickness of the solum ranges from 20 to 36 inches. Rippable siltstone, sandstone, and shale bedrock is within 40 inches. The thickness of the loess cap is less than 12 inches.

The A1 horizon is very dark grayish brown (10YR 3/2) to dark yellowish brown (10YR 3/4) silt loam and is 2 to 5 inches thick. Reaction is very strongly acid or strongly acid unless the soil is limed. The A2 horizon is pale brown (10YR 6/3) to yellowish brown (10YR 5/4) and has weak to moderate fine granular structure. Shale, sandstone, and siltstone fragments make up less than 20 percent of the A horizon.

The B horizon has hue of 7.5Y or 10YR, value of 5, and chroma of 4 to 8. Also, some subhorizons are light olive brown (2.5Y 5/4). The B horizon is loam, silt loam, or light silty clay loam. Reaction is strongly acid to extremely acid. Shale, siltstone, or sandstone fragments make up 0 to 50 percent of the B horizon.

The C horizon has hue of 7.5YR to 2.5Y, value of 5 or 6, and chroma of 4 to 8. It is loam, silt loam, silty clay loam, and clay loam. Reaction is strongly acid or very strongly acid. Shale, siltstone, and sandstone fragments make up 5 to 95 percent of the C horizon. The C horizon that formed in shale has a dominant hue of 2.5Y, and that which formed in sandstone has a dominant hue of 7.5YR.

Henshaw series

The Henshaw series consists of deep, somewhat poorly drained, moderately slowly permeable soils on broad, very slightly convex lacustrine terraces. These soils formed in stratified silty and clayey lacustrine sediment. Slopes range from 0 to 2 percent.

Henshaw soils are similar to Iva, McGary, and Muren soils and are commonly adjacent to Evansville, Patton, and Uniontown soils on the landscape. Iva soils are grayer in the A2 horizon and upper part of the B horizon and formed in loess. McGary soils have more clay in the argillic horizon and C horizon. Immediately below the Ap or A1 horizon, McGary soils have chroma of 2 in the matrix. Muren soils are browner in the upper part of the B horizon, have less clay in the lower part of the B horizon, and formed in loess. Evansville and Patton soils are gleyed throughout the lower solum and do not have an argillic horizon. Patton soils are mollic. Uniontown soils have no mottles in the upper 10 inches or more of the argillic horizon.

Typical pedon of Henshaw silt loam, 0 to 2 percent slopes, in a cultivated field, 1,270 feet east and 200 feet north of southwest corner sec. 10, T. 6 S., R. 7 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam; many fine faint pale brown (10YR 6/3) mottles; weak fine granular structure; friable; common very fine iron and manganese oxide accumlutions; slightly acid; abrupt smooth boundary.

A2—7 to 9 inches; yellowish brown (10YR 5/4) silt loam; many fine light brownish gray (10YR 6/2) mottles; moderate medium platy structure parting to weak fine granular; friable; common discontinuous distinct light gray (10YR 7/2) silt films on faces of peds; common very fine iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

B21t—9 to 15 inches; yellowish brown (10YR 5/4) silty clay loam; common fine light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common fine and very fine pores; many continuous prominent thin dark yellowish brown (10YR 4/4) clay films on faces of peds; many continuous distinct thin light yellowish brown (2.5Y 6/3) silt films over clay films; common fine iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

B22t—15 to 23 inches; yellowish brown (10YR 5/4) silty clay loam; common fine light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common fine and very fine pores; many continuous prominent thin dark yellowish brown (10YR 4/4) clay films on faces of peds; many continuous distinct thin light yellowish brown (2.5Y 6/3) silt films over clay films; common fine iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

IIB23t—23 to 32 inches; light yellowish brown (2.5Y 6/4) heavy silty clay loam; many fine light brownish gray (2.5Y 6/2) mottles; weak medium and coarse prismatic structure parting to moderate medium subangular blocky; firm; common fine and very fine pores; many continuous distinct thin brown (10YR 5/3) clay films on faces of peds; many continuous distinct thin light brownish gray (2.5Y 6/2) silt films on faces of peds; common fine iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

IIB24t—32 to 41 inches; light yellowish brown (2.5Y 6/4) silty clay loam; many fine light brownish gray (10YR 6/2) and common fine yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; common fine and very fine pores; many discontinuous distinct thin brown (10YR 5/3) clay films on faces of peds; common discontinuous distinct thin light brownish gray (10YR 6/2) silt films on faces of peds; many fine iron and manganese oxide accumulations; slightly acid; clear wavy boundary.

IIB3t—41 to 50 inches; yellowish brown (10YR 5/4) and light yellowish brown (2.5Y 6/4) silty clay loam; common fine light brownish gray (2.5Y 6/2) mottles; weak coarse subangular blocky structure; firm; common to many fine and very fine pores; common discontinuous distinct thin brown (10YR 5/3) clay films on faces of peds; common discontinuous distinct thin light brownish gray (2.5Y 6/2) silt films lining pores; few fine iron and manganese oxide accumulations; mildly alkaline; clear wavy boundary.

IIC—50 to 70 inches; yellowish brown (10YR 5/4) stratified silt loam and silty clay loam and many (50 percent) fine distinct light brownish gray (10YR 6/2) and gray (10YR 5/1) mottles; massive; firm; few fine iron and manganese oxide accumulations; slight effervescence; moderately alkaline.

The thickness of the solum is 40 to 54 inches. The thickness of the loess cap is 15 to 30 inches.

The Ap horizon is dark grayish brown (10YR 4/2) to brown (10YR 5/3). Reaction is medium acid unless the soil is limed. The A2 horizon, where present, ranges from brown (10YR 5/3) to light yellowish brown (2.5Y 6/4) silt loam that has weak to moderate thin to thick platy structure.

The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 4 to 6. Mottles with chroma of 2 are few to many. The matrix of the lower horizons is commonly mottled. The B2 horizon is heavy silt loam or light silty clay loam in the upper part and heavy silt loam to heavy silty clay loam in the lower part. Reaction is strongly acid to slightly acid.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 to 6. It is stratified silt loam and silty clay loam. Reaction is neutral to moderately alkaline.

Hosmer series

The Hosmer series consists of deep, well drained, very slowly permeable soils on loess covered uplands. These soils have a fragipan. They formed in silty loess that is more than 4 feet deep. Slopes range from 0 to 18 percent.

Hosmer soils are similar to Alford, Pekin, Sciotoville, Tilsit, and Zanesville soils. Alford soils do not have a fragipan. Pekin soils have more sand in the lower part of the solum, a less strongly expressed fragipan, and formed in alluvium deposited by streams. Sciotoville soils have more sand and very fine mica flakes and formed in alluvium deposited by the Ohio River. Tilsit and Zanesville soils have more sand in the lower part of the Bx horizon and formed partly in residuum.

Typical pedon of Hosmer silt loam, 2 to 6 percent slopes, eroded, in an abandoned field, 1,480 feet east and 260 feet north of southwest corner sec. 3, T. 5 S., R. 9 W.

Ap—0 to 9 inches; brown (10YR 5/3) silt loam; moderate fine granular structure; friable; many fine roots; many very fine pores; medium acid; abrupt smooth boundary.

B1—9 to 13 inches; yellowish brown (10YR 5/4) heavy silt loam; weak fine subangular blocky structure; firm; common fine roots; moderate fine and very fine pores; strongly acid; clear wavy boundary.

B21t—13 to 18 inches; yellowish brown (10YR 5/6) light silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; many very fine and fine pores; many continuous distinct thin brown (7.5YR 5/4) clay films on faces of peds and in pores; few fine iron and manganese oxide stains; strongly acid; clear wavy boundary.

B22t—18 to 26 inches; yellowish brown (10YR 5/6) light silty clay loam; strong medium subangular blocky structure; firm; common fine roots; many very fine and fine pores; many continuous prominent thin brown (7.5YR 5/4) clay films on faces of peds and in pores; very strongly acid; clear wavy boundary.

B23t—26 to 30 inches; strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) light silty clay loam; strong medium subangular blocky structure; firm; common fine roots; many very fine and fine pores; many continuous prominent thin dark brown (7.5YR 4/4) clay films on faces of peds and in pores; strongly acid; clear wavy boundary.

Bx1—30 to 36 inches; brown (7.5YR 4/4) light silty clay loam; strong coarse prismatic structure parting to weak very thick platy; very firm; common fine roots on tops of prisms and common flattened fine roots along prisms; many very fine and fine pores; many discontinuous prominent thin dark brown (7.5YR 4/4) clay films on faces of peds and in pores; many continuous prominent thick gray (10YR 6/1) silt films on faces of peds; strongly acid; clear wavy boundary.

Bx2—36 to 65 inches; brown (7.5YR 4/4) heavy silt loam; strong very coarse prismatic structure parting to weak very thick platy; few flattened small roots between prisms; many very fine discontinuous inped vesicular pores and common fine continuous random exped tubular pores; many discontinuous distinct thin dark brown (7.5YR 4/4) clay films on faces of peds and in pores; many continuous prominent thick gray (10YR 6/1) silt films on faces of prism peds; strongly acid; gradual wavy boundary.

The thickness of the solum ranges from 48 to 84 inches. The thickness of the loess cap ranges from 48 to 96 inches. Depth to the fragipan ranges from 25 to 36 inches.

The Ap horizon ranges from brown (10YR 5/3) to dark grayish brown (10YR 4/2). An A1 horizon, where present, ranges from dark brown (10YR 4/3) to very dark grayish brown (10YR 3/2). Reaction is extremely acid to medium acid unless the soil is limed. An A2 horizon, where present, ranges from dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/6). It is silt loam and has weak or moderate thin to thick platy structure.

The B2 horizon has hue of 7.5YR and 10YR, value of 4 or 5, and chroma of 4 to 6. It is heavy silt loam or light silty clay loam. Some pedons are mottled below the upper 10 inches of the argillic horizon. Reaction in the B2 horizon is extremely acid to medium acid.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 6. It is silt loam or silt. Reaction is very strongly acid to neutral.

Huntington series

The Huntington series consists of deep, well drained, moderately permeable soils on the Ohio River flood plains. These soils formed in neutral alluvium. Slopes range from 0 to 2 percent.

Huntington soils are similar to Woodmere soils and are commonly adjacent to Newark soils on the landscape. Huntington soils have a mollic epipedon. Woodmere soils have a buried strongly acid or very strongly acid B2b horizon and have more clay within a depth of 40 inches. Newark soils have low chroma mottles immediately below the Ap horizon.

Typical pedon of Huntington silt loam, in a cultivated field, 1,440 feet east and 200 feet south of center sec. 22, T. 7 S., R. 8 W.

Ap—0 to 11 inches; dark brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; very fine mica flakes throughout; neutral; abrupt smooth boundary.

B21—11 to 14 inches; dark brown (10YR 3/3) silt loam, brown (10YR 4/3) crushed; moderate medium granular structure; friable; very fine mica flakes throughout; neutral; clear wavy boundary.

B22—14 to 19 inches; dark brown (10YR 3/3) silt loam, (10YR 3/4) crushed; weak medium subangular blocky structure; friable; very fine mica flakes throughout; neutral; clear wavy boundary.

B23—19 to 35 inches; dark brown (10YR 4/3) heavy silt loam; weak medium subangular blocky structure; friable; very fine mica flakes throughout; neutral; clear wavy boundary.

B24—35 to 44 inches; brown (10YR 4/3) heavy silt loam; weak coarse subangular blocky structure; friable; very fine mica flakes throughout; neutral; gradual wavy boundary.

C—44 to 60 inches; brown (10YR 4/3) heavy silt loam; massive; friable; very fine mica flakes throughout; neutral.

The thickness of the solum ranges from 40 to 50 inches.

The Ap horizon is dark brown (10YR 3/3) or very dark grayish brown (10YR 3/2) when moist and light brownish gray (10YR 6/2) and pale brown (10YR 6/3) when dry. The A horizon is 10 to 15 inches thick and ranges from loam to light silty clay loam.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam, silt loam, and light silty clay loam. Reaction is neutral or mildly alkaline.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is silt loam, loam, and silty clay loam with thin strata of fine sand and clay. Reaction is neutral or mildly alkaline.

These Huntington soils are taxadjuncts to the Huntington series because they do not have a mollic epipedon. This difference does not alter the usefulness or behavior characteristics of the soils.

Iva series

The Iva series consists of deep, somewhat poorly drained, slowly permeable soils on loess covered uplands. These soils formed in silty loess more than 5 feet deep. Slopes range from 0 to 2 percent.

Iva soils are similar to Bartle, Henshaw, Johnsburg, McGary, and Weinbach soils and are commonly adjacent to Alford, Hosmer, and Muren soils on the landscape. Bartle, Hosmer, Johnsburg, and Weinbach soils have a fragipan at a depth of about 18 to 36 inches. Bartle soils formed in alluvium. Henshaw soils lack low chroma in the matrix of the horizon immediately below the Ap or A1 horizon, are more clayey in the lower part of the argillic horizon, and formed in stratified silt and clay sediment. Johnsburg soils formed partly in residuum. McGary soils have more clay in the argillic horizon, have a thinner solum, and formed in stratified clay and silt sediment. Weinbach soils formed in alluvium deposited by the Ohio River. The alluvium contains noticeable amounts of very fine mica flakes throughout. Alford soils have a brighter colored solum that is free of mottles. Hosmer soils lack low chroma mottles in the upper 10 inches of the argillic horizon. Muren soils lack low chroma in the horizon below the Ap or A1 horizon.

Typical pedon of Iva silt loam, 0 to 2 percent slopes, in a cultivated field, 40 feet east and 1,640 feet south of center sec. 6, T. 4 S., R. 9 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable; common fine pores; neutral; abrupt smooth boundary.

A2—9 to 15 inches; light brownish gray (10YR 6/2) silt loam; many fine distinct pale brown (10YR 6/3) and yellowish brown (10YR 5/4) mottles; moderate medium platy structure parting to moderate fine granular; friable; many very fine and fine pores; few fine iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

B1t—15 to 19 inches; yellowish brown (10YR 5/4) heavy silt loam; many fine distinct light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; friable; many very fine and fine pores; few patchy distinct thin dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

B21t—19 to 28 inches; light brownish gray (10YR 6/2) light silty clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; moderate and strong coarse subangular blocky structure; firm; common very fine pores; many continuous distinct thin dark brown (10YR 4/3) and grayish brown (10YR 5/2) clay films on faces of peds and in some pores; common discontinuous prominent thin light gray (10YR 7/1) silt films lining pores; common fine iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

B22t—28 to 46 inches; yellowish brown (10YR 5/6) light silty clay loam; many fine distinct light brownish gray (10YR 6/2) mottles; moderate coarse subangular blocky structure; firm; few fine and very fine pores; common continuous prominent thin dark brown (10YR 4/3) and grayish brown (10YR 5/2) clay loam films on faces of peds and pores; common discontinuous prominent thin light gray (10YR 7/1) silt films lining pores; common fine iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

B31t—46 to 52 inches; yellowish brown (10YR 5/6) heavy silt loam; many fine distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; friable; common fine and very fine pores; few patchy distinct thin dark brown (10YR 4/4) clay films on faces of peds; common fine iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

B32—52 to 58 inches; yellowish brown (10YR 5/6) heavy silt loam; weak coarse subangular blocky structure; friable; common fine pores; medium acid; gradual wavy boundary.

C—58 to 71 inches; yellowish brown (10YR 5/6) silt loam; many fine light brownish gray (10YR 6/2) mottles; massive; friable; common fine pores; medium acid.

The thickness of the solum ranges from 36 to 60 inches. The thickness of the loess cap ranges from 60 to 132 inches.

The Ap horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). Reaction is medium acid to strongly acid unless the soil is limed. An A2 horizon, where present, is light brownish gray (10YR 6/2) or grayish brown (10YR 5/2) silt loam that has weak or moderate thin to thick platy structure.

The B2 horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4 and is mottled. It is heavy silt loam or light silty clay loam. Reaction is strongly acid or medium acid.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6 and has mottles with chroma of 1 to 3. Reaction is medium acid to neutral.

Johnsburg series

The Johnsburg series consists of deep, somewhat poorly drained, very slowly permeable soils on loess covered uplands. These soils have a fragipan. They formed in silty loess 2 1/2 to 4 feet deep and the underlying residuum weathered from siltstone, shale, and sandstone. Slopes range from 0 to 2 percent.

Johnsburg soils are similar to Bartle, Iva, and Weinbach soils and are commonly adjacent to Hosmer, Tilsit, and Zanesville soils on the landscape. Bartle soils have a less strongly expressed fragipan, have more sand in the upper solum, and formed in alluvium. Iva soils lack a fragipan and formed entirely in loess. Weinbach soils have more sand in the upper solum, have noticeable amounts of very fine mica flakes throughout, and formed in alluvium deposited by the Ohio River. Hosmer soils lack low chroma mottles, have less sand in the lower solum, and formed entirely in loess. Tilsit soils do not have low chroma mottles immediately below the Ap or A1 horizon. Zanesville soils have an argillic B horizon with hue of 7.5YR and do not have low chroma mottles in the argillic horizon above the fragipan.

Typical pedon of Johnsburg silt loam, 0 to 2 percent slopes, in a cultivated field, 320 feet west and 220 feet south of northwest corner sec. 29, T. 3 S., R. 6 W.

Ap—0 to 9 inches; grayish brown (10YR 5/2) silt loam; moderate fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

A2—9 to 13 inches; pale brown (10YR 6/3) silt loam; many fine faint grayish brown (10YR 5/2) and common fine faint yellowish brown (10YR 5/4) mottles; weak medium platy structure parting to weak fine granular; friable; common fine roots; common fine pores; strongly acid; clear wavy boundary.

B1—13 to 17 inches; pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) heavy silt loam; many fine faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; friable; common fine roots; common fine pores; few discontinuous distinct thin yellowish brown (10YR 5/4) clay films on faces of peds; common fine dark yellowish brown (10YR 4/4) iron and manganese oxide stains; strongly acid; clear wavy boundary.

B21t—17 to 22 inches; gray (10YR 6/1) heavy silt loam; many fine distinct yellowish brown (10YR 5/4) and common fine distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; common fine roots; common fine pores; many continuous distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; many discontinuous distinct thin and medium light gray (10YR 6/1) silt films on faces of peds and in pores; common fine dark yellowish brown (10YR 4/4) iron and manganese oxide stains; very strongly acid; clear wavy boundary.

B22t—22 to 30 inches; light brownish gray (10YR 6/2) heavy silt loam; many fine distinct light yellowish brown (10YR 6/4) and pale brown (10YR 6/3) mottles; strong coarse prismatic structure parting to moderate medium subangular blocky; very firm; brittle; common fine flattened roots between prisms and common rounded roots on prism caps; common fine and medium inped tubular pores and many very fine inped vesicular pores; common discontinuous distinct thin grayish brown (10YR 5/2) and dark brown (10YR 3/3) clay films on faces of peds and in pores; many continuous prominent thick light gray (10YR 6/1) silt films on faces of peds; common fine distinct dark yellowish brown (10YR 4/4) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

Bx—30 to 47 inches; yellowish brown (10YR 5/4) heavy silt loam; many fine distinct grayish brown (10YR 5/2) and pale brown (10YR 6/3) mottles; strong very coarse prismatic structure parting to weak thick platy; very firm; brittle; common fine flattened roots between prisms; few fine exped tubular pores and many very fine inped vesicular pores; common discontinuous distinct thin dark yellowish brown (10YR 4/4) clay films on faces of peds and in pores; many continuous prominent medium light gray (10YR 6/1) silt films on faces of peds; few fine dark brown (10YR 3/3) iron and manganese oxide stains; strongly acid; clear wavy boundary.

IIBx2—47 to 58 inches; yellowish brown (10YR 5/6) heavy silt loam; common fine light brownish gray (10YR 6/2) mottles; strong very coarse prismatic structure parting to weak thick platy; very firm; brittle; few fine flattened roots between prisms; few fine exped tubular pores and many very fine inped vesicular pores; common fine dark brown (10YR 3/3) iron and manganese oxide stains; strongly acid; gradual wavy boundary.

IIC—58 to 80 inches; yellowish brown (10YR 5/6) silt loam; common fine faint light brownish gray (10YR 6/3) and pale brown (10YR 6/3) mottles; massive; firm; strongly acid.

The thickness of the solum ranges from 42 to 75 inches. The thickness of the loess cap ranges from 30 to 48 inches. Depth to the fragipan ranges from 18 to 30 inches. Depth to rippable bedrock ranges from 50 to 84 inches.

The Ap horizon is dark grayish brown (10YR 4/2) to pale brown (10YR 6/3). Reaction is very strongly acid or strongly acid unless the soil is limed. An A2 horizon, if present, is pale brown (10YR 6/3) to grayish brown (10YR 5/2) silt loam that has weak or moderate thin to thick platy structure and is mottled.

The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6 and is mottled. The Bx horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 8. The B2 horizon and Bx horizon are heavy silt loam or light silty clay loam. The IIBx horizon also includes loam and clay loam. Shale, sandstone, and siltstone fragments make up less than 10 percent of the IIB horizon. Reaction is strongly acid to extremely acid.

The C horizon has hue of 7.5YR to 2.5Y, value of 5 to 7, and chroma of 1 to 8. It is loam, silt loam, silty clay loam, and clay loam. Reaction is very strongly acid to medium acid. The C horizon which formed in shale dominantly has hue of 2.5Y and that which formed in sandstone dominantly has hue of 7.5YR.

These Johnsburg soils are taxadjuncts to the Johnsburg series because they have grayer colors. This difference does not alter the usefulness or behavior characteristics of the soils.

Markland series

The Markland series consists of deep, well drained, slowly permeable soils on side slopes of the broad, flat lacustrine terraces. These soils formed in stratified clayey and silty lacustrine sediment. Slopes range from 2 to 18 percent.

Markland soils are similar to Alford, Uniontown, Wellston, and Wheeling soils and are commonly adjacent to McGary and Zipp soils on the landscape. Alford, Uniontown, Wellston, and Wheeling soils have less clay in the argillic horizon. Alford soils have a thicker solum and formed in loess. Wellston soils formed in loess and underlying residuum. Wheeling soils have very fine mica flakes throughout, are more sandy, and formed in alluvium deposited by the Ohio River. McGary soils have low chroma mottles in the upper 10 inches of the argillic horizon. Zipp soils do not have an argillic horizon, have a more clayey A horizon, and are gleyed.

Typical pedon of Markland silt loam, 2 to 6 percent slopes, eroded, in an abandoned field, 600 feet west and 200 feet north of center sec. 17, T. 5 S., R. 7 W.

Ap—0 to 8 inches; brown (10YR 5/3) heavy silt loam; moderate fine granular structure; friable; medium acid; clear smooth boundary.

B21t—8 to 11 inches; yellowish brown (10YR 5/6) heavy silty clay loam; moderate fine angular blocky structure; firm; few discontinuous prominent thin light olive brown (2.5Y 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—11 to 17 inches; yellowish brown (10YR 5/4) light silty clay; strong medium angular blocky structure; firm; many continuous prominent medium light olive brown (2.5Y 5/4) and dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B23t—17 to 33 inches; dark yellowish brown (10YR 4/4) and olive brown (2.5Y 4/4) light silty clay; strong medium angular blocky structure; firm; few fine and few very fine roots; many continuous prominent thin and medium dark yellowish brown (10YR 4/3) and light olive brown (2.5Y 5/4) clay films on faces of peds; mildly alkaline; clear wavy boundary.

B3—33 to 39 inches; light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/4) light silty clay; common fine distinct grayish brown (2.5Y 5/2) mottles; moderate coarse angular blocky structure; firm; common discontinuous prominent medium grayish brown (2.5Y 5/2) and dark yellowish brown (10YR 4/4) clay films on faces of peds; light brownish gray (2.5Y 6/2) fine threads of free lime; strong effervescence; mildly alkaline; clear wavy boundary.

C1—39 to 50 inches; yellowish brown (10YR 5/4) and light olive brown (2.5Y 5/4) stratified silty clay and silty clay loam; common fine distinct brownish gray (2.5Y 6/2) mottles; moderate very fine and fine platy structure; firm; grayish brown (2.5Y 5/2) weathering clay strata; light brownish gray (2.5Y 6/2) free lime accumulations; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—50 to 60 inches; yellowish brown (10YR 5/4) and light olive brown (2.5Y 5/4) stratified light silty clay; common fine distinct light brownish gray (2.5Y 6/2) mottles; weak thin and very thin platy structure; firm; grayish brown (2.5Y 5/2) weathering clay strata; light brownish gray (2.5Y 6/2) fine threads of free lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 36 inches. Thickness of the loess cap ranges from 0 to 15 inches.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 5/3). The A1 horizon, where present, is very dark grayish brown (10YR 3/2) silt loam. The Ap horizon in severely eroded areas is silty clay loam. Reaction is strongly acid to slightly acid unless the soil is limed. An A2 horizon, where present, is pale brown (10YR 6/3) to yellowish brown (10YR 5/4) silt loam that has weak to moderate thin to thick platy structure.

The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. Reaction is strongly acid to neutral in the upper horizons and medium acid to moderately alkaline in the lower horizons.

The C horizon has hue of 10YR or 2.5Y, value of 5, and chroma of 4 to 6. It is stratified silty clay, clay, silty clay loam, and silt loam. Reaction is mildly alkaline or moderately alkaline.

McGary series

The McGary series consists of deep, somewhat poorly drained, slowly permeable soils on broad, very slightly convex, lacustrine terraces. These soils formed in stratified clay and silt lacustrine sediment. Slopes range from 0 to 2 percent.

The McGary soils are similar to Henshaw and Iva soils and are commonly adjacent to the Markland and Zipp soils on the landscape. McGary soils have more clay in the argillic horizon and C horizon than Henshaw and Iva soils. Henshaw soils have dominant chroma of 4 or more immediately below the Ap or A1 horizon. Iva soils have a thicker solum and formed entirely in loess. Markland soils do not have low chroma mottles in the upper 10 inches of the argillic horizon. Zipp soils have a darker surface layer and dominantly low chroma in the subsoil. The A horizon is more clayey and the B horizon is not argillic.

Typical pedon of McGary silt loam, 0 to 2 percent slopes, in woods, 150 feet east and 200 feet north of center sec. 13, T. 5 S., R. 7 W.

A1—0 to 2 inches; dark gray (10YR 4/1) silt loam; moderate fine granular structure; friable; medium acid; abrupt smooth boundary.

A21—2 to 6 inches; light brownish gray (10YR 6/2) silt loam; many fine faint distinct pale brown (10YR 6/3) and yellowish brown (10YR 5/4) mottles; weak thick platy structure parting to moderate fine granular; friable; common fine roots; common fine pores; strongly acid; abrupt smooth boundary.

A22—6 to 9 inches; light brownish gray (10YR 6/2) silt loam; many fine faint yellowish brown (10YR 5/4) mottles; moderate thick platy structure parting to moderate fine granular; friable; common fine roots; strongly acid; abrupt smooth boundary.

IIB1t—9 to 13 inches; light brownish gray (2.5Y 6/2) light silty clay; many fine distinct yellow (10YR 5/4) mottles; strong fine angular blocky structure; firm; common fine roots; common fine pores; common discontinuous distinct thin dark yellowish brown (10YR 4/4) clay films on faces of peds and in linings of pores; strongly acid; abrupt smooth boundary.

IIB21t—13 to 20 inches; yellowish brown (10YR 5/4) silty clay; many fine prominent light brownish gray (2.5Y 6/2) and gray (5Y 6/1) mottles; strong medium angular blocky structure; firm; many continuous distinct thin light brownish gray (2.5Y 6/2) clay films on all ped faces and many discontinuous distinct thin dark yellowish brown (10YR 4/4) clay films on faces of peds; many continuous prominent thin gray (5Y 5/1) silt films on faces of peds; strongly acid; clear wavy boundary.

IIB22t—20 to 30 inches; brown (10YR 5/3) silty clay; many fine distinct light olive gray (5Y 6/2) mottles; strong medium angular blocky structure; firm; many continuous prominent thin gray (2.5Y 5/1) clay films on all faces of peds and common discontinuous prominent thin dark brown (10YR 4/3) clay films on peds and in linings of pores; medium acid; clear wavy boundary.

IIB3—30 to 36 inches; light olive brown (2.5Y 5/6) and brown (10YR 5/3) light silty clay; many fine faint light olive gray (5Y 6/2) mottles; strong medium angular blocky structure; firm; common discontinuous prominent thin gray (5Y 5/1) clay films on faces of peds; neutral; clear smooth boundary.

IIC—36 to 60 inches; light olive brown (2.5Y 5/4) stratified silty clay and silty clay loam; many fine distinct grayish brown (2.5Y 6/2) mottles; moderate medium platy structure; firm; common fine lime concretions; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 33 to 40 inches. Thickness of the loess cap ranges from 0 to 12 inches.

The Ap horizon is dark grayish brown (10YR 4/2) to gray (10YR 5/1). The A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 4/1). Reaction is strongly acid to slightly acid unless the soil is limed. The A2 horizon, where present, is light brownish gray (10YR 6/2) to gray (10YR 5/1) silt loam and has weak or moderate thin to thick platy structure.

The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or 1. The B horizon is silty clay or heavy silty clay loam. Reaction is strongly acid or medium acid in the upper part and medium acid to mildly alkaline in the lower part.

The C horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 to 6. The C horizon is gray (10YR 5/1 and 6/1). It is stratified clay, silty clay, silty clay loam, and silt loam.

Muren series

The Muren series consists of deep, moderately well drained, moderately slowly permeable soils on loess covered uplands. These soils formed in silty loess that is more than 5 feet deep. Slopes range from 0 to 6 percent.

Muren soils are similar to Henshaw and Hosmer soils and are commonly adjacent to Alford and Iva soils on the landscape. Henshaw soils have low chroma mottles immediately below the Ap or A horizon, have more clay in the argillic horizon, and formed in stratified silt and clay sediment. Hosmer soils have a fragipan. Alford soils are free of mottles and they have an argillic horizon. Iva soils have a low chroma matrix immediately below the Ap or A1 horizon.

Typical pedon of Muren silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 260 feet west and 1,390 feet north of southeast corner sec. 28, T. 6 S., R. 9 W.

Ap—0 to 8 inches; brown (10YR 5/3) silt loam; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

B21t—8 to 12 inches; yellowish brown (10YR 5/4) light silty clay loam; moderate medium subangular blocky structure; firm; common very fine pores; medium acid; clear wavy boundary.

B22t—12 to 26 inches; yellowish brown (10YR 5/6) light silty clay loam; common fine faint pale brown (10YR 6/3) and grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; firm; common fine pores; many continuous distinct thin yellowish brown (10YR 5/4) and brown (7.5YR 4/4) clay films on peds; common discontinuous faint pale brown (10YR 6/3) silt films on faces of peds; common fine and medium iron and manganese oxide accumulations and stains; strongly acid; clear wavy boundary.

B23t—26 to 42 inches; yellowish brown (10YR 5/6) light silty clay loam; common fine faint pale brown (10YR 6/3) and grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; firm; common fine pores; many continuous distinct thin yellowish brown (10YR 5/4) and brown (7.5Y 4/4) clay films on faces of peds; common discontinuous faint thin silt coatings; common fine and medium iron and manganese oxide accumulations and stains; strongly acid; clear wavy boundary.

B3—42 to 46 inches; yellowish brown (10YR 5/6) heavy silt loam; many fine faint brownish yellow (10YR 6/6) and light brownish gray (10YR 6/2) mottles; moderate coarse subangular blocky structure; firm; many very fine and few fine pores; common fine iron and manganese oxide accumulations and stains; medium acid; clear wavy boundary.

C—46 to 66 inches; yellowish brown (10YR 5/6) silt loam; many fine distinct light brownish gray (10YR 6/2) and pale brown (10YR 6/3) mottles; massive; firm; many very fine pores; common fine iron and manganese oxide accumulations; slightly acid; gradual wavy boundary.

Thickness of the solum ranges from 43 to 60 inches. The thickness of the loess cap ranges from 60 to 120 inches.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4). Reaction is medium acid or strongly acid unless the soil is limed. An A2 horizon, where present, is brown (10YR 5/3) or yellowish brown (10YR 5/4) silt loam and has weak or moderate thin to thick platy structure.

The B2 horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. Mottles with chroma of 2 or 1 are within the upper 10 inches of the argillic horizon. The B2 horizon is heavy silt loam or light silty clay loam. Reaction is strongly acid or medium acid.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 3 to 6. Mottles are of low chroma. The C horizon is silt loam or silt. Reaction is medium acid to neutral.

Newark series

The Newark series consists of deep, somewhat poorly drained, moderately permeable soils on the Ohio River flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

The Newark soils are similar to Stendal and Wilbur soils and are commonly adjacent to the Huntington soils on the landscape. Stendal and Wilbur soils have less clay; have very few, if any, mica flakes; and formed in stream alluvium. Stendal soils are strongly acid or very strongly acid in the upper 40 inches. Huntington soils do not have low chroma mottles in the upper 10 inches of the B2 horizon.

Typical pedon of Newark silty clay loam, in a cultivated field, 830 feet west and 970 feet north of southeast corner sec. 23, T. 7 S., R. 8 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam, pale brown (10YR 6/3) dry; weak fine granular structure; very fine mica flakes throughout; friable; neutral; abrupt smooth boundary.

B21—10 to 24 inches; grayish brown (10YR 5/2) silty clay loam; many fine faint dark grayish brown (10YR 4/2) and brown (10YR 5/3) mottles; weak moderate granular structure; firm; many fine mica flakes throughout; neutral; clear wavy boundary.

B22—24 to 30 inches; dark grayish brown (10YR 4/2) silty clay loam; many fine faint brown (10YR 4/3) and many fine distinct brown (10YR 5/3) and gray (10YR 5/1) mottles; many very fine mica flakes throughout; weak medium granular structure; firm; neutral; clear wavy boundary.

C—30 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; many fine distinct dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/6) and many fine faint pale brown (10YR 6/3) mottles; weak medium platy structure to massive; firm; common fine iron and manganese oxide accumulations; many very fine mica flakes throughout; neutral.

Thickness of the solum ranges from 25 to 40 inches.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3). The A horizon is silty clay loam or heavy silt loam. Reaction is neutral or mildly alkaline.

The B2 horizon mainly has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The lower part has value of 6 and 7 and chroma of 1. The B horizon is light silty clay loam or heavy silt loam. Reaction is neutral or mildly alkaline.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 to 4. It is stratified silt loam and silty clay loam with few fine strata of clay and fine sand. Reaction is neutral or mildly alkaline.

Patton series

The Patton series consists of deep, poorly drained, moderately permeable soils on broad, very slightly concave, lacustrine terraces. These soils formed in stratified silt and clay lacustrine sediment. Slopes range from 0 to 1 percent.

The Patton soils are similar to Evansville and Zipp soils and are commonly adjacent to Henshaw and Uniontown soils on the landscape. Patton soils have a mollic epipedon. Zipp soils have more clay in the solum and formed in more clayey sediment. Henshaw soils have a lighter colored, less clayey A horizon and an argillic B horizon. Uniontown soils are browner throughout, do not have low chroma mottles in the upper part of the solum, and have an argillic B horizon.

Typical pedon of Patton silty clay loam, in a cultivated field, 220 feet west and 325 feet north of center sec. 31, T. 6 S., R. 8 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) light silty clay loam; weak medium granular structure; friable; many fine and many very fine roots; neutral; abrupt smooth boundary.

B21g—10 to 13 inches; dark gray (5Y 4/1) light silty clay loam, gray (10YR 5/1) dry; common fine distinct olive gray (5Y 4/2) and olive (5Y 4/3) mottles; moderate fine subangular blocky structure; firm; many fine roots; common fine pores; neutral; clear wavy boundary.

B22g—13 to 16 inches; dark gray (5Y 4/1) light silty clay loam; common fine distinct olive brown (2.5Y 4/4) mottles; weak fine prismatic structure parting to moderate medium subangular; firm; common medium and common fine roots; common fine pores; neutral; clear wavy boundary.

B23g—16 to 24 inches; dark gray (5Y 4/1) silty clay loam; common fine distinct olive (5Y 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular and angular blocky; firm; common medium and common fine roots; common fine pores; neutral; clear wavy boundary.

B24g—24 to 32 inches; gray (5Y 5/1) silty clay loam; common fine distinct brown (2.5Y 5/2) and olive brown (2.5Y 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common medium and fine roots; common fine pores; neutral; gradual wavy boundary.

B25g—32 to 42 inches; gray (5Y 5/1) silty clay loam; many fine distinct olive (5Y 5/3), light olive gray, and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; common fine roots; common fine pores; common dark gray (5Y 4/1) with common fine distinct olive brown (2.5Y 4/4) crayfish fills from upper horizons; mildly alkaline; gradual wavy boundary.

C—42 to 60 inches; gray (5Y 6/1) silty clay loam and olive brown (2.5Y 6/6) clay; many fine distinct olive yellow (2.5Y 6/6) mottles; massive; firm; common fine roots; slight effervescence; moderately alkaline.

Thickness of the solum ranges from 30 to 42 inches. The thickness of the mollic epipedon ranges from 10 to 15 inches.

The mollic epipedon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). The A horizon is light silty clay loam or heavy silt loam. Reaction is neutral or mildly alkaline. The mollic epipedon extends into the B2g horizon in some pedons.

The B2g horizon has hue of 5Y to 10YR, value of 4 or 5, and chroma of 0 or 1 to a depth of 30 inches. The lower part of the B2g horizon has value of 6 and chroma of 2. It is silty clay loam to heavy silt loam. Reaction is neutral or mildly alkaline. Average clay content is 27 to 35 percent.

The C horizon has hue of 5Y to 10YR, value of 4 to 7, and chroma of 0 to 6. It is stratified silt loam, silty clay loam, silty clay, or clay. Reaction is neutral to moderately alkaline.

Pekin series

The Pekin series consists of deep, moderately well drained, very slowly permeable soils on old stream terraces. These soils have a fragipan. They formed in silty alluvium. Slopes range from 1 to 4 percent.

Pekin soils are similar to Hosmer, Sciotoville, and Tilsit soils and are commonly adjacent to Bartle and Peoga soils on the landscape. Hosmer, Sciotoville, and Tilsit soils have a more strongly expressed fragipan. Hosmer soils do not have mottles in the upper 10 inches of the argillic horizon and formed entirely in loess. Sciotoville soils have slightly more sand, are commonly redder, have a noticeable amount of very fine mica flakes throughout the solum, and formed in alluvium deposited by the Ohio River. Tilsit soils formed partly in loess and the underlying residuum from siltstone, shale, and sandstone. Bartle soils have mottles immediately below the Ap or A1 horizon. Peoga soils are grayer throughout and do not have a fragipan.

Typical pedon of Pekin silt loam, 1 to 4 percent slopes, eroded, in a cultivated field, 150 feet west and 640 feet south of northeast corner sec. 23, T. 4 S., R. 6 W.

Ap—0 to 7 inches; brown (10YR 5/3) silt loam; weak fine granular structure; friable; many fine and many very fine roots; neutral; abrupt smooth boundary.

B21t—7 to 14 inches; yellowish brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; firm; common fine roots; few fine pores; many discontinuous distinct thin dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine dark yellowish brown (10YR 4/4) iron and manganese oxide stains; strongly acid; clear wavy boundary.

B22t—14 to 21 inches; yellowish brown (10YR 5/4) heavy silt loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to moderate medium subangular; firm; brittle; common fine roots on ped caps; many fine tubular pores; many discontinuous distinct dark brown (10YR 3/3) clay films on faces of peds and some walls of pores; many continuous prominent thick, 1- to 10-millimeter light brownish gray (10YR 6/2) silt films on faces of peds and in pores; few fine dark yellowish brown (10YR 4/4) iron and manganese oxide stains; strongly acid; clear wavy boundary.

Bx1—21 to 28 inches; yellowish brown (10YR 5/4) heavy silt loam; common fine distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to weak very thick platy; very firm; brittle; many fine and common medium flattened roots along prism walls and on prism caps; many very fine inped vesicular pores and many fine random exped tubular pores; many discontinuous distinct thin dark yellowish brown (10YR 4/4) clay films on faces of peds and some walls of pores; many continuous prominent thick, 1- to 5-millimeter light gray (10YR 6/1) silt films on caps and walls of prisms and in pores; common fine dark brown (10YR 3/3) iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

Bx2—28 to 48 inches; yellowish brown (10YR 5/4) and brownish yellow (10YR 6/6) heavy silt loam, common fine distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to weak very thick platy; very firm; brittle; few fine and common medium flattened roots along prism walls; many very fine inped vesicular pores and many fine exped random tubular pores; common discontinuous distinct thin grayish brown (10YR 5/2) clay films on faces of peds and in pores; many continuous prominent medium light gray (10YR 6/1) silt films on caps and walls of all prisms and on some walls of pores; many fine dark yellowish brown (10YR 4/4) iron and manganese oxide stains; medium acid; gradual wavy boundary.

B3—48 to 58 inches; brownish yellow (10YR 6/6) and light yellowish brown (10YR 6/4) heavy silt loam; weak coarse subangular blocky structure; firm; few fine roots; common patchy distinct thin brown (10YR 4/3) clay films on faces of peds; common continuous distinct thin light brownish gray (10YR 6/2) silt films on faces of peds; common fine very dark brown (10YR 2/2) iron and manganese oxide accumulations; medium acid; gradual wavy boundary.

C—58 to 66 inches; brownish yellow (10YR 6/6) and light yellowish brown (10YR 6/4) heavy silt loam; massive; friable and firm; medium acid.

The thickness of the solum ranges from 42 to 60 inches. Depth to the fragipan ranges from 18 to 30 inches.

The Ap horizon is brown (10YR 5/3) or dark grayish brown (10YR 4/2). Reaction is strongly acid to medium acid unless the soil is limed. An A2 horizon, where present, is pale brown (10YR 6/3) silt loam that has weak or moderate thin to thick platy structure.

The B2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. Low chroma mottles are not in the upper part of the argillic horizon but are within the upper 10 inches of the argillic horizon. The B2 horizon is silt loam or light silty clay loam. Reaction is very strongly acid to medium acid.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 8. It is stratified silt loam or silty clay loam and loam. Reaction is medium acid to neutral.

Peoga series

The Peoga series consists of deep, poorly drained, slowly permeable soils on very slightly convex, old stream terraces. These soils formed in silty alluvium. Slopes range from 0 to 1 percent.

Peoga soils are similar to Birds and Bonnie soils and are commonly adjacent to Bartle and Pekin soils on the landscape. Birds and Bonnie soils do not have an argillic horizon, have less clay to a depth of 40 inches, and are on stream flood plains. Bartle and Pekin soils have a fragipan. Bartle soils have at least one B2 subhorizon above the fragipan that has matrix chroma of 3 to 6. Pekin soils dominantly have chroma of 3 to 6.

Typical pedon of Peoga silt loam, in a cultivated field, 35 feet west and 120 feet south of northeast corner sec. 9, T. 4 S., R. 6 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam; weak medium granular structure; friable; few fine and many very fine roots; neutral; abrupt smooth boundary.

A2—8 to 15 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine and many very fine roots; common fine pores; numerous old vertical crayfish fills; strongly acid; clear wavy boundary.

B1g—15 to 26 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse prismatic structure; friable; few fine roots; common fine pores; few discontinuous distinct thin light gray (10YR 7/1) silt films on faces of peds; numerous old vertical crayfish fills; very strongly acid; clear smooth boundary.

B21tg—26 to 32 inches; gray (10YR 6/1) light silty clay loam; common medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; moderate medium and coarse prismatic structure parting to weak medium and coarse subangular blocky; firm; few fine roots; few fine pores; few discontinuous faint thin gray (10YR 5/1) and dark brown (7.5YR 4/4) clay films on faces of peds and in pores; many continuous distinct thin light gray (10YR 7/1) silt films on faces of peds; numerous old vertical crayfish fills; very strongly acid; clear wavy boundary.

B22tg—32 to 48 inches; gray (10YR 6/1) light silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure; firm; few fine pores; many discontinuous prominent thin gray (10YR 6/1) clay films on faces of peds; common continuous thin light gray (10YR 7/1) silt films on faces of peds and in pores; numerous old vertical crayfish fills; strongly acid; clear wavy boundary.

B3—48 to 60 inches; strong brown (7.5YR 5/6) stratified light silty clay loam and silt loam; many coarse distinct gray (10YR 6/1) mottles and streaks; weak coarse prismatic structure; firm; few fine pores; common black (10YR 2/1) iron and manganese oxide accumulations; numerous old vertical crayfish fills; strongly acid; gradual wavy boundary.

C—60 to 80 inches; strong brown (7.5YR 5/6) and gray (10YR 6/1) stratified light silty clay loam and silt loam; massive; firm; numerous old vertical crayfish fills; neutral.

The thickness of the solum ranges from 52 to 72 inches.

The Ap horizon is light gray (10YR 6/1) to grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2). Reaction is strongly acid to medium acid unless the soil is limed. An A2 horizon has hue of 10YR, value of 6 or 7, and chroma of 1 or 2.

The B2 horizon has hue of 10YR or 2.5Y, value of 6 or 7, and chroma of 1 or 2 or value of 5 and chroma of 1. It is silt loam or light silty clay loam. Reaction is very strongly acid or strongly acid.

The C horizon has hue of 7.5YR to 5Y, value of 5 or 7, and chroma of 1 to 8. It is stratified silt loam or silty clay loam. Reaction is strongly acid or neutral.

Sciotoville series

The Sciotoville series consists of deep, moderately well drained, slowly permeable soils on the Ohio River terraces. These soils have a fragipan. They formed in alluvium that contains a noticeable amount of very fine mica flakes throughout. Slopes range from 1 to 3 percent.

The Sciotoville soils are similar to Hosmer, Pekin, and Tilsit soils and are commonly adjacent to Weinbach and Wheeling soils on the landscape. Hosmer and Tilsit soils are more silty in the upper part of the solum. Hosmer soils formed entirely in loess and do not have low chroma mottles in the upper 10 inches of the argillic horizon. Pekin soils have a less strongly expressed fragipan; have slightly less sand; commonly are yellower; do not have a noticeable amount of very fine mica flakes throughout the solum; and formed in alluvium deposited by streams. Tilsit soils commonly are yellower and formed in loess and underlying residuum from sandstone, siltstone, and shale.

Typical pedon of Sciotoville silt loam, 1 to 3 percent slopes, in a cultivated field, 370 feet east and 430 feet north of southwest corner sec. 20, T. 6 S., R. 7 W.

Ap—0 to 8 inches; brown (10YR 5/3) silt loam; moderate fine granular structure; friable; many fine and many very fine roots; very fine mica flakes throughout; strongly acid; abrupt smooth boundary.

B21t—8 to 17 inches; yellowish brown (10YR 5/4) light silty clay loam; moderate medium subangular blocky structure; firm; many fine and many very fine roots; common very fine pores; common continuous distinct thin dark yellowish brown (10YR 4/4) clay films on faces of peds; very fine mica flakes throughout; very strongly acid; clear wavy boundary.

B22t—17 to 24 inches; yellowish brown (10YR 5/4) light silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very firm; common fine and common very fine roots; common fine pores; common continuous distinct thin dark brown (10YR 4/3) clay films on faces of peds; very fine mica flakes throughout; very strongly acid; clear wavy boundary.

Bx1—24 to 36 inches; brown (7.5YR 5/4) light silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; strong very coarse prismatic structure parting to weak very thick platy; very firm; brittle; common fine and common very fine roots on tops of prisms; common fine flattened roots along prism walls; many very fine discontinuous inped vesicular pores and few fine continuous random exped tubular pores; common continuous distinct thin dark brown (7.5YR 4/4) clay films on faces of prisms; many continuous prominent thick light brownish gray (10YR 6/2) silt films on caps and walls of faces of prisms; very fine mica flakes throughout; very strongly acid; clear wavy boundary.

Bx2—36 to 45 inches; brown (7.5YR 5/4) light silty clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; strong very coarse prismatic structure parting to weak very thick platy; very firm; brittle; common fine and few very fine flattened roots along prism walls; very fine discontinuous inped vesicular pores and few fine continuous random exped tubular pores; common continuous prominent medium gray (10YR 6/1) silt films on caps and walls of faces of prisms; very fine mica flakes throughout; very strongly acid; clear wavy boundary.

Bx3—45 to 55 inches; yellowish brown (10YR 5/4) light silty clay loam; common fine prominent gray (10YR 6/1) mottles; moderate very coarse prismatic structure parting to weak very thick platy; very firm; brittle; common fine and few very fine flattened roots along prism walls; many very fine discontinuous inped vesicular pores and few fine continuous random exped tubular pores; common discontinuous distinct thin dark brown (10YR 4/3) and light brownish gray (10YR 6/2) clay films on faces of prisms; very fine mica flakes throughout; strongly acid; gradual wavy boundary.

B3t—55 to 60 inches; yellowish brown (10YR 5/4) light silty clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; moderate coarse subangular blocky structure; firm; few fine roots; few fine pores; common discontinuous distinct thin dark brown (7.5YR 4/4) clay films on faces of peds; few discontinuous distinct thin gray (10YR 6/1) silt films as flows on faces of pores; very fine mica flakes throughout; medium acid; gradual wavy boundary.

C—60 to 80 inches; yellowish brown (10YR 5/4) stratified silty clay loam and silt loam; massive; firm; very fine mica flakes throughout; medium acid.

Thickness of the solum ranges from 48 to 60 inches. Depth to the fragipan ranges from 20 to 32 inches.

The Ap horizon is brown (10YR 5/3) to grayish brown (10YR 4/2). Reaction is strongly acid to medium acid unless the soil is limed. An A2 horizon, where present, is brown (10YR 5/3) or grayish brown (10YR 5/2) silt loam that has weak or moderate thin to thick platy structure.

The B2 horizon has hue of 7.5YR and 10YR, value of 4 or 5, and chroma of 3 or 4. Mottles with chroma of 2 or 1 are within the upper 6 to 10 inches of the argillic horizon. The B2 horizon is heavy silt loam or light silty clay loam that contains 10 to 20 percent fine sand. Reaction is very strongly acid to medium acid.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 1. It is stratified silty clay loam and silt loam to loamy sand. Reaction is very strongly acid to slightly acid.

These Sciotoville soils contain less sand than is defined for the Sciotoville series. This difference does not alter the usefulness or behavior characteristics of the soils.

Steff series

The Steff series consists of deep, moderately well drained, moderately permeable soils on stream flood plains. These soils formed in strongly acid or very strongly acid silty alluvium. Slopes range from 0 to 1 percent.

Steff soils are similar to Wilbur soils and are commonly adjacent to Bonnie and Stendal soils on the landscape. Wilbur soils have slightly less clay and are neutral to medium acid to a depth of 40 inches. Bonnie soils are grayer and have matrix chroma of 1 or 2 to a depth of 30 inches. Stendal soils are grayer, and have chroma of 2 or 1 immediately below the A horizon.

Typical pedon of Steff silt loam, in a cultivated field, 100 feet east and 900 feet north of southwest corner sec. 21, T. 4 S., R. 7 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; friable; neutral; abrupt smooth boundary.

B21—9 to 13 inches; brown (10YR 5/3) silt loam; weak medium platy structure parting to weak fine granular; friable; common fine pores; neutral; clear wavy boundary.

B22—13 to 17 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; common fine pores; strongly acid; clear smooth boundary.

B23—17 to 33 inches; brown (10YR 5/3) silt loam; common fine faint pale brown (10YR 6/3) and light brownish gray (10YR 6/2) mottles; weak fine granular structure; friable; common fine pores; strongly acid; clear smooth boundary.

C1—33 to 40 inches; pale brown (10YR 6/3) silt loam; many fine faint light brownish gray (10YR 6/2) and yellowish brown (10YR 5/4) mottles; massive; friable; common fine pores; common fine dark brown (7.5YR 4/4) iron and manganese oxide stains; strongly acid; gradual smooth boundary.

C2—40 to 60 inches; light brownish gray (10YR 6/2) silt loam; many fine yellowish brown (10YR 5/4) mottles; massive; friable; common fine pores; dark brown (7.5YR 4/4) iron and manganese oxide stains; strongly acid.

Thickness of the solum ranges from 24 to 40 inches.

The A horizon is brown (10YR 5/3) or dark brown (10YR 4/3). Reaction is strongly acid unless the soil is limed.

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Mottles with chroma of 2 are within a depth of 24 inches. The lower part of the B horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. Reaction is strongly acid or very strongly acid.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 to 6. Reaction is strongly acid or very strongly acid.

Stendal series

The Stendal series consists of deep, somewhat poorly drained, moderately permeable soils on stream flood plains. These soils formed in strongly acid or very strongly acid silty alluvium. Slopes range from 0 to 1 percent.

Stendal soils are similar to Newark and Wakeland soils and are commonly adjacent to Bonnie and Steff soils on the landscape. Newark soils have more clay and formed in alluvium deposited by the Ohio River. The alluvium contains a noticeable amount of very fine mica throughout. Newark soils are neutral or mildly alkaline to a depth of 40 inches. Wakeland soils have slightly less clay and are neutral to medium acid to a depth of 40 inches. Bonnie soils are grayer and have matrix chroma of 1 or 2 to a depth of 30 inches. Steff soils are browner and have chroma of 3 or more immediately below the A horizon.

Typical pedon of Stendal silt loam, in a cultivated field, 1,100 feet west and 700 feet south of northeast corner sec. 14, T. 4 S., R. 7 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; friable; neutral; abrupt smooth boundary.

C1—6 to 10 inches; grayish brown (10YR 5/2) and brown (10YR 5/3) silt loam; weak thin platy structure parting to weak fine granular; friable; many fine dark yellowish brown (10YR 3/4) iron and manganese oxide stains; strongly acid; clear smooth boundary.

C2—10 to 18 inches; brown (10YR 5/3) silt loam; many fine faint grayish brown (10YR 5/2) and common fine distinct light brownish gray (10YR 6/2) and gray (10YR 6/1) mottles; weak fine granular structure; friable; strongly acid; clear wavy boundary.

C3g—18 to 30 inches; mottled grayish brown (10YR 5/2) and brown (10YR 5/3) silt loam; weak fine granular structure; friable; few fine distinct dark yellowish brown (10YR 3/4) iron and manganese oxide stains; strongly acid; clear smooth boundary.

C4g—30 to 40 inches; light gray (10YR 6/1) silt loam; many fine distinct brown (10YR 5/3) and common fine distinct brownish yellow (10YR 6/6) mottles; weak fine granular structure; friable; common fine distinct dark yellowish brown (10YR 3/4) iron and manganese oxide stains; strongly acid; clear wavy boundary.

C5—40 to 60 inches; brown (10YR 5/3) silt loam; many fine distinct light gray (10YR 6/1) mottles; massive; friable; many fine dark yellowish brown (10YR 3/4) iron and manganese oxide stains; strongly acid.

The thickness of the A horizon is 3 to 12 inches.

The A horizon is grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2). Reaction is strongly acid unless the soil is limed.

The C horizon, to a depth of 40 inches, has hue of 10YR, value of 5 or 6, and chroma of 1 to 3. Value of 5 and chroma of 2 dominate to a depth of 30 inches. Reaction is strongly acid or very strongly acid to a depth of 40 inches.

Tilsit series

The Tilsit series consist of deep, moderately well drained, very slowly permeable soils on loess covered uplands. These soils have a fragipan. They formed in silty loess that is 2 1/2 to 4 feet deep and underlying residuum weathered from siltstone, shale, and sandstone. Slopes range from 0 to 6 percent.

Tilsit soils are similar to Hosmer, Pekin, Sciotoville, and Zanesville soils and are commonly adjacent to Johnsburg soils on the landscape. The Hosmer soils have less sand in the lower part of the solum and formed entirely in loess that is more than 4 feet deep. Pekin and Sciotoville soils have more sand in the upper part of the solum and formed in alluvium. Pekin soils have a less strongly expressed fragipan. Sciotoville soils also have a noticeable amount of very fine mica flakes throughout. Zanesville soils are dominantly redder (7.5YR) in the B2t horizon and do not have low chroma mottles in the B2t horizon above the Bx horizon. Johnsburg soils have low chroma mottles immediately below the Ap or A1 horizon.

Typical pedon of Tilsit silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 360 feet east and 2,360 feet north of southwest corner sec. 2, T. 4 S., R. 6 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

B21t—7 to 18 inches; yellowish brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; many discontinuous prominent thin brown (7.5YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—18 to 20 inches; yellowish brown (10YR 5/6), light yellowish brown (10YR 6/4), and pale brown (10YR 6/3) heavy silt loam; common fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; many discontinuous prominent thin brown (7.5YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B23t—20 to 24 inches; yellowish brown (10YR 5/6) heavy silt loam; common fine distinct light yellowish brown (2.5Y 6/4) and light brownish gray (10YR 6/2) mottles; moderate coarse prismatic structure parting to moderate coarse subangular; very firm; many fine roots and many fine flattened roots along prisms; many very fine and common fine pores; many discontinuous brown (7.5YR 5/4) and dark brown (7.5YR 4/4) clay films on faces of peds and many continuous prominent thick light gray (10YR 6/1) silt films on faces of peds and in clay films; very strongly acid; clear wavy boundary.

Bx1—24 to 39 inches; yellowish brown (10YR 5/4) heavy silt loam; common fine distinct light brownish gray (10YR 6/2) mottles; strong very coarse prismatic structure parting to weak thick platy; very firm; brittle; common fine flattened roots along prism walls; many very fine inped vesicular pores and common fine vertical exped tubular pores; common discontinuous faint thin dark brown (7.5YR 4/4) clay films on faces of peds and in silt films; many continuous prominent thick light gray (10YR 6/1) and light brownish gray (10YR 6/2) silt films on faces of peds; strongly acid; clear wavy boundary.

IIBx2—39 to 53 inches; light yellowish brown (2.5Y 6/4 and 10YR 6/4) light silty clay loam; strong very coarse prismatic structure parting to weak thick platy; very firm; brittle; few fine flattened roots along prism walls; many very fine inped vesicular pores and few fine vertical exped tubular pores; few fine flattened roots along prism walls; common discontinuous faint thin dark brown (7.5YR 4/4) clay films on faces of peds and in silt films; many discontinuous prominent medium light gray (10YR 6/1) silt films along prism walls; few fine dark brown (7.5YR 4/4) iron and manganese oxide stains; few thin shale channers; strongly acid; gradual wavy boundary.

IIB3—53 to 58 inches; light yellowish brown (2.5Y 6/4) silty clay loam; common fine distinct light brownish gray (2.5Y 6/2) mottles; weak thick platy structure; firm; common discontinuous distinct thin yellowish brown (10YR 5/4) clay films on faces of peds; few fine dark brown (7.5YR 4/4) iron and manganese oxide stains; few thin shale channers; medium acid; gradual wavy boundary.

IIC—58 to 80 inches; light yellowish brown (2.5Y 6/4) silty clay loam; common fine distinct light brownish gray (2.5Y 6/2) mottles; massive; firm; few thin shale fragments; medium acid.

Thickness of the solum ranges from 40 to 60 inches. The thickness of the loess cap ranges from 30 to 48 inches. Depth to the fragipan ranges from 18 to 28 inches. Depth to rippable bedrock ranges from 50 to 90 inches.

The Ap horizon ranges from brown (10YR 5/3) to dark grayish brown (10YR 4/2). Reaction is strongly acid unless the soil is limed. An A2 horizon, where present, is brown (10YR 5/3), yellowish brown (10YR 5/4), or light olive brown (2.5Y 5/4) silt loam that has weak to moderate thin to thick platy structure.

The B2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 6. Mottles with chroma of 2 are in the lower part of the B2t horizon. The B2 horizon is silt loam to light silty clay loam if it formed in loess and silt loam, silty clay loam, and loam if it formed in residuum. Reaction is extremely acid to medium acid. Shale fragments make up less than 5 percent of the B horizon.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 8. It is loam or clay loam and silt loam to silty clay. Reaction is extremely acid to medium acid. Shale fragments make up less than 50 percent of the upper part of the C horizon. The C horizon dominantly has hue of 2.5Y if it formed in shale and 7.5YR if it formed in sandstone.

These Tilsit soils are taxadjuncts to the Tilsit series because of high base saturation and because they have mottles with chroma of 2 above the fragipan. This difference does not alter the usefulness or behavior characteristics of the soils.

Uniontown series

The Uniontown series consists of deep, well drained, moderately permeable soils on side slopes of broad, flat lacustrine terraces. These soils formed in stratified silty and clayey lacustrine sediment. Slopes range from 2 to 18 percent.

Uniontown soils are similar to Alford, Markland, Wellston, and Wheeling soils and commonly are adjacent to Evansville, Henshaw, and Patton soils. Alford soils have a thicker solum and formed entirely in loess. Markland soils have more clay in the argillic horizon. Wellston soils formed in loess and underlying residuum from siltstone, sandstone, and shale. Wheeling soils have less clay in the argillic horizon, have more sand in the solum, are dominantly redder, and formed in alluvium deposited by the Ohio River. The alluvium contains a noticeable amount of very fine mica flakes throughout. Evansville and Patton soils are gleyed, have dominant chroma of 0 to 2 throughout, and lack an argillic horizon. Henshaw soils have mottles or matrix with chroma of 2 in the upper 10 inches of the argillic horizon. Patton soils have a mollic epipedon.

Typical pedon of Uniontown silt loam, 2 to 6 percent slopes, eroded, in an abandoned field, 1,200 feet west and 160 feet north of center sec. 1, T. 7 S., R. 8 W.

Ap—0 to 9 inches; brown (10YR 5/3) silt loam; moderate medium granular structure; friable; many fine and many very fine roots; medium acid; abrupt smooth boundary.

B21t—9 to 14 inches; yellowish brown (10YR 5/4) light silty clay loam; moderate medium and fine subangular blocky structure; firm; many fine and many very fine roots; common fine pores; many continuous distinct thin brown (10YR 4/3) clay films on faces of peds; medium acid; clear wavy boundary.

IIB22t—14 to 22 inches; light olive brown (2.5Y 5/6) silty clay loam; strong medium subangular blocky structure; firm; common fine and many very fine roots; common fine pores; many continuous prominent thin dark brown (10YR 4/3) clay films on faces of peds; medium acid; clear wavy boundary.

IIB23t—22 to 36 inches; light olive brown (2.5Y 5/6) silty clay loam; strong coarse angular and subangular blocky structure; firm; common fine and common very fine roots; common fine pores; many continuous prominent medium dark brown (10YR 4/3) clay films on faces of peds; medium acid; clear wavy boundary.

IIB3t—36 to 40 inches; light olive brown (2.5Y 5/6) heavy silt loam; common fine faint yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; moderate and weak coarse subangular blocky structure; friable; few fine and common very fine roots; few fine pores; many patchy distinct thin dark brown (10YR 4/3) clay films on faces of peds; slight effervescence; mildly alkaline; clear wavy boundary.

IIC1—40 to 48 inches; light yellowish brown (2.5Y 6/4) silt loam; common fine faint light olive brown (2.5Y 5/6) and few fine faint grayish brown (2.5Y 5/2) mottles; massive; friable; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC2—48 to 60 inches; light yellowish brown (2.5Y 6/4) laminated silt loam; common fine faint light olive brown (2.5Y 5/6) and few fine faint grayish brown (2.5Y 5/2) mottles; massive; friable; common fine lime nodules throughout; strong effervescence; moderately alkaline.

Solum thickness ranges from 30 to 40 inches. Thickness of the loess cap is 15 to 28 inches.

The A horizon is brown (10YR 5/3) or dark brown (10YR 4/3). Reaction is medium acid to neutral unless the soil is limed. An A2 horizon, where present, is pale brown (10YR 6/3) or brown (10YR 5/3) silt loam that has weak or moderate thin to thick platy structure.

The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 to 6. It is heavy silt loam or silty clay loam. The lower part of the B2 horizon includes heavy silty clay loam. Reaction is strongly acid to slightly acid in the upper part and medium acid to mildly alkaline in the lower part.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 to 6. It is stratified silt loam, silty clay loam, and silty clay. Reaction is neutral to moderately alkaline.

Wakeland series

The Wakeland series consists of deep, somewhat poorly drained, moderately permeable soils on stream flood plains. These soils formed in neutral to medium acid silty alluvium. Slopes range from 0 to 1 percent.

Wakeland soils are similar to Newark and Stendal soils and are commonly adjacent to Birds and Wilbur soils on the landscape. Newark soils have more clay and formed in Ohio River alluvium with a noticeable amount of mica flakes throughout. Stendal soils have slightly more clay and are strongly acid or very strongly acid to a depth of 40 inches. Birds soils are grayer with matrix chroma of 1 or 2 to a depth of 30 inches. Wilbur soils are browner with matrix chroma of 3 or more immediately below the A horizon.

Typical pedon of Wakeland silt loam, in a cultivated field, 2,440 feet west and 800 feet north of southeast corner sec. 9, T. 7 S., R. 8 W.

Ap—0 to 10 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; friable; common fine and many very fine roots; neutral; abrupt smooth boundary.

C1—10 to 15 inches; grayish brown (10YR 5/2) silt loam; many fine distinct yellowish brown (10YR 5/4) mottles; weak medium platy structure parting to weak fine granular; friable; common fine and many very fine roots; common fine dark brown (7.5YR 4/4) iron and manganese oxide stains; neutral; gradual wavy boundary.

C2—15 to 30 inches; brown (10YR 5/3) silt loam; many fine faint grayish brown (10YR 5/2) and common fine distinct gray (10YR 6/1) mottles; weak fine granular structure; friable; few fine and common very fine roots; common fine dark brown (7.5YR 4/4) iron and manganese oxide stains; slightly acid; gradual wavy boundary.

C3—30 to 60 inches; gray (10YR 5/1) silt loam; many fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; many fine dark brown (7.5YR 4/4) iron and manganese oxide stains; neutral.

Thickness of the A horizon ranges from 3 to 12 inches.

The A horizon is dark grayish brown (10YR 4/2) to brown (10YR 5/3). Reaction is medium acid to neutral.

The C horizon, to a depth of 30 inches, has hue of 10YR, value of 5 or 6, and chroma of 1 to 4. In at least one part of this horizon, chroma of 3 is dominant. Reaction is medium acid to neutral to a depth of 40 inches.

Weinbach series

The Weinbach series consists of deep, somewhat poorly drained, very slowly permeable soils on the Ohio River terraces. These soils have a fragipan. They formed in alluvium. Slopes range from 0 to 2 percent.

Weinbach soils are similar to Bartle, Iva, and Johnsburg soils and are commonly adjacent to Sciotoville and Wheeling soils on the landscape. Bartle, Iva, and Johnsburg soils lack the noticeable amount of very fine mica flakes throughout. Bartle soils have a less strongly expressed fragipan, have less sand in the lower part of the solum, and formed in stream alluvium. Iva soils do not have a fragipan, have less sand in the solum, and formed entirely in loess. Johnsburg soils have less sand in the upper part of the solum and formed in loess and underlying residuum from siltstone, shale, and sandstone. Sciotoville soils are browner, have matrix chroma of 3 or more immediately below the Ap or A1 horizon, and are dominantly redder. Wheeling soils do not have a fragipan and do not have low chroma mottles in the upper 10 inches of the argillic horizon.

Typical pedon of Weinbach silt loam, 0 to 2 percent slopes, in a cultivated field, 100 feet west and 710 feet north of southeast corner of sec. 11, T. 7 S., R. 8 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; friable; many fine and many very fine roots; many very fine very dark brown (10YR 2/2) iron and manganese oxide accumulations; very fine mica flakes throughout; neutral; abrupt smooth boundary.

A2—8 to 11 inches; mottled light brownish gray (10YR 6/2) and pale brown (10YR 6/3) silt loam; weak medium platy structure parting to weak fine granular; friable; many fine and common very fine roots; common very fine very dark brown (10YR 2/2) iron and manganese oxide accumulations; very fine mica flakes throughout; medium acid; clear wavy boundary.

B2t—11 to 25 inches; mottled light brownish gray (10YR 6/2) and pale brown (10YR 6/3) heavy silt loam; moderate medium subangular blocky structure; firm; common fine and common very fine roots; common very fine pores; many continuous thin dark yellowish brown (10YR 4/4) clay films on faces of peds and lining some pores; common very dark brown (10YR 2/2) iron and manganese oxide accumulations; very fine mica flakes throughout; strongly acid; clear wavy boundary.

Bx1—25 to 34 inches; light brownish gray (10YR 6/2) light silty clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; strong very coarse prismatic structure parting to weak very thick platy; very firm; brittle; common fine flattened roots on prism caps and common fine and very fine flattened roots along prism walls; many fine discontinuous inped vesicular pores and common medium vertical exped tubular pores; many discontinuous thin dark brown (7.5YR 4/4) clay films on faces of peds and in some pore channels and thin faint light brownish gray (10YR 6/2) in some silt films on faces of peds; many continuous prominent thick (as much as 15 millimeters) light gray (10YR 7/1) silt films on prism walls and some faces of pore channels which contain 30 percent light brownish gray (10YR 6/2) clay films; few fine dark brown (7.5YR 4/4) iron and manganese oxide accumulations; very fine mica flakes throughout; medium acid; gradual wavy boundary.

Bx2—34 to 52 inches; brown (7.5YR 5/4) light silty clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; strong very coarse prismatic structure parting to weak very thick platy; very firm; brittle; common fine and common very fine flattened roots along prism walls; many fine inped vesicular pores and common medium vertical exped tubular pores; many discontinuous distinct thin dark yellowish brown (10YR 4/4) clay films on faces of peds; many discontinuous and continuous prominent medium and thin light gray (10YR 7/1) silt films on faces of peds and thin films on faces of pore channels; few fine dark brown (7.5YR 3/2) iron and manganese oxide accumulations; very fine mica flakes throughout; strongly acid; gradual wavy boundary.

B3t—52 to 58 inches; yellowish brown (10YR 5/6) and brown (7.5YR 5/6) heavy silt loam; common fine distinct light gray (10YR 7/2) mottles; weak coarse subangular blocky structure; friable; common discontinuous distinct thin dark brown (7.5YR 4/4) clay films on faces of peds; few continuous distinct medium pale brown (10YR 6/3) silt films on faces of peds; few fine black (N 2/0) iron and manganese oxide accumulations; very fine mica flakes throughout; strongly acid; gradual wavy boundary.

C—58 to 80 inches; yellowish brown (10YR 5/6) and brown (7.5YR 4/4) heavy silt loam; many fine distinct light gray (10YR 6/1) mottles; massive; friable; very fine mica flakes throughout; medium acid.

Thickness of the solum ranges from 42 to 60 inches. Depth to the fragipan ranges from 18 to 30 inches.

The Ap horizon is grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), or brown (10YR 5/3). Reaction is strongly acid to slightly acid unless the soil is limed. An A2 horizon, where present, is grayish brown (10YR 5/2) or light brownish gray (10YR 6/2) silt loam that has weak to moderate thin to thick platy structure.

The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. The horizon below the Ap or A1 horizon has chroma of 2 in the matrix. Between the A horizon and the Bx horizon, at least one horizon has a matrix with chroma of 3 or 4. The B2 horizon is heavy silt loam or silty clay loam. Reaction is extremely acid to medium acid.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 6. It is stratified silt loam, loam, silty clay loam, or loamy sand. Reaction is extremely acid to slightly acid.

Wellston series

The Wellston series consists of deep, well drained, moderately permeable soils on loess covered uplands. These soils formed in silty loess and underlying residuum weathered from sandstone, siltstone, and shale. Slopes range from 12 to 25 percent.

Wellston soils are similar to Alford, Gilpin, Markland, Uniontown, and Wheeling soils and are commonly adjacent to Johnsburg, Tilsit, and Zanesville soils on the landscape. Alford soils have less sand in the solum and formed entirely in loess. Gilpin soils have a thinner solum and a thinner loess cap, have an argillic horizon less than 18 inches thick, and are shallower to rippable bedrock.

Markland and Uniontown soils have more clay in the lower argillic horizon and formed in stratified silt and clay. Wheeling soils have more sand in the solum and formed in alluvium that contains a noticeable amount of very fine mica flakes throughout. Johnsburg, Tilsit, and Zanesville soils have a fragipan. Johnsburg and Tilsit have low chroma mottles in the subsoil.

Typical pedon of Wellston silt loam, 12 to 18 percent slopes, in woods, 2,040 feet east and 1,040 feet north of southwest corner sec. 17, T. 4 S., R. 6 S.

A1—0 to 4 inches; dark brown (10YR 3/3) silt loam; moderate very fine and fine granular structure; friable; many fine and very fine roots; neutral; clear wavy boundary.

A2—4 to 10 inches; brown (10YR 5/3) silt loam; weak thick platy structure parting to moderate fine granular; friable; many fine and many very fine roots; strongly acid; clear wavy boundary.

B1t—10 to 14 inches; yellowish brown (10YR 5/4) and brown (7.5YR 5/4) heavy silt loam; moderate fine subangular blocky structure; friable; common fine and many very fine roots; few discontinuous faint thin dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B21t—14 to 20 inches; yellowish brown (10YR 5/6) heavy silt loam; moderate fine subangular blocky structure; firm; common medium and common fine and common very fine roots; many continuous prominent thin dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

IIB22t—20 to 30 inches; yellowish brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; firm; common medium and common fine and common very fine roots; many continuous prominent thin dark brown (10YR 4/3) clay films on faces of peds; strongly acid; clear wavy boundary.

IIB23t—30 to 36 inches; yellowish brown (10YR 5/6) heavy silt loam; moderate coarse subangular blocky structure; firm; common medium and few fine common very fine roots; many continuous prominent thin dark brown (7.5YR 4/4) clay films on faces of peds; 5 percent sandstone channers less than 2 inches long; strongly acid; clear wavy boundary.

IIB3—36 to 40 inches; yellowish brown (10YR 5/4) shaly heavy loam; weak coarse subangular blocky structure; firm; common medium and few fine and common very fine roots; few patchy distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; 15 percent shaly channers less than 2 inches long; strongly acid; gradual wavy boundary.

IIC—40 to 44 inches; yellowish brown (10YR 5/6) very shaly heavy loam; common fine light brownish gray (10YR 6/2) streaks of weathering rock materials; massive; firm; few fine roots; 35 percent siltstone and shale fragments; strongly acid.

IICr—44 to 46 inches; weathering fine interbedded siltstone and shale.

Thickness of the solum ranges from 32 to 48 inches. Thickness of the loess cap is 20 to 48 inches. Part of the solum formed in residuum. Depth to rippable bedrock ranges from 40 to 60 inches.

The A1 horizon ranges from very dark grayish brown (10YR 3/2) to dark brown (10YR 4/3). The Ap horizon ranges from brown (10YR 5/3) to dark grayish brown (10YR 4/2). Reaction is strongly acid to extremely acid unless the soil is limed. An A2 horizon, where present, is pale brown (10YR 6/3) to yellowish brown (10YR 5/4) silt loam that has weak to moderate thin to thick platy structure.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam to light silty clay loam. Thickness of the argillic horizon is 18 to 36 inches. Reaction is strongly acid to extremely acid. Shale fragment content ranges from 0 percent in the upper part to 40 percent in the lower part.

The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 8. It is silt loam, loam, or clay loam. Reaction is extremely acid to slightly acid. Shale fragment content ranges from 20 to 90 percent. The C horizon has hue of 2.5Y if it formed in shale and 7.5YR if it formed in sandstone.

Wheeling series

The Wheeling series consists of deep, well drained, moderately permeable soils on the Ohio River terraces. These soils formed in alluvium that contains a noticeable amount of very fine mica flakes throughout. Slopes range from 0 to 6 percent.

The Wheeling soils are similar to Alford, Gilpin, Markland, Uniontown, Wellston, and Woodmere soils and are commonly adjacent to Sciotoville and Weinbach soils on the landscape. Wheeling soils have more sand throughout the solum than the other soils. Alford, Gilpin, Markland, Uniontown, and Wellston soils lack the noticeable amount of very fine mica flakes throughout. Alford soils formed in silty loess. Gilpin soils have a thinner solum and formed in very thin loess and underlying residuum from sandstone, siltstone, and shale. Markland and Uniontown soils have more clay in the argillic horizon and formed in stratified silt and clay. Wellston soils formed in loess and underlying residuum from siltstone, shale, and sandstone. Woodmere soils are neutral or slightly acid in the upper 20 to 40 inches, do not have an argillic horizon, and are more clayey throughout the solum. Sciotoville and Weinbach soils have a fragipan at a depth of about 18 to 32 inches and have mottles in the upper 10 inches of the argillic horizon.

Typical pedon of Wheeling silt loam, 0 to 2 percent slopes, in a cultivated field, 600 feet east and 100 feet north of the southwest corner of sec. 20, T. 6 S., R. 7 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak medium platy structure parting to moderate fine granular; friable; many fine roots; very fine mica flakes throughout; neutral; abrupt wavy boundary.

B1t—8 to 12 inches; yellowish brown (10YR 5/6) heavy silt loam; moderate fine subangular blocky structure; firm; many fine roots; few fine and very fine discontinuous and continuous pores; common discontinuous distinct thin brown (7.5YR 5/4) clay films on faces of peds; very fine mica flakes throughout; strongly acid; clear wavy boundary.

B21t—12 to 20 inches; strong brown (7.5YR 5/6) light silty clay loam; moderate fine subangular blocky structure; firm; common fine roots; few fine and very fine pores; many continuous prominent thin dark brown (7.5YR 4/4) clay films on faces of peds and lining pores; very fine mica flakes throughout; very strongly acid; clear wavy boundary.

B22t—20 to 36 inches; strong brown (7.5YR 5/6) light silty clay loam; moderate medium and coarse subangular blocky structure; firm; common fine roots mostly along faces of peds; common fine pores; many continuous prominent thin dark brown (7.5YR 4/4) clay films on faces of peds and lining pores; very fine mica flakes throughout; strongly acid; clear wavy boundary.

B23t—36 to 50 inches; yellowish brown (10YR 5/4) clay loam; moderate and coarse subangular blocky structure; firm; few fine roots mostly along faces of peds; few fine pores; many continuous prominent thin brown (10YR 4/3) clay films on faces of peds and lining pores; very fine mica flakes throughout; strongly acid; clear wavy boundary.

C—50 to 60 inches; brown (10YR 5/3) loamy sand; structureless; loose; few fine roots; very fine mica flakes throughout; strongly acid.

Thickness of the solum ranges from 45 to 60 inches.

The Ap horizon is brown (10YR 5/3), dark brown (10YR 4/3), or dark grayish brown (10YR 4/2) loam or silt loam. Reaction is very strongly acid to medium acid unless the soil is limed. An A2 horizon, when present, is yellowish brown (10YR 5/4) or brown (7.5YR 5/4) loam or silt loam that has weak to moderate thin to thick platy structure.

The B2t horizon has hue of 7.5YR and 10YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, clay loam, or silty clay loam. Reaction is strongly acid or medium acid.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is stratified and ranges from loamy sand to silty clay loam. Reaction is strongly acid to slightly acid.

These Wheeling soils are taxadjuncts to the Wheeling series because they contain less sand than is defined for the series. This difference does not alter the usefulness or behavior of the soils.

Wilbur series

The Wilbur series consists of deep, moderately well drained, moderately permeable soils on stream flood plains. These soils formed in neutral to medium acid silty alluvium. Slopes range from 0 to 2 percent.

The Wilbur soils are similar to Steff soils and are commonly adjacent to Birds and Wakeland soils on the landscape. Steff soils have slightly more clay and are strongly acid or very strongly acid to a depth of 40 inches. Birds soils are grayer and have matrix chroma of 1 or 2 to a depth of 30 inches. Wakeland soils are grayer, and immediately below the A horizon they have chroma of 2 or 1.

Typical pedon of Wilbur silt loam, in a cultivated field, 400 feet west and 30 feet north of southeast corner of sec. 14, T. 5 S., R. 9 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

C1—10 to 15 inches; dark brown (10YR 4/3) silt loam; weak medium platy structure parting to weak fine granular; friable; medium acid; clear wavy boundary.

C2—15 to 30 inches; brown (10YR 5/3) silt loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak fine granular structure; friable; common fine dark yellowish brown (10YR 4/4) iron and manganese oxide accumulations; medium acid; clear wavy boundary.

C3—30 to 44 inches; brown (10YR 5/3) silt loam; many fine faint light brownish gray (10YR 6/2) mottles; very weak thin to thick platy structure; many fine dark yellowish brown (10YR 4/4) iron and manganese oxide accumulations; medium acid; clear smooth boundary.

C4—44 to 60 inches; gray (10YR 5/1) silt loam; many fine distinct dark yellowish brown (10YR 4/4) mottles; massive; friable; many fine dark brown (10YR 4/4) iron and manganese oxide accumulations; medium acid.

Thickness of the solum ranges from 3 to 12 inches.

The Ap horizon is dark brown (10YR 4/3) or brown (10YR 5/3). Reaction is medium acid to neutral.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. Mottles that have chroma of 2 are within a depth of 24 inches. Reaction is medium acid to neutral.

Woodmere series

The Woodmere series consists of deep, well drained, moderately slowly permeable soils on the Ohio River flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Woodmere soils are similar to Huntington and Wheeling soils and are commonly adjacent to Newark soils on the landscape. Huntington soils are neutral or mildly alkaline and do not have a buried B2b horizon within a depth of 40 inches. Wheeling soils have more sand throughout and have an argillic horizon, and less than 20 inches of the solum formed in neutral alluvium. Newark soils are grayer in the matrix and have grayer mottles in the upper 10 inches of the B horizon.

Typical pedon of Woodmere silty clay loam, in a cultivated field, 2,400 feet east and 120 feet south of northwest corner sec. 22, T. 7 S., R. 8 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) silty clay loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; very fine mica flakes throughout; neutral; abrupt smooth boundary.

B2—10 to 24 inches; dark brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; very fine mica flakes throughout; neutral; clear wavy boundary.

IIB1b—24 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; common discontinuous distinct thin dark brown (10YR 4/3) clay films on faces of peds; very fine mica flakes throughout; medium acid; clear wavy boundary.

IIB2b—30 to 70 inches; brown (7.5YR 5/4) light silty clay; weak very coarse prismatic structure parting to moderate coarse subangular blocky; firm; many discontinuous distinct brown (7.5YR 4/3) clay films on faces of peds and lining pores; common discontinuous distinct pale brown (10YR 6/3) silt films on clay films and faces of peds; common fine dark brown (7.5YR 4/4) iron and manganese oxide accumulations; very fine mica flakes throughout; very strongly acid; gradual wavy boundary.

IIB3b—70 to 76 inches; brown (7.5YR 5/4) light silty clay loam; weak medium subangular blocky structure; firm; few discontinuous faint thin brown (7.5YR 4/3) clay films on faces of peds and in pore channels; common discontinuous distinct pale brown (10YR 6/3) silt films on faces of peds; many fine dark brown (7.5YR 4/4) iron and manganese oxide accumulations; very fine mica flakes throughout; very strongly acid; gradual wavy boundary.

IIC—76 to 84 inches; brown (7.5YR 5/4) light silty clay; massive; firm; very fine mica flakes; strongly acid.

Thickness of the solum ranges from 50 to 80 inches. Depth to the buried B2b horizon ranges from 20 to 40 inches.

The Ap horizon is dark brown (10YR 4/3 and 3/3) moist and pale brown (10YR 6/3) or light brownish gray (10YR 6/2) dry. It is light silty clay loam or heavy silt loam. Reaction is neutral or slightly acid.

The horizon below the B2b horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is heavy silt loam or silty clay loam. Reaction is neutral or slightly acid. The B2b horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 or 5. It is silty clay loam or silty clay. Reaction is strongly acid or very strongly acid.

The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, chroma of 4 to 6. It is stratified silty clay to loam. Reaction is strongly acid or medium acid.

Zanesville series

The Zanesville series consists of deep, well drained, slowly permeable soils on loess covered uplands. These soils have a fragipan. They formed in silty loess 1 1/2 to 4 feet deep and underlying residuum weathered from siltstone, shale, and sandstone. Slopes range from 2 to 18 percent.

Zanesville soils are similar to Hosmer and Tilsit soils and are commonly adjacent to Gilpin, Johnsburg, and Wellston soils on the landscape. Hosmer soils have less sand in the lower part of the solum and formed entirely in loess that is more than 4 feet deep. Tilsit soils are yellower in the B2t horizon and have mottles with low chroma in the B2t and Bx horizons. Gilpin and Wellston soils do not have a fragipan. Gilpin soils have a thinner solum and are shallower to rippable bedrock. Johnsburg soils are grayer in the upper part of the solum and have mottles with low chroma immediately below the Ap or A1 horizon.

Typical pedon (fig. 15) of Zanesville silt loam, 2 to 6 percent slopes, eroded, in an abandoned field, 150 feet west and 100 feet south of northeast corner sec. 19, T. 4 S., R. 6 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure in the upper part and weak medium platy structure in the lower part; friable; many fine and many very fine roots; very strongly acid; abrupt smooth boundary.

B21t—7 to 18 inches; strong brown (7.5YR 5/6) light silty clay loam; moderate medium subangular blocky structure; firm; common fine and many very fine roots; common fine pores; many discontinuous prominent thin brown (7.5YR 4/4) clay films on faces of peds and lining pores; very strongly acid; clear wavy boundary.

B22t—18 to 32 inches; strong brown (7.5YR 5/6) heavy silt loam; moderate coarse subangular blocky structure; firm; common fine and very fine roots; common fine pores; many discontinuous prominent thin brown (7.5YR 4/4) clay films on faces of peds and lining pores; very strongly acid; clear wavy boundary.

Bx1—32 to 43 inches; brown (7.5YR 4/4) heavy silt loam; strong very coarse prismatic structure parting to weak very thick platy; very firm; brittle; common fine and many very fine roots on prism caps and common fine and common very fine flattened roots along walls of prisms; many very fine inped vesicular pores and few fine random exped tubular pores; many discontinuous faint thin light brownish gray (10YR 6/2) clay films within the silt films; common discontinuous distinct thin dark brown (7.5YR 4/4) clay films on faces of peds; many continuous prominent thick light gray (10YR 6/1) silt films on all faces of prisms and lining pores; strongly acid; gradual wavy boundary.

IIBx2—43 to 52 inches; brown (7.5YR 4/4) heavy silt loam; strong very coarse prismatic structure parting to weak very thick platy; very firm; brittle; common fine and common very fine flattened roots along prism walls; many very fine inped vesicular pores and few fine random exped tubular pores; common discontinuous distinct thin dark brown (7.5YR 4/4) clay films on faces of peds; many continuous prominent 10 millimeter thick silt films on faces of prisms and lining pores; strongly acid; clear wavy boundary.

IIB3—52 to 59 inches; yellowish brown (10YR 5/4) loam; weak coarse subangular blocky structure; friable; few fine and common very fine roots; many fine pores; strongly acid; gradual smooth boundary.

IIC—59 to 68 inches; yellowish brown (10YR 5/6) loam; massive; friable; strongly acid; gradual smooth boundary.

IIR—68 to 70 inches; siltstone and sandstone bedrock.

Thickness of the solum ranges from 34 to 60 inches. The thickness of the loess cap ranges from 18 to 48 inches. Depth to the fragipan ranges from 23 to 32 inches. Depth to rippable bedrock ranges from 44 to 80 inches.

The Ap or A1 horizon ranges from yellowish brown (10YR 5/4) to dark grayish brown (10YR 4/2). Reaction is medium acid or strongly acid unless the soil is limed. An A2 horizon, if present, is yellowish brown (10YR 5/4) or brown (10YR 5/3) silt loam that has weak or moderate thin to thick platy structure.

The B2t and Bx horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The B2t horizon has a dominant hue of 7.5YR and is silt loam, loam, light silty clay loam, and light clay loam. Reaction is very strongly acid or strongly acid. The lower part of the solum is 3 to 15 percent shale fragments.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 8. It is loam and silt loam to silty clay, clay loam, or sandy clay loam. Reaction is very strongly acid or strongly acid. The C horizon is 20 to 90 percent shale fragments. It dominantly has hue of 2.5Y if it formed in shale and 7.5YR if it formed in sandstone.

Zipp series

The Zipp series consists of deep, very poorly drained, slowly permeable soils on broad, very slightly concave lacustrine terraces. These soils formed in stratified clay and silt lacustrine sediment. Slopes range from 0 to 1 percent.

The Zipp soils are similar to Evansville and Patton soils and are commonly adjacent to Markland and McGary soils on the landscape. Evansville and Patton soils have less clay in the solum and formed in less clayey sediment. Patton soils have a mollic epipedon. Markland soils are browner throughout, lack mottles in the upper part of the solum, and have an argillic B horizon. McGary soils have a lighter colored, less clayey A horizon and an argillic B horizon.

Typical pedon of Zipp silty clay loam, in a cultivated field, 300 feet east and 150 feet south of center sec. 19, T. 5 S., R. 9 W.

Ap—0 to 10 inches; dark gray (10YR 4/1) heavy silty clay loam; common fine distinct olive (5Y 5/3) mottles; weak very fine granular structure; firm; neutral; abrupt smooth boundary.

B21g—10 to 17 inches; dark gray (5Y 4/1) light silty clay; common fine distinct olive (5Y 5/3) mottles; strong medium angular blocky structure; firm; many continuous faint thin dark gray (5Y 4/1) pressure films on faces of peds; neutral; clear smooth boundary.

B22g—17 to 26 inches; gray (5Y 5/1) light silty clay; many fine distinct olive (5Y 5/4 and 5/6) and light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to strong coarse angular blocky; firm; many continuous faint thin dark gray (5Y 4/1) pressure films on faces of peds; neutral; gradual wavy boundary.

B23g—26 to 35 inches; dark gray (5Y 4/1) light silty clay; many fine distinct olive (5Y 5/6 and 5/4) and olive yellow (2.5Y 6/6) mottles; weak coarse prismatic structure parting to strong coarse angular blocky; firm; many continuous faint thin dark gray (5Y 4/1) pressure films on faces of peds; neutral; gradual wavy boundary.

B24g—35 to 48 inches; gray (5Y 5/1) light silty clay; many (40 percent) fine distinct olive (5Y 5/4) and light olive brown (2.5Y 5/4) mottles; very weak coarse prismatic structure parting to moderate medium angular blocky; firm; many continuous faint thin dark gray (5Y 4/1) pressure films on faces of peds; neutral; gradual smooth boundary.

C—48 to 60 inches; dark gray (5Y 4/1) and yellow (2.5Y 7/6) light silty clay; many fine distinct olive (5Y 4/3) and light olive brown (2.5Y 5/6) mottles; massive; firm; mildly alkaline.

Thickness of the solum is 36 to 48 inches.

The A horizon is dark gray (10YR 4/1) or dark grayish brown (10YR 4/2) light silty clay or heavy silty clay loam.

The Bg horizon has hue of 5Y to 10YR, value of 4 to 6, and chroma of 1 or less. The lower part of the solum has value of 6. The Bg horizon is silty clay or heavy silty clay loam. Reaction is neutral or mildy alkaline.

The C horizon has hue of 5Y to 10YR, value of 4 to 7, and chroma of 1 to 6 and has mottles. In some pedons it has neutral (N) hue and value of 4 to 7. It is stratified silty clay, clay, silty clay loam, and silt loam. Reaction is neutral to moderately alkaline.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*7*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 15, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalfs (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Hapludalfs (*Hapl*, meaning simple horizons, plus *udalfs*, the suborder of Alfisols that have a udic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-silty, mixed, mesic, Typic Hapludalfs.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

The following pages define the major factors of soil formation and describe their degree of importance in the formation of the soils in Warrick County.

Factors of soil formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of any soil are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

Parent material

Parent material is the unconsolidated mass in which a soil forms. Surface rock in Warrick County is of Pennsylvanian age. It is siltstone, shale, and sandstone (fig. 16). The uplands have material from this rock less than 20 feet below the surface. This condition is present in the Zanesville-Tilsit-Wellston, Hosmer-Zanesville, Alford-Muren, and Orthents units. During the Illinoian and Wisconsin glacial periods of the Pleistocene age, loess (windblown silt) was deposited on these uplands. On nearly level to gently sloping uplands, the loess cap ranges from 30 feet on Alford silt loam in the southwestern part of the county to 2 1/2 feet on Zanesville silt loam in the northeastern part (*4*, *5*).

The upper part of the loess is Peorian, which has hue of 10YR. A gritty loess below the silty loess is noted by the grating sound when a knife is drawn through it. In the lower part of many soil profiles there is a loess which has hue of 7.5YR, which is the Farmdale or Roxana loess, but no attempt was made to differentiate the different loess deposits in the typical profile descriptions. Farmdale loess is less than 50 inches thick in the southwestern part of the county and less than 10 inches thick in the northeastern part. There are some paleosols and weakly expressed paleosol-like profiles exposed along some vertical strip-mine cuts. There is also some of the older, redder Loveland loess in the southwestern part of the county. This loess is difficult to differentiate in the field from material weathered from fine sandstone or coarse siltstone of similar color.

While the loess was deposited on the uplands, water was backing up streams and forming lakes. Soils of the Zipp-McGary-Evansville unit formed in the lake sediment. Later in the Wisconsin glacial period, the Ohio River with its faster water cut through previous deposits and redeposited sediment in which the Weinbach, Wheeling, and Sciotoville soils of the Huntington-Newark-Wheeling unit formed. Erosion is a source of alluvium in which the Huntington and Newark soils along the Ohio River and the Wakeland, Stendal, and Bonnie soils along streams form.

Plant and animal life

Warrick County was mostly covered by hardwoods. Swamp grasses were dominant vegetation on Zipp, Patton, and Evansville soils which formed in the previous lake bed. Animal life has had a minor influence of soil formation except to mix the upper layers as is done by earthworms. Man's influence has been to alter vegetation and fertility, drain wet soils, and increase erosion on other soils.

Climate

Climate is mild midcontinental and is relatively uniform throughout the county. Summers are hot and humid, and winters are cool and humid.

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil and the amount of water available for the weathering of minerals and for the transporting of soil materials.

Climate, through its influence on soil temperature, determines the rate of chemical reactions in the soil. This influence is important, but its effect is noticed in large areas rather than in relatively small areas such as a county. When the glaciers melted, the Ohio and Wabash Rivers carried large sediment loads. Some of the sediment was deposited on the glacial flood plains and blocked tributary streams to form lakes. The flood plains also became the source of loess. Winds were dominantly from the west, making the Wabash River and local streams the major source of loess. Winds from the southwest during the summers deposited loess from the Ohio River. The Ohio River was the primary source only for the southernmost 4 or 5 miles of uplands.

Microclimate is of minor consequence and soil formation is related more to slope and surface runoff. For more detailed information on the climate of the county, see the section "General nature of the county."

Relief

Relief plays a major part in soil formation. The steeper the soil, the shallower. For example, the Gilpin soils are steep, and they are moderately deep. The Wellston soils are strongly sloping and moderately steep and they are deep. Also, in the Alford map units the Alford silt loam, 6 to 12 percent slopes, eroded, has a thinner subsoil than the Alford silt loam, 2 to 6 percent slopes, as a result of relief. On nearly level soils, if the relief is concave, the water ponds for long periods and such soils as Zipp silty clay loam form.

Conversely, if the relief is convex the water flows off and such soils as McGary silt loam form. Generally, the greater the slope, the better the soil drainage. Natural soil drainage ranges from well drained for soils on ridgetops and side slopes to very poorly drained for soils in depressions.

Time

Time is needed for all the other soil-forming factors to exert their influence on the soil. For example, recent alluvium washed off the uplands fills the valley. The clays, bases, and organic matter move downward with each rain, and the material soon shows color changes. The Stendall soil on the flood plain is an example of a soil formed in recent alluvium. With time, a soil may aggregate, develop blocky structure, and develop a clayey layer, which is the subsoil. With more time and more weathering, a layer such as the fragipan can form. The Bartle soil on the stream terrace is an example of a soil that has a fragipan.

Processes of soil formation

Several processes are involved in the formation of the soils of this county. These processes are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and bases; and the liberation and translocation of silicate clay minerals. In most soils more than one of these processes has been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all the soils of this county. The organic matter content of some soils is low, and that of others is high. Generally, the soils that have the most organic matter, such as the Patton or Huntington soils, have a thick, very dark gray or dark brown surface layer.

Carbonates and bases have been leached from the upper horizons of nearly all the soils of this county. Leaching is generally believed to precede the translocation of silicate clay minerals. All of the carbonates and some of the bases have been leached from the A and B horizons of most soils except some lacustrine soils. The leaching is indicated by an acid reaction. Leaching of wet soils is slower because of high water tables. Clay and silt particles accumulate in pores and other voids and form films on the surfaces along which water moves.

Leaching of bases and translocation of silicate clays and silt are among the more important processes in horizon differentiation in the soils of this county. Alford or Hosmer soil are examples of soils in which translocated silicate clays have accumulated in the B2t horizon in the form of clay films.

The reduction and transfer of iron, or gleying, has occurred in all of the very poorly drained, poorly drained, and somewhat poorly drained soils of this county. In the naturally wet soils this process has been significant in horizon differentiation. The gray color of the subsoil indicates the redistribution of iron oxides. The reduction is commonly accompanied by some transfer of the iron, either from upper horizons to lower horizons or completely out of the profile. Mottles, which are in some horizons, indicate segregation of iron. Concretions, accumulations, and stains are evidence of iron segregation and reduction.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

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

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the 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 frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Channery soil. A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

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

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

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

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

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

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

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

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

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

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

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

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

Cemented.—Hard; little affected by moistening.

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

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.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

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

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

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

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

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

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

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

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

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

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

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

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

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

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A silty, 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. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

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

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

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. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

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

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

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.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

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

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

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and 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 the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

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.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

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

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

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

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

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

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

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

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

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

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

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

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

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

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.

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

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

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

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

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

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

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

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

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

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

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

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

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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

Illustrations

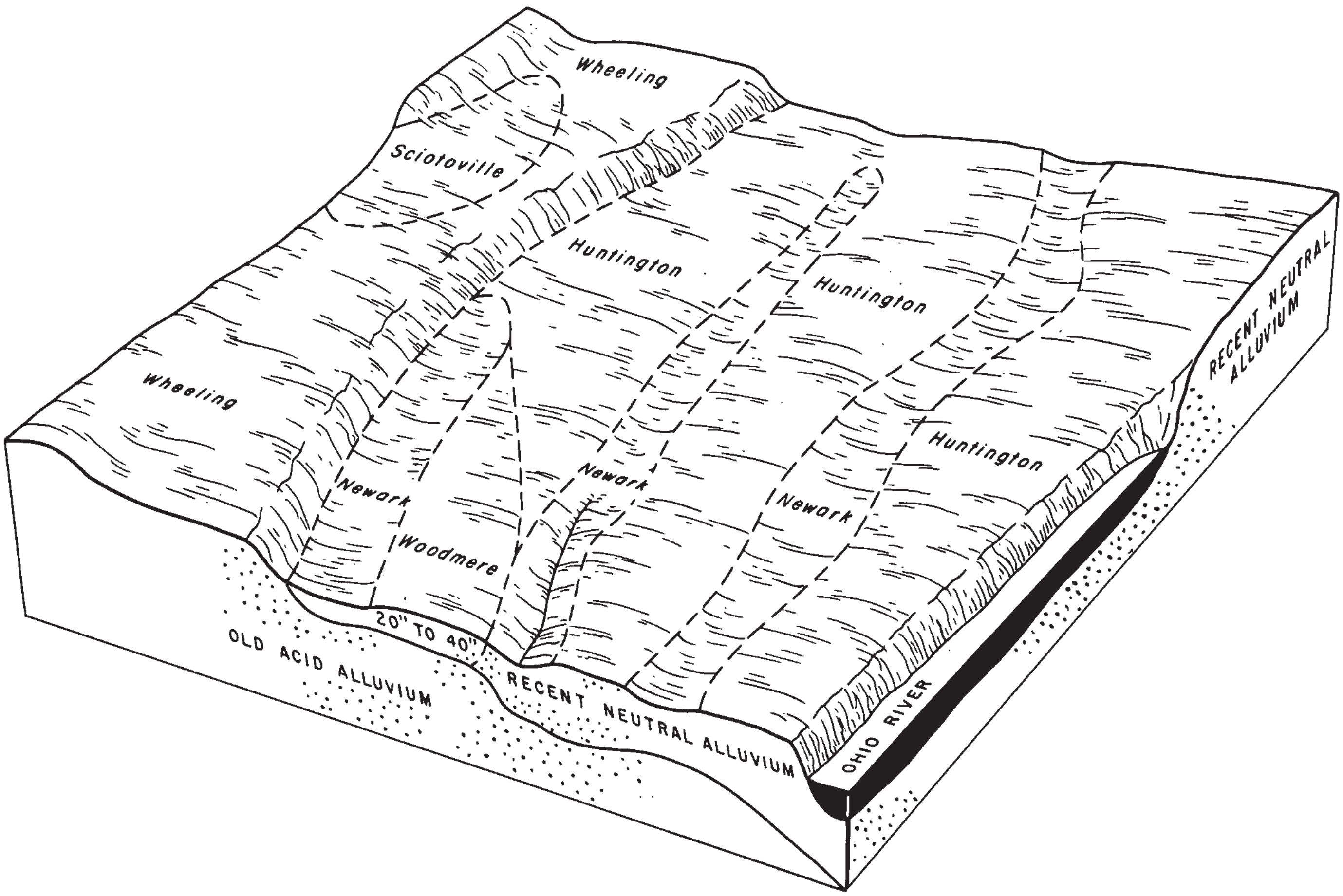

Figure 1.—Pattern of soils and underlying material in Huntington-Newark-Wheeling.

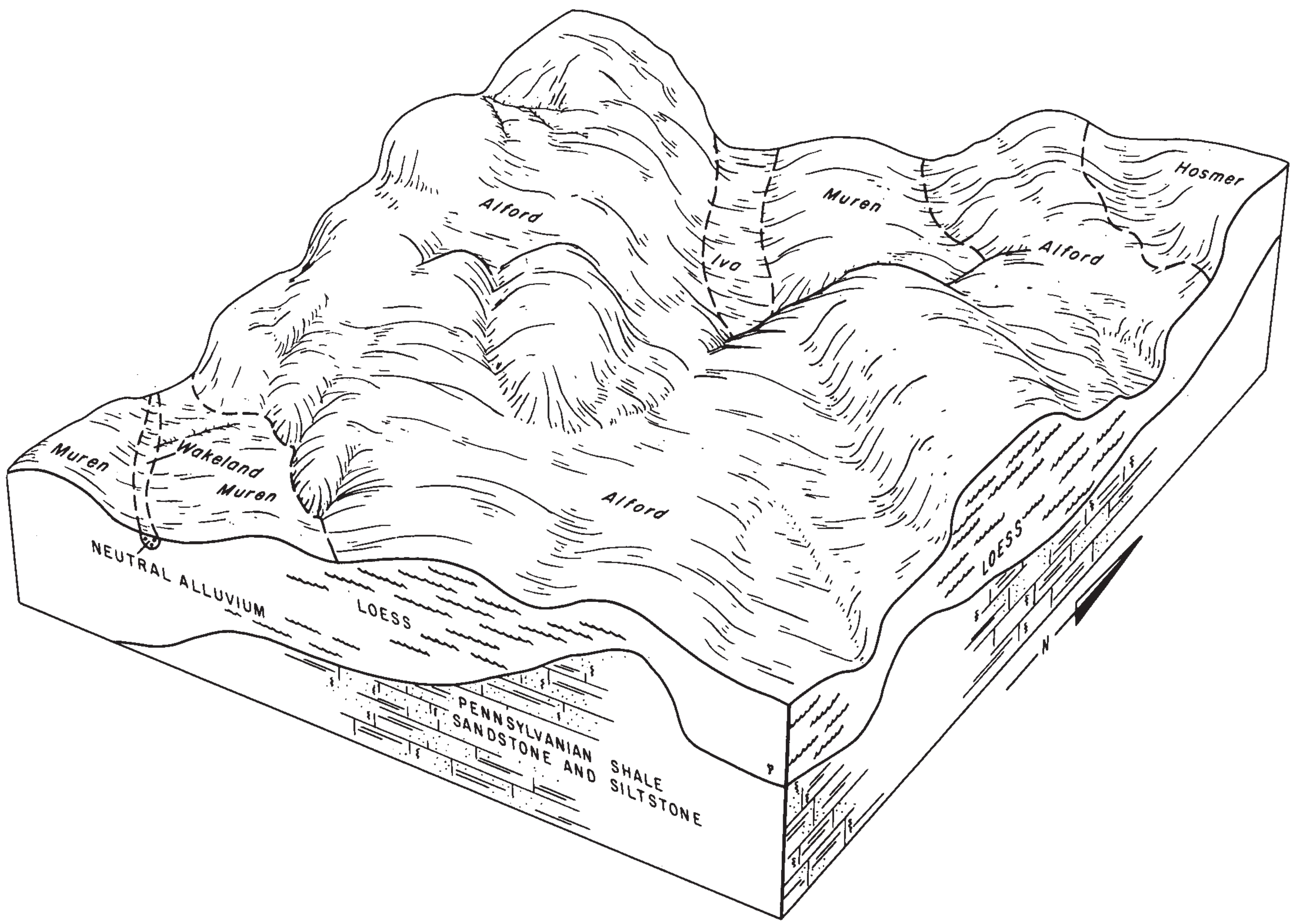

Figure 2.—Pattern of soils and underlying material in Alford-Muren.

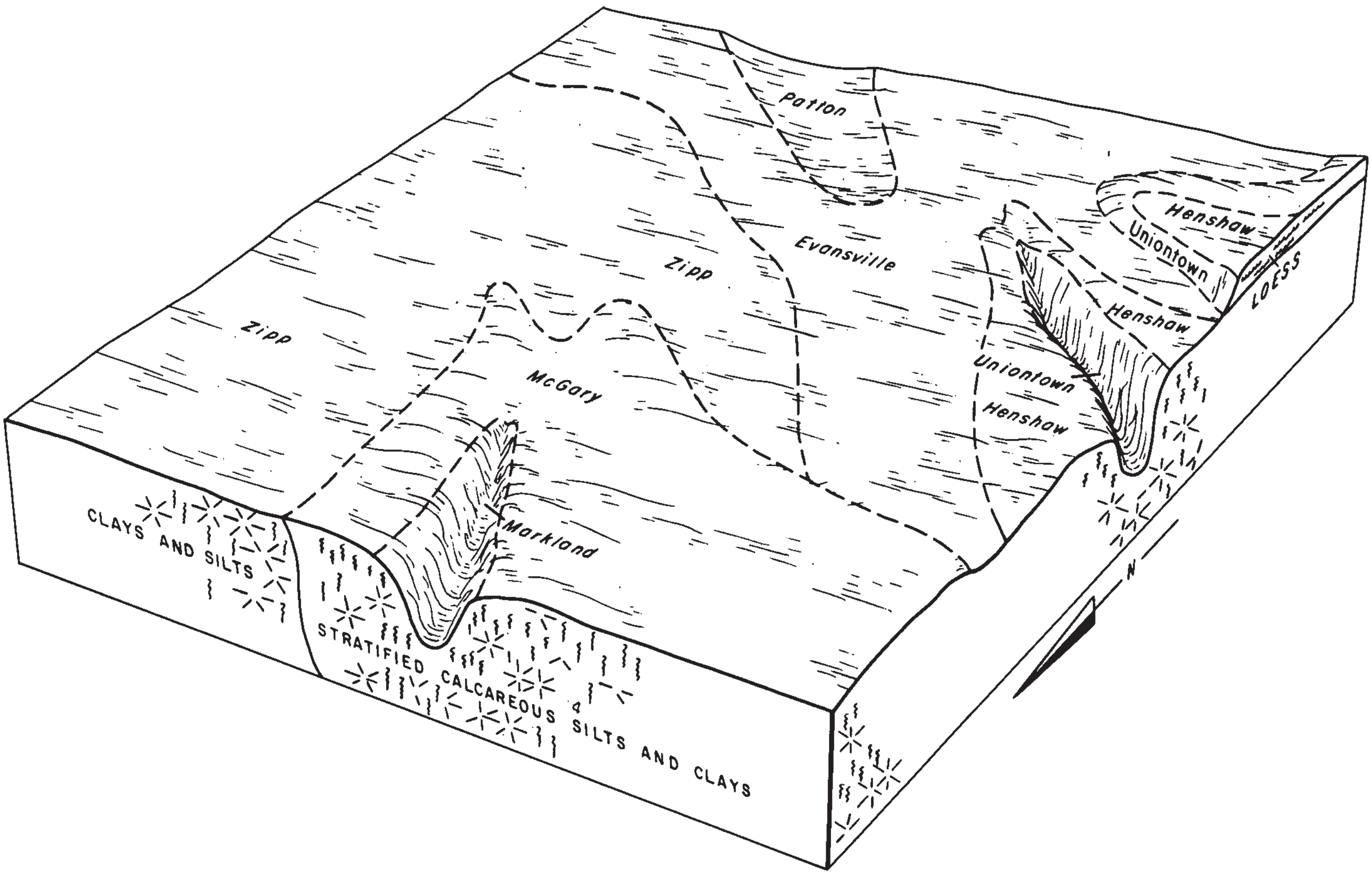

Figure 3.—Pattern of soils and underlying material in Zipp-McGary-Evansville.

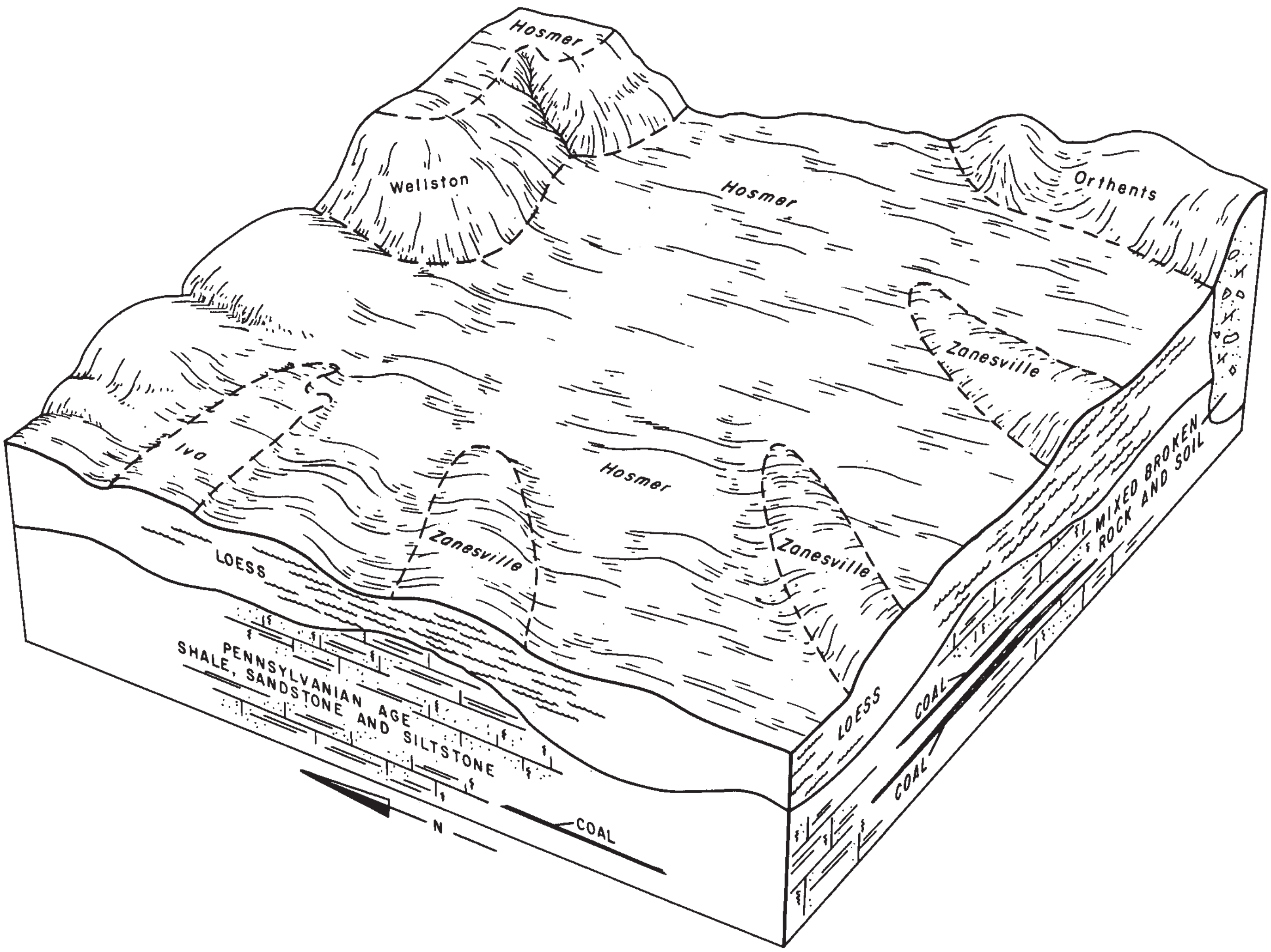

Figure 4.—Pattern of soils and underlying material in Hosmer-Zanesville.

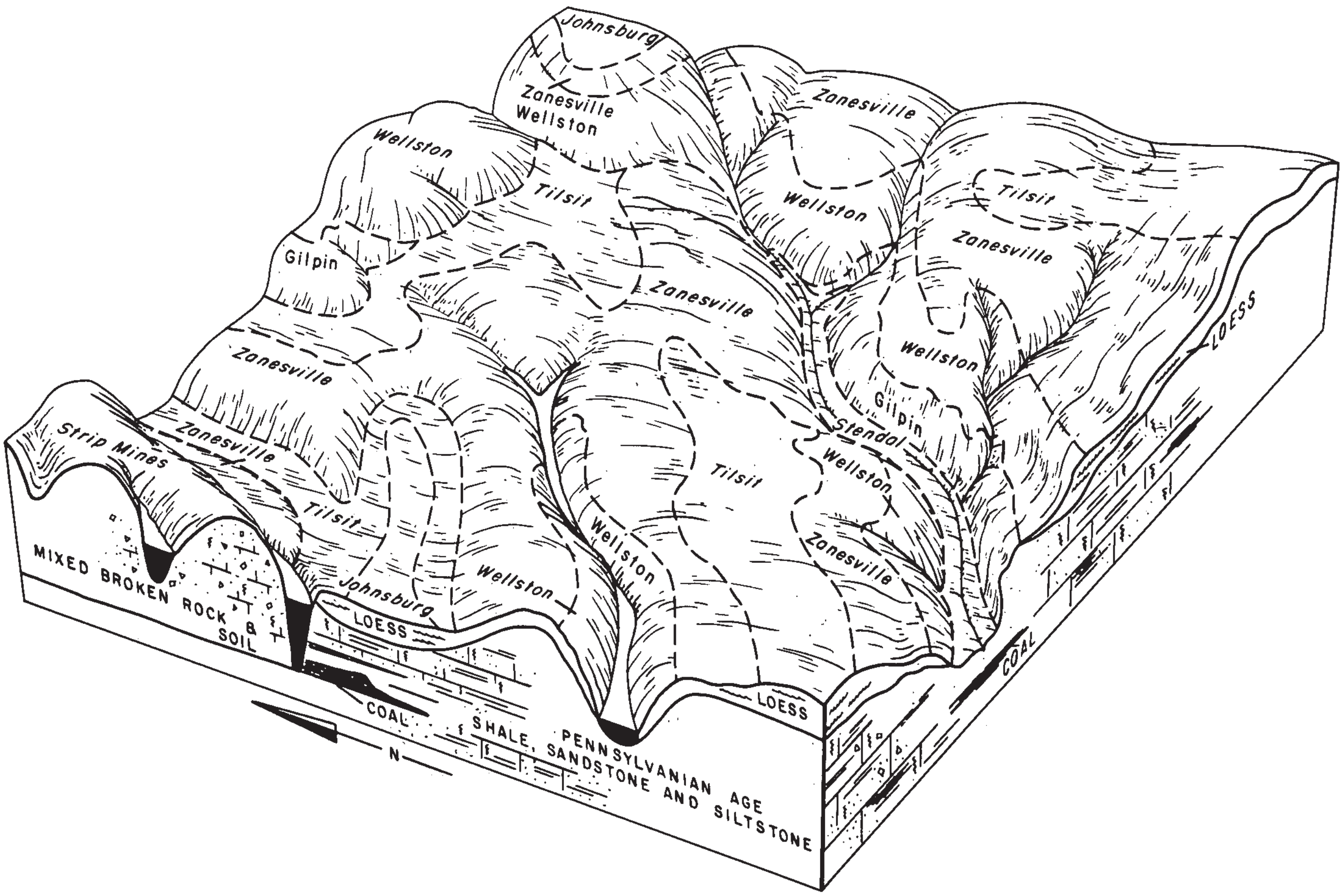

Figure 5.—Pattern of soils and underlying material in Zanesville-Tilsit-Wellston.

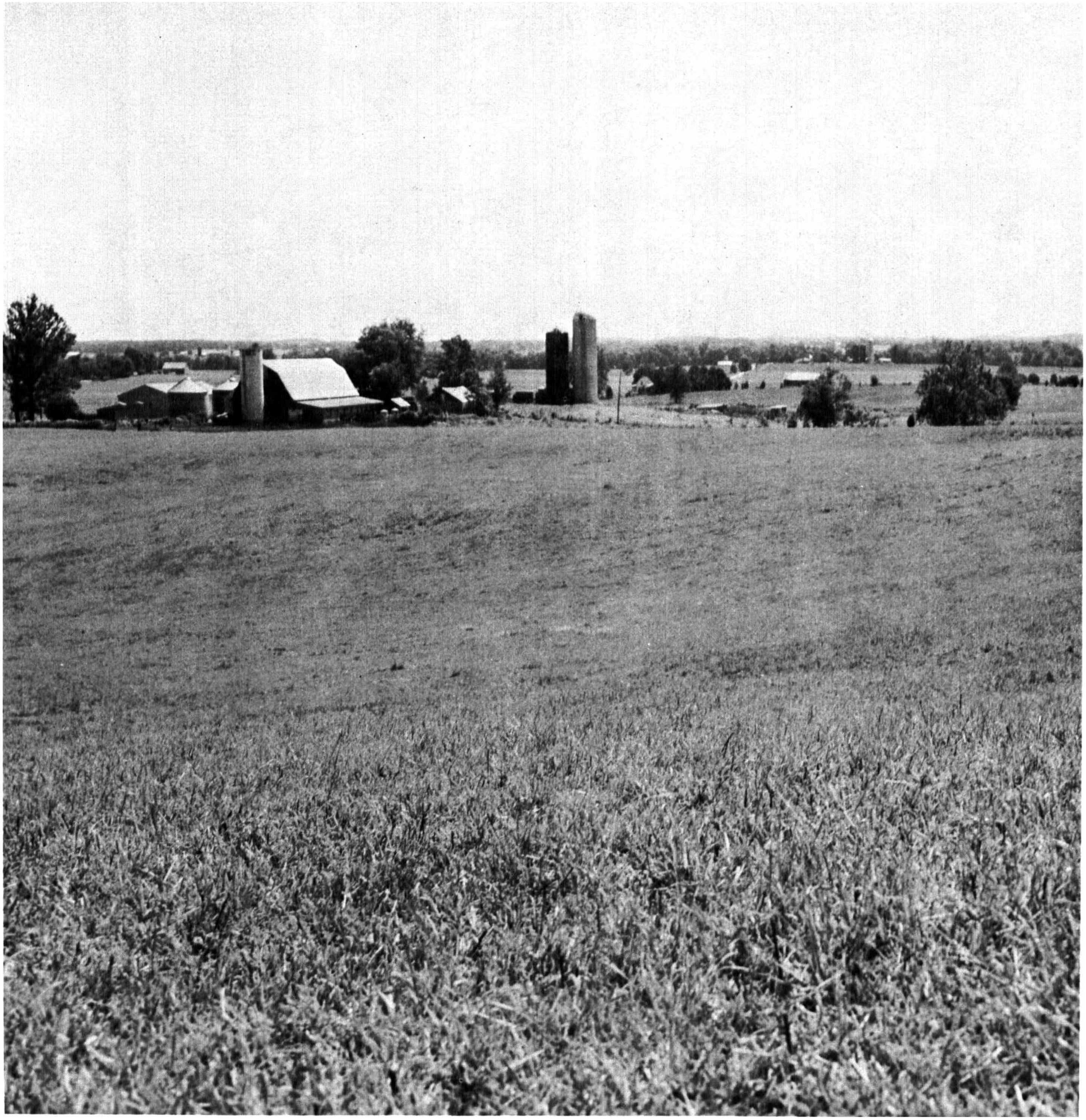

Figure 6.—Fescue on Zanesville and Wellston soils in Zanesville-Tilsit-Wellston map unit.

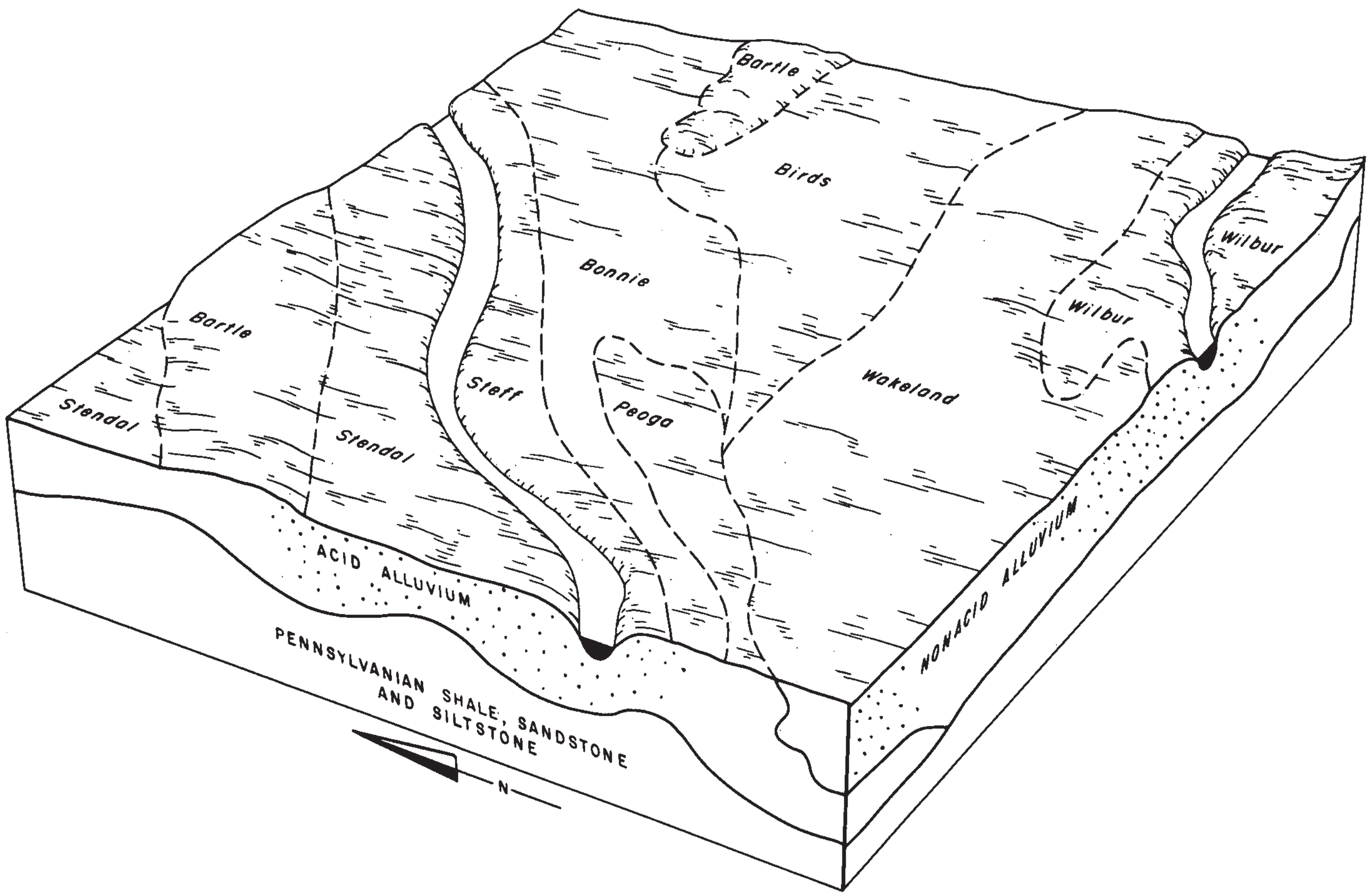

Figure 7.—Pattern of soils and underlying material in Stendal-Wakeland-Bonnie.

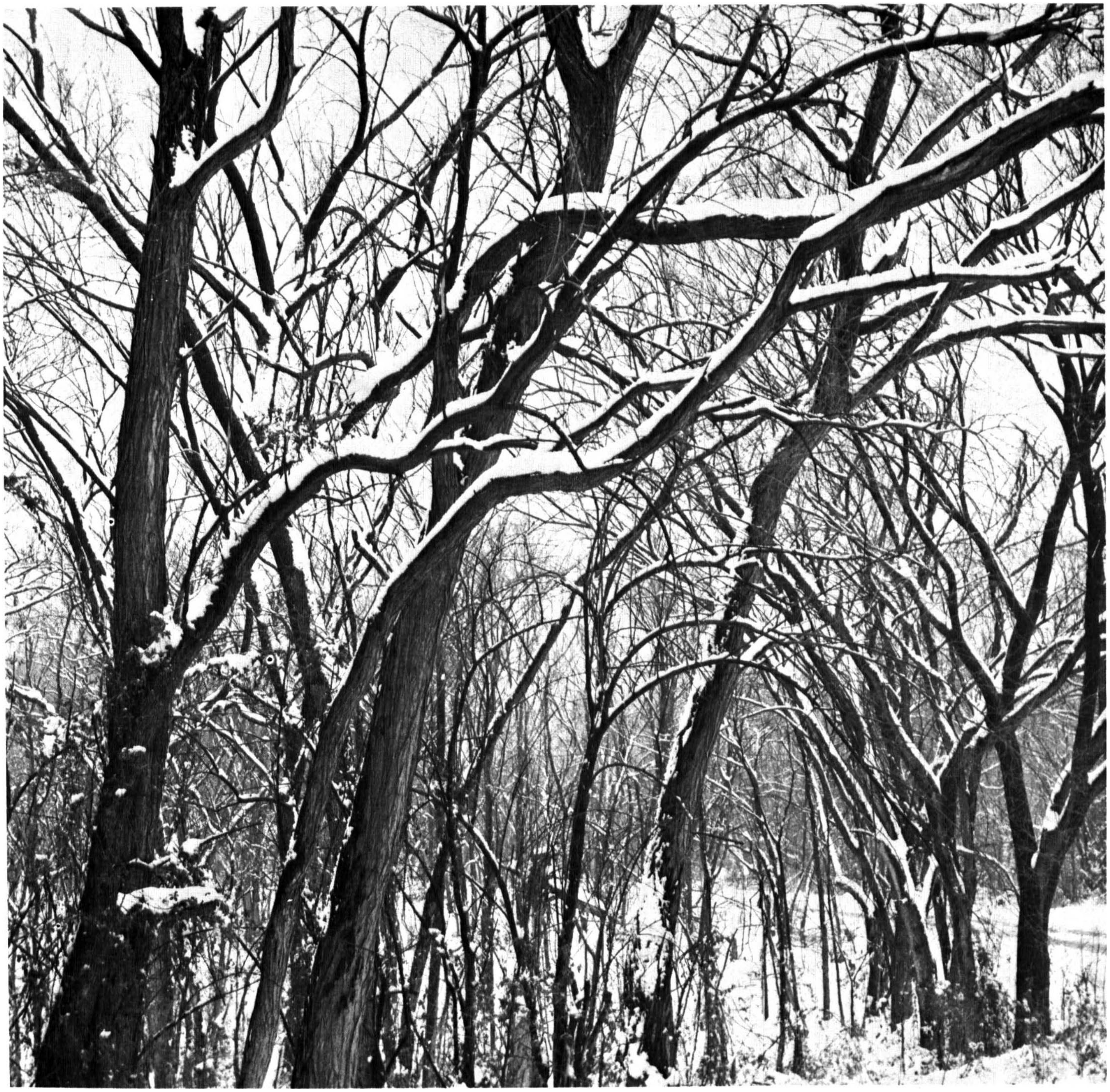

Figure 8.—Black locust on Alford silt loam, 6 to 12 percent slopes, eroded. Black locust grows rapidly on this soil.

Figure 9.—Crayfish castles on wet Bonnie silt loam.

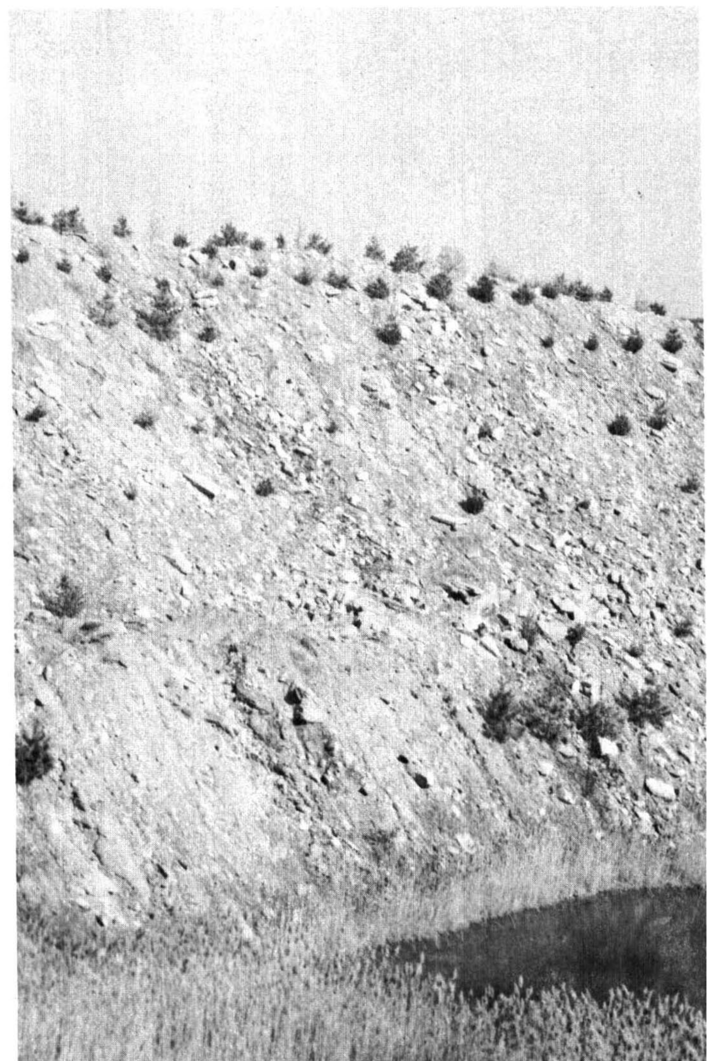

Figure 10.—Seven year old pine trees on Orthents, stony, 33 to 90 percent slopes.

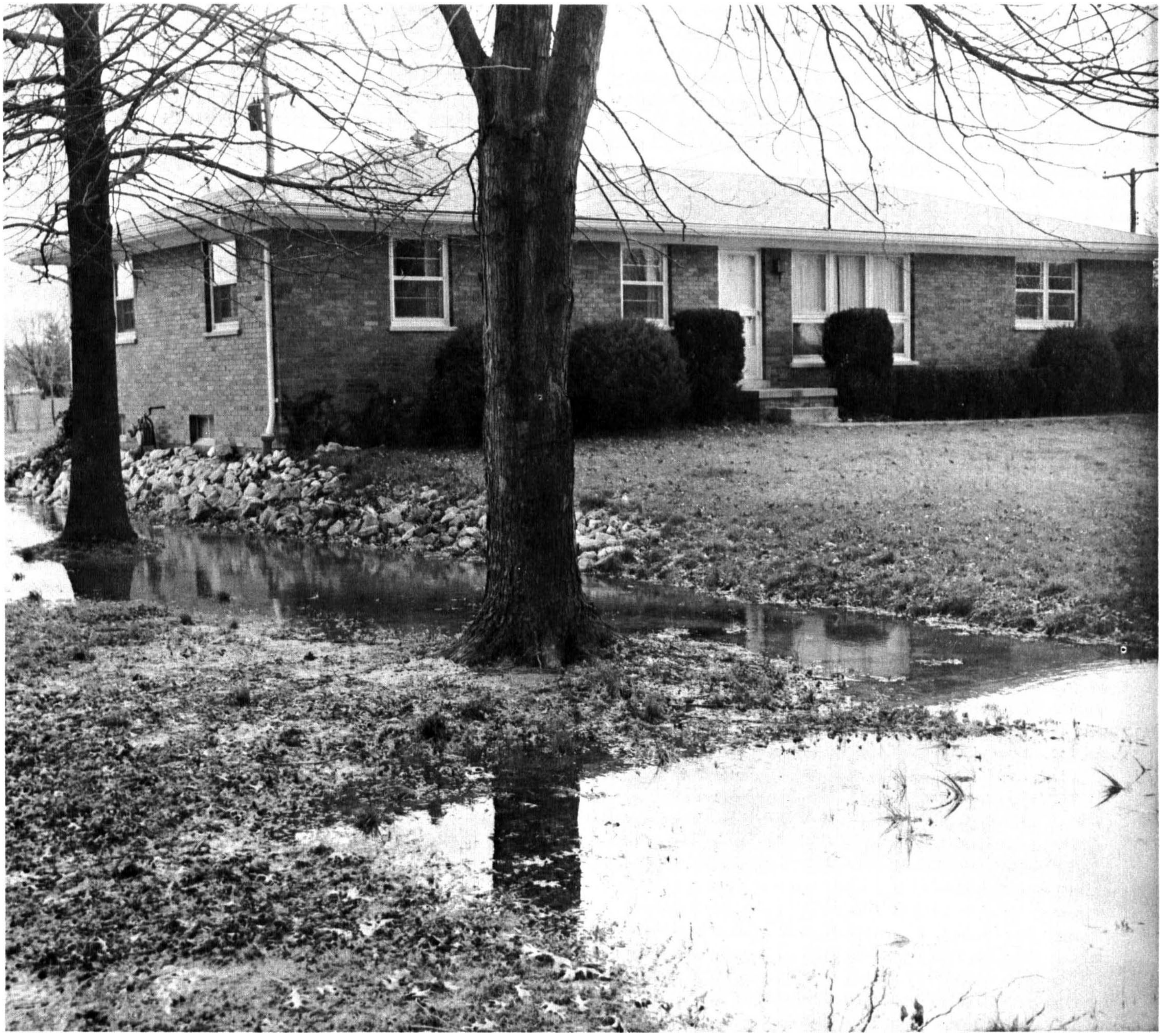

Figure 11.—High water table in Weinbach silt loam, 0 to 2 percent slopes.

Figure 12.—Farm pond in Zanesville silt loam, 6 to 12 percent slopes, severely eroded. Farm ponds provide water for homes and have esthetic value.

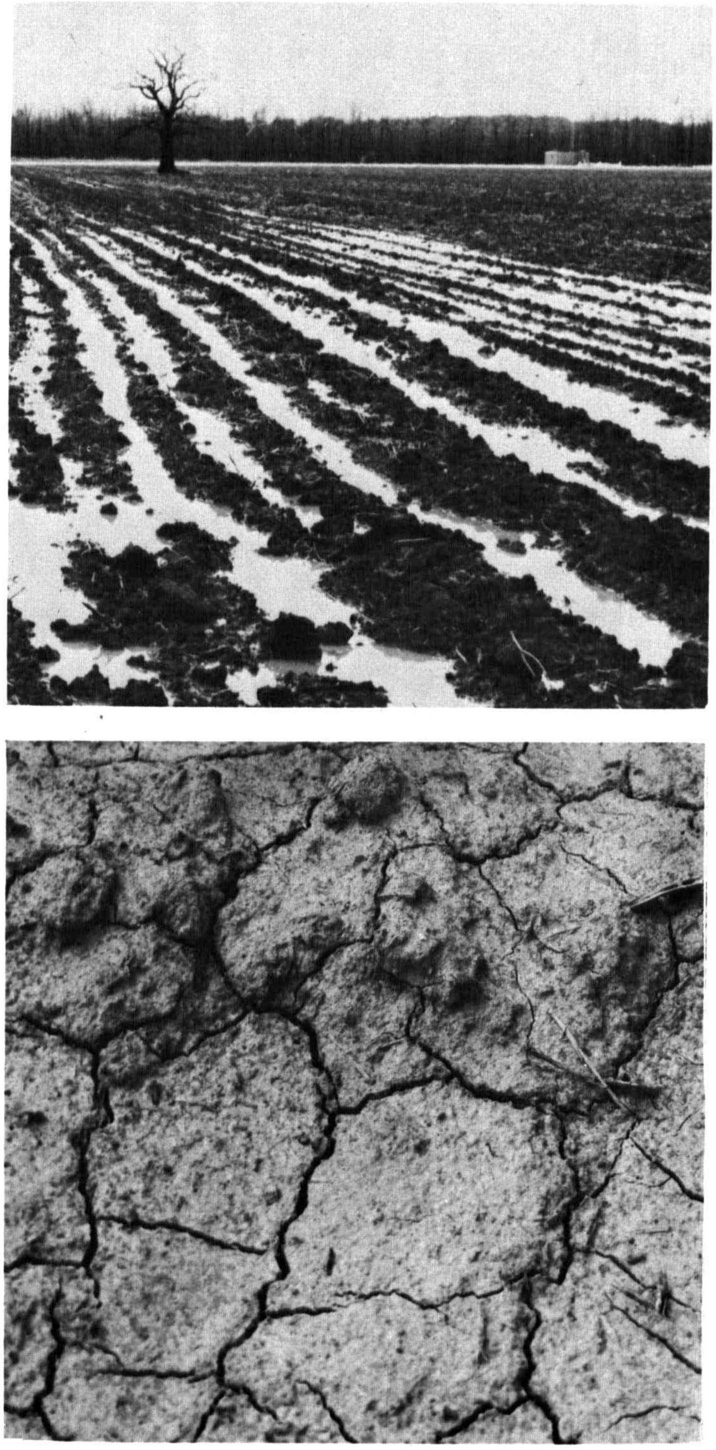

Figure 13.—Top: Zipp silty clay loam ponded in winter. Bottom: Zipp silty clay loam shrinks and cracks when dry.

Figure 14.—Post oak on McGary silt loam. Growth is slow on this soil. Site index 35; woodland suitability group 3o.

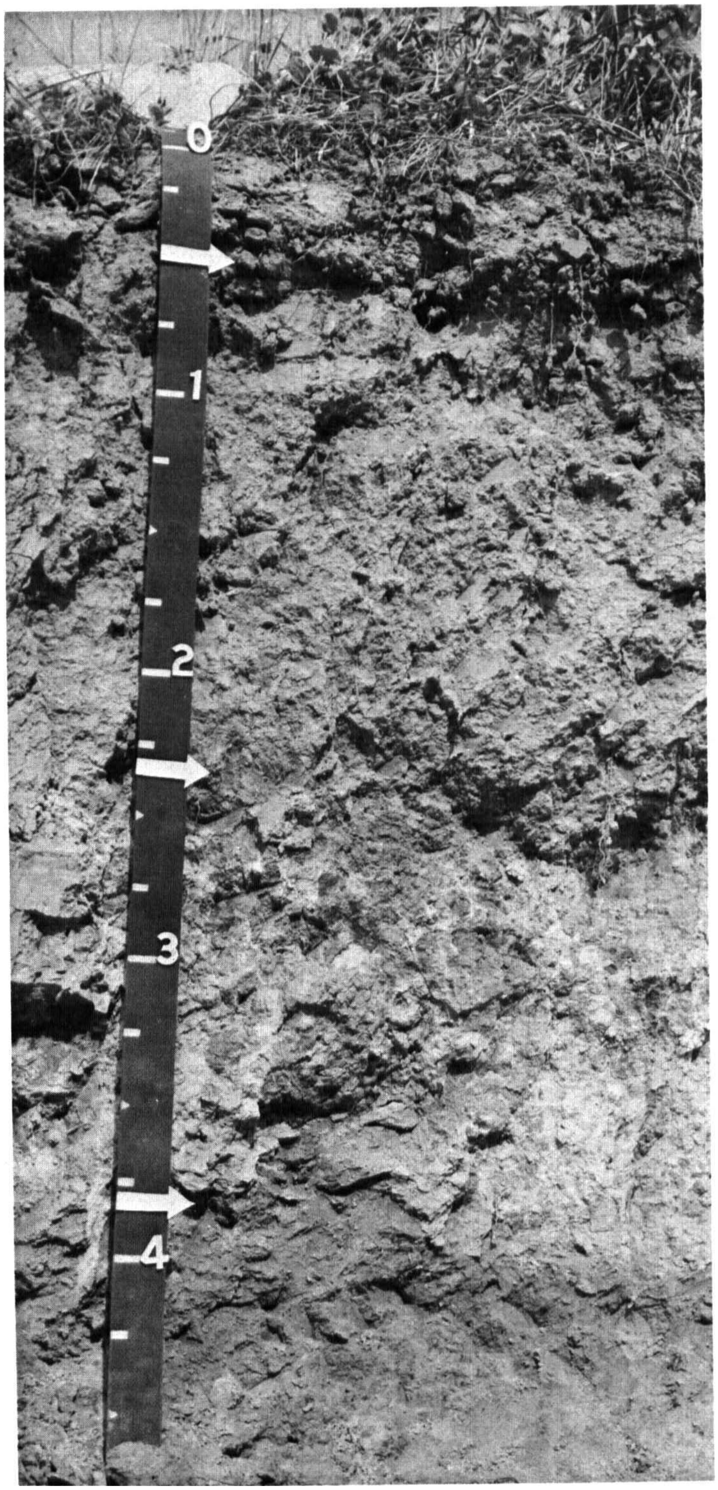

Figure 15.—Profile of Zanesville silt loam.

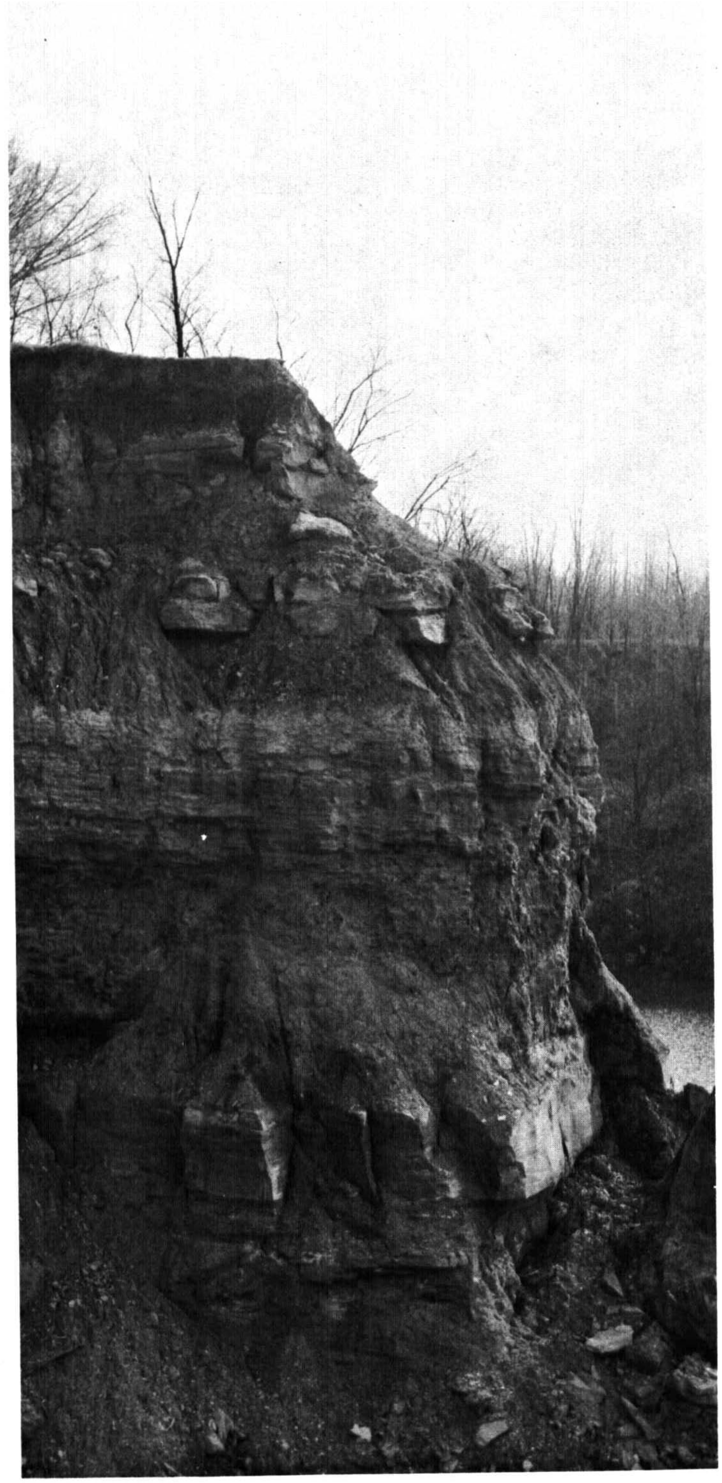

Figure 16.—Pit wall about 75 feet high. Upper 6 feet is Peorian loess; below is interbedded Pennsylvania shale, sandstone, and siltstone.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data are from Evansville and Boonville]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	2 years in 10 will have at least 5 days with-- Maximum temperature equal to or higher than--	2 years in 10 will have at least 5 days with-- Minimum temperature equal to or lower than--	Average monthly total	1 year in 10 will have-- Less than--	1 year in 10 will have-- More than--	Days with snow cover	Average depth of snow on days with snow cover
	°F	°F	°F	°F	In	In	In		In
January---	42	24	61	- 2	3.8	0.6	8.1	5.2	1.9
February--	45	26	63	4	2.8	0.6	5.7	2.9	2.6
March-----	55	34	73	13	4.3	0.8	8.9	1.7	2.4
April-----	68	46	82	28	4.0	1.3	6.8	0.1	3.0
May-------	77	54	88	37	4.1	1.2	7.3	0	0
June------	86	63	94	48	4.1	1.7	8.3	0	0
July------	89	67	95	54	3.2	0.7	6.0	0	0
August----	88	64	94	51	3.4	2.1	5.9	0	0
September-	81	57	92	39	3.0	0.9	7.2	0	0
October---	71	45	83	29	3.0	0.5	6.3	0	0
November--	55	35	72	16	3.1	1.4	5.6	0.4	2.1
December--	44	27	63	5	2.8	1.7	4.4	1.7	2.2
Year---	67	45	---	---	41.6	30.3	53.6	12.0	2.4

TABLE 2.--PROBABILITIES OF LAST FREEZING TEMPERATURES IN SPRING AND FIRST IN FALL

[Data are from Evansville Airport]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than--	Mar. 22	Mar. 28	Apr. 5	Apr. 16	Apr. 25
2 years in 10 later than--	Mar. 12	Mar. 20	Mar. 31	Apr. 11	Apr. 19
5 years in 10 later than--	Feb. 22	Mar. 5	Mar. 21	Apr. 1	Apr. 7
Fall:					
1 year in 10 later than--	Nov. 17	Nov. 10	Oct. 30	Oct. 22	Oct. 10
2 years in 10 later than--	Nov. 25	Nov. 16	Nov. 3	Oct. 25	Oct. 15
5 years in 10 later than--	Dec. 10	Nov. 28	Nov. 11	Nov. 2	Oct. 23

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AfB2	Alford silt loam, 2 to 6 percent slopes, eroded	3,695	1.5
AfC	Alford silt loam, 6 to 12 percent slopes	725	0.3
AfC3	Alford silt loam, 6 to 12 percent slopes, severely eroded	3,295	1.3
AfD	Alford silt loam, 12 to 18 percent slopes	445	0.2
AfD3	Alford silt loam, 12 to 18 percent slopes, severely eroded	1,165	0.5
AfE	Alford silt loam, 18 to 25 percent slopes	410	0.2
Ba	Bartle silt loam	3,170	1.3
Bd	Birds silt loam	4,730	1.9
Bn	Bonnie silt loam	9,660	3.9
Ev	Evansville silt loam	3,905	1.6
GnF	Gilpin silt loam, 25 to 35 percent slopes	1,190	0.5
GpD	Gilpin soils, gullied, 12 to 18 percent slopes	2,160	0.9
HeA	Henshaw silt loam, 0 to 2 percent slopes	3,030	1.2
HoA	Hosmer silt loam, 0 to 2 percent slopes	4,575	1.8
HoB	Hosmer silt loam, 2 to 6 percent slopes	29,170	11.7
HoB3	Hosmer silt loam, 2 to 6 percent slopes, severely eroded	4,390	1.8
HoC	Hosmer silt loam, 6 to 12 percent slopes	895	0.4
HoC3	Hosmer silt loam, 6 to 12 percent slopes, severely eroded	10,850	4.3
HoD	Hosmer silt loam, 12 to 18 percent slopes	285	0.1
HoD3	Hosmer silt loam, 12 to 18 percent slopes, severely eroded	380	0.2
Hu	Huntington silt loam	1,160	0.5
IvA	Iva silt loam, 0 to 2 percent slopes	1,675	0.7
JoA	Johnsburg silt loam, 0 to 2 percent slopes	925	0.4
MkB2	Markland silt loam, 2 to 6 percent slopes, eroded	1,480	0.6
MkC	Markland silt loam, 6 to 18 percent slopes	350	0.1
MoC3	Markland silty clay loam, 6 to 18 percent slopes, severely eroded	1,055	0.4
MrA	McGary silt loam, 0 to 2 percent slopes	6,645	2.7
MuA	Muren silt loam, 0 to 2 percent slopes	325	0.1
MuB2	Muren silt loam, 2 to 6 percent slopes, eroded	1,030	0.4
Ne	Newark silty clay loam	1,070	0.4
OrB	Orthents, 0 to 8 percent slopes	665	0.3
OrD	Orthents, 8 to 25 percent slopes	8,145	3.3
OrG	Orthents, 33 to 90 percent slopes	13,740	5.5
OsF	Orthents stony, 8 to 33 percent slopes	4,835	1.9
OsG	Orthents stony, 33 to 90 percent slopes	10,420	4.2
Pa	Patton silty clay loam	780	0.3
PeB2	Pekin silt loam, 1 to 4 percent slopes, eroded	355	0.1
Pg	Peoga silt loam	735	0.3
ScA	Sciotoville silt loam, 1 to 3 percent slopes	425	0.2
Se	Steff silt loam	3,835	1.5
Sn	Stendal silt loam	15,670	6.3
TtA	Tilsit silt loam, 0 to 2 percent slopes	475	0.2
TtB2	Tilsit silt loam, 2 to 6 percent slopes, eroded	4,280	1.7
UnB2	Uniontown silt loam, 2 to 6 percent slopes, eroded	1,100	0.4
UnC	Uniontown silt loam, 6 to 12 percent slopes	320	0.1
UnD	Uniontown silt loam, 12 to 18 percent slopes	345	0.1
UtC3	Uniontown silty clay loam, 6 to 12 percent slopes, severely eroded	865	0.3
Wa	Wakeland silt loam	11,610	4.6
WbA	Weinbach silt loam, 0 to 2 percent slopes	550	0.2
WeD	Wellston silt loam, 12 to 18 percent slopes	1,835	0.7
WeD3	Wellston silt loam, 12 to 18 percent slopes, severely eroded	2,545	1.0
WeE2	Wellston silt loam, 18 to 25 percent slopes, eroded	3,225	1.3
WhA	Wheeling silt loam, 0 to 2 percent slopes	545	0.2
WhB2	Wheeling silt loam, 2 to 6 percent slopes, eroded	395	0.2
Wm	Wilbur silt loam	2,700	1.1
Wo	Woodmere silty clay loam	480	0.2
ZaB2	Zanesville silt loam, 2 to 6 percent slopes, eroded	9,790	3.9
ZaC	Zanesville silt loam, 6 to 12 percent slopes	1,390	0.6
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	21,460	8.6
ZaD	Zanesville silt loam, 12 to 18 percent slopes	605	0.2
ZaD3	Zanesville silt loam, 12 to 18 percent slopes, severely eroded	6,355	2.5
Zp	Zipp silty clay loam	11,470	4.6
	Water	4,455	1.8
	Total	250,240	100.0

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management in 1976. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
AfB2----------------------- Alford	120	42	48	4.0	8.0
AfC------------------------ Alford	110	38	,4	3.6	7.2
AfC3----------------------- Alford	105	37	42	3.4	6.8
AfD------------------------ Alford	95	33	38	3.1	6.2
AfD3----------------------- Alford	---	---	---	3.0	6.0
AfE------------------------ Alford	---	---	---	2.8	5.6
Ba------------------------- Bartle	110	38	50	3.6	7.2
Bd------------------------- Birds	110	38	---	3.6	7.2
Bn------------------------- Bonnie	105	39	---	4.3	8.4
Ev------------------------- Evansville	145	51	48	4.0	8.0
GnF, GpD------------------- Gilpin	---	---	---	---	---
HeA------------------------ Henshaw	125	45	---	4.0	---
HoA------------------------ Hosmer	105	37	47	3.4	6.8
HoB------------------------ Hosmer	105	37	47	3.4	6.8
HoB3----------------------- Hosmer	85	30	38	2.8	5.6
HoC------------------------ Hosmer	95	33	41	3.1	6.2
HoC3----------------------- Hosmer	75	26	34	2.5	5.0
HoD------------------------ Hosmer	80	28	36	2.6	5.2
HoD3----------------------- Hosmer	---	---	27	2.0	4.0
Hu------------------------- Huntington	125	43	---	3.0	6.0
IvA------------------------ Iva	135	42	39	4.4	8.8

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
JoA------------------------ Johnsburg	100	35	45	3.3	6.6
MkB2----------------------- Markland	80	28	36	2.6	5.2
MkC------------------------ Markland	70	24	32	2.3	4.6
MoC3----------------------- Markland	---	---	27	2.0	4.0
MrA------------------------ McGary	100	35	45	2.3	4.6
MuA------------------------ Muren	125	44	50	4.1	8.2
MuB2----------------------- Muren	120	42	48	4.0	8.0
Ne------------------------- Newark	120	40	---	4.0	8.0
OrB**, OrD**, OrG**, OsF**, OsG**. Orthents					
Pa------------------------- Patton	150	53	50	4.0	8.0
PeB2----------------------- Pekin	100	37	47	3.1	6.2
Pg------------------------- Peoga	100	42	42	4.1	8.2
ScA------------------------ Sciotoville	100	40	48	4.0	8.0
Se------------------------- Steff	120	45	---	4.0	8.0
Sn------------------------- Stendal	115	42	---	4.3	8.6
TtA------------------------ Tilsit	95	37	47	3.5	7.0
TtB2----------------------- Tilsit	85	35	45	3.3	6.6
UnB2----------------------- Uniontown	110	40	44	4.0	8.0
UnC------------------------ Uniontown	95	39	44	3.6	7.2
UnD------------------------ Uniontown	90	32	37	3.0	6.0
UtC3----------------------- Uniontown	80	28	32	2.8	5.6
Wa------------------------- Wakeland	120	43	---	4.4	8.8

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
WbA: Weinbach	110	38	47	3.6	7.2
WeD: Wellston	80	28	35	3.0	6.0
WeD3: Wellston	70	26	31	2.7	5.4
WeE2: Wellston	---	---	30	2.9	5.8
WhA: Wheeling	100	43	53	4.2	8.4
WhB2: Wheeling	100	40	50	4.2	8.4
Wm: Wilbur	125	44	---	4.1	8.2
Wo: Woodmere	125	44	50	4.1	8.2
ZaB2: Zanesville	100	35	47	3.5	7.0
ZaC, ZaC3: Zanesville	80	30	41	2.7	5.2
ZaD, ZaD3: Zanesville	70	27	33	2.2	4.4
Zp: Zipp	95	37	42	3.4	6.8

* 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 a period of 30 days.

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

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
AfB2, AfC, AfC3, AfD, AfD3: Alford	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	94 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
AfE: Alford	1r	Moderate	Moderate	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
Ba: Bartle	3o	Slight	Slight	Slight	Slight	White oak Pin oak Yellow-poplar Sweetgum	75 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
Bd: Birds	2w	Slight	Severe	Moderate	Slight	Eastern cottonwood Pin oak Sweetgum Cherrybark oak American sycamore	100 90 --- --- ---	Eastern cottonwood, red maple, American sycamore, baldcypress, water tupelo.
Bn: Bonnie	2w	Slight	Moderate	Moderate	Severe	Pin oak Eastern cottonwood Sweetgum Cherrybark oak American sycamore	90 100 --- --- ---	Eastern cottonwood, red maple, American sycamore, sweetgum, baldcypress, pin oak.
Ev: Evansville	2w	Slight	Severe	Moderate	Moderate	Pin oak White oak Sweetgum	90 75 90	Eastern white pine, baldcypress, Norway spruce, red maple, white ash, sweetgum.
GnF, GpD: Gilpin	3r	Moderate	Moderate	Moderate	Slight	Northern red oak Yellow-poplar		Virginia pine, eastern white pine, black cherry, yellow-poplar.
HeA: Henshaw	1w	Slight	Moderate	Slight	Severe	Pin oak Yellow-poplar Sweetgum	95 95 95	White ash, sweetgum, eastern cottonwood, yellow-poplar.
HoA, HoB, HoB3, HoC, HoC3: Hosmer	2o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Virginia pine Sugar maple	75 90 75 75	Eastern white pine, shortleaf pine, red pine, yellow-poplar, white ash.
HoD, HoD3: Hosmer	2r	Moderate	Moderate	Slight	Slight	White oak Yellow-poplar Virginia pine Sugar maple	75 90 75 75	Eastern white pine, shortleaf pine, red pine, yellow-poplar, white ash.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
Hu: Huntington	1o	Slight	Slight	Slight	Slight	Yellow-poplar Northern red oak	95 85	Yellow-poplar, black walnut, black locust, eastern white pine.
IvA: Iva	3o	Slight	Moderate	Slight	Slight	White oak Pin oak Yellow-poplar Sweetgum	75 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
JoA: Johnsburg	3o	Slight	Slight	Slight	Moderate	White oak Northern red oak Pin oak Yellow-poplar Sweetgum	70 75 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
MkB2, MkC, MoC3: Markland	2c	Slight	Slight	Slight	Slight	White oak Northern red oak	75 75	Eastern white pine, red pine, yellow-poplar, white ash.
MrA: McGary	3o	Slight	Slight	Slight	Slight	White oak Pin oak Yellow-poplar Sweetgum	70 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
MuA, MuB2: Muren	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, black locust, yellow-poplar, white ash.
Ne: Newark	1w	Slight	Moderate	Slight	Moderate	Pin oak Eastern cottonwood Northern red oak Yellow-poplar Sweetgum	99 94 85 95 88	Eastern cottonwood, sweetgum, post oak, loblolly pine, red maple, American sycamore, eastern white pine, yellow-poplar.
Pa: Patton	2w	Slight	Severe	Moderate	Moderate	Pin oak White oak Sweetgum Northern red oak	85 75 80 75	Eastern white pine, baldcypress, Norway spruce, red maple, white ash, sweetgum.
PeB2: Pekin	3d	Slight	Slight	Slight	Moderate	White oak Yellow-poplar Virginia pine Sugar maple	70 85 75 75	Eastern white pine, shortleaf pine, red pine, yellow-poplar, white ash.
Pg: Peoga	2w	Slight	Severe	Severe	Moderate	Pin oak White oak Sweetgum	90 75 90	Eastern white pine, baldcypress, Norway spruce, red maple, white ash, sweetgum.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
ScA----------------- Sciotoville	2o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Eastern white pine--	80 90 90	Eastern white pine, yellow-poplar, European larch.
Se------------------ Steff	1w	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar-------	80 95	Yellow-poplar, eastern white pine, loblolly pine, sweetgum, black walnut.
Sn------------------ Stendal	2w	Slight	Moderate	Slight	Slight	Pin oak------------- Sweetgum------------ Yellow-poplar------- Virginia pine-------	90 85 90 90	Eastern white pine, baldcypress, American sycamore, red maple, white ash.
TtA, TtB2----------- Tilsit	3o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Eastern white pine-- Virginia pine------- Shortleaf pine------	70 89 80 70 78	Eastern white pine, Virginia pine, shortleaf pine.
UnB2, UnC, UnD------ Uniontown	2o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Sweetgum------------ Virginia pine-------	81 91 90 80	Yellow-poplar, eastern white pine, black walnut, shortleaf pine, Virginia pine.
UtC3---------------- Uniontown	2o	Slight	Moderate	Slight	Slight	Northern red oak---- Virginia pine-------	70 70	Virginia pine, loblolly pine.
Wa------------------ Wakeland	2w	Slight	Moderate	Slight	Slight	Pin oak------------- Sweetgum------------ Yellow-poplar------- Virginia pine-------	90 85 90 90	Eastern white pine, baldcypress, American sycamore, red maple, white ash.
WbA----------------- Weinbach	2w	Slight	Moderate	Slight	Moderate	White oak----------- Pin oak------------- Yellow-poplar------- Sweetgum------------	75 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
WeD, WeD3, WeE2----- Wellston	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine-------		Eastern white pine, black walnut, yellow-poplar.
WhA, WhB2----------- Wheeling	1o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar-------	80 90	Eastern white pine, yellow-poplar, black walnut.
Wm------------------ Wilbur	1o	Slight	Slight	Slight	Slight	Yellow-poplar-------	100	Eastern white pine, black walnut, yellow-poplar, black locust.
Wo------------------ Woodmere	1o	Slight	Slight	Slight	Slight	Yellow-poplar-------	100	Eastern white pine, black walnut, yellow-poplar, black locust.
ZaB2, ZaC, ZaC3----- Zanesville	3o	Slight	Slight	Slight	Slight	Northern red oak---- Virginia pine-------	68 70	Virginia pine, eastern white pine, shortleaf pine.
ZaD, ZaD3----------- Zanesville	3r	Slight	Moderate	Slight	Moderate	Northern red oak---- Virginia pine-------	68 70	Virginia pine, eastern white pine, shortleaf pine.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
Zp: Zipp	2w	Slight	Severe	Severe	Severe	Pin oak White oak Sweetgum	85 75 90	Eastern white pine, baldcypress, Norway spruce, red maple, white ash, sweetgum.

TABLE 6.--BUILDING SITE DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
AfB2----------------- Alford	Slight----------------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
AfC, AfC3----------- Alford	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: frost action, low strength.
AfD, AfD3, AfE----- Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, slope, low strength.
Ba------------------- Bartle	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action, wetness.
Bd------------------- Birds	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, frost action.
Bn------------------- Bonnie	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, frost action.
Ev------------------- Evansville	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.
GnF, GpD*----------- Gilpin	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
HeA----------------- Henshaw	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Moderate: low strength, floods, wetness.
HoA----------------- Hosmer	Moderate: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.
HoB, HoB3----------- Hosmer	Moderate: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Severe: frost action.
HoC, HoC3----------- Hosmer	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Severe: frost action.
HoD, HoD3----------- Hosmer	Severe: slope.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Severe: frost action, slope.
Hu------------------- Huntington	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.
IvA----------------- Iva	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.

See footnote at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
JoA-----Johnsburg	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.
MkB2-----Markland	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
MkC, MoC3-----Markland	Moderate: too clayey, slope.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength.
MrA-----McGary	Severe: wetness.	Severe: shrink-swell, wetness, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.
MuA-----Muren	Moderate: wetness.	Moderate: low strength, shrink-swell.	Moderate: wetness, low strength.	Moderate: low strength, shrink-swell.	Severe: frost action, low strength.
MuB2-----Muren	Moderate: wetness.	Moderate: low strength, shrink-swell.	Moderate: wetness, low strength.	Moderate: slope, low strength.	Severe: frost action, low strength.
Ne-----Newark	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
OrB*, OrD*, OrG*, OsF*, OsG*. Orthents					
Pa-----Patton	Severe: wetness.	Severe: wetness, low strength, floods.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, frost action, low strength.
PeB2-----Pekin	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: frost action.
Pg-----Peoga	Severe: wetness.	Severe: wetness, low strength.	Severe: wetness.	Severe: wetness, low strength.	Severe: wetness, frost action, low strength.
ScA-----Sciotoville	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: frost action, low strength.
Se-----Steff	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.
Sn-----Stendal	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.
TtA-----Tilsit	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: low strength.
TtB2-----Tilsit	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Moderate: low strength.

See footnote at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
UnB2: Uniontown	Moderate: wetness.	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Severe: low strength.
UnC: Uniontown	Moderate: slope, wetness.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Severe: low strength.
UnD: Uniontown	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength.
UtC3: Uniontown	Moderate: slope, wetness.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Severe: low strength.
Wa: Wakeland	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.
WbA: Weinbach	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: frost action, wetness.
WeD, WeD3, WeE2: Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
WhA: Wheeling	Slight	Slight	Slight	Slight	Moderate: frost action, low strength.
WhB2: Wheeling	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
Wm: Wilbur	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.
Wo: Woodmere	Moderate: floods, wetness.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, frost action, low strength.
ZaB2: Zanesville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.
ZaC, ZaC3: Zanesville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: frost action.
ZaD, ZaD3: Zanesville	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, frost action.
Zp: Zipp	Severe: wetness, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, floods, low strength.

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

TABLE 7.--SANITARY FACILITIES

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AfB2: Alford	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
AfC, AfC3: Alford	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
AfD, AfD3, AfE: Alford	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Ba: Bartle	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
Bd: Birds	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Bn: Bonnie	Severe: floods, percs slowly, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Ev: Evansville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
GnF, GpD*: Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
HeA: Henshaw	Severe: wetness, percs slowly.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Good.
HoA: Hosmer	Severe: percs slowly.	Slight	Moderate: wetness.	Slight	Good.
HoB, HoB3: Hosmer	Severe: percs slowly.	Moderate: slope.	Moderate: wetness.	Slight	Good.
HoC, HoC3: Hosmer	Severe: percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: slope.	Fair: slope.
HoD, HoD3: Hosmer	Severe: percs slowly, slope.	Severe: slope.	Moderate: slope, wetness.	Severe: slope.	Poor: slope.
Hu: Huntington	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
IvA: Iva	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
JoA: Johnsburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
MkB2: Markland	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 7.--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
MkC, MoC3: Markland	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
MrA: McGary	Severe: wetness, percs slowly.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
MuA, MuB2: Muren	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Good.
Ne: Newark	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
OrB*, OrD*, OrG*, OsF*, OsG*. Orthents					
Pa: Patton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
PeB2: Pekin	Severe: percs slowly, wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Fair: wetness.
Pg: Peoga	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
ScA: Sciotoville	Severe: percs slowly, wetness.	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness, seepage.	Fair: too clayey, wetness.
Se: Steff	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.	Good.
Sn: Stendal	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
TtA, TtB2: Tilsit	Severe: percs slowly, wetness.	Moderate: depth to rock.	Severe: wetness, depth to rock.	Severe: wetness.	Fair: too clayey.
UnB2: Uniontown	Moderate: percs slowly, wetness.	Moderate: slope, seepage.	Moderate: wetness.	Slight	Good.
UnC: Uniontown	Moderate: percs slowly, wetness.	Severe: slope.	Moderate: wetness.	Moderate: slope.	Fair: slope.
UnD: Uniontown	Severe: slope.	Severe: slope.	Moderate: wetness, slope.	Severe: slope.	
UtC3: Uniontown	Moderate: percs slowly, wetness.	Severe: slope.	Moderate: wetness.	Moderate: slope.	Fair: too clayey.
Wa: Wakeland	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
WbA: Weinbach	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

See footnote at end of table.

TABLE 7.--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
WeD, WeD3, WeE2----- Wellston	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
WhA------------------ Wheeling	Moderate: wetness, seepage.	Moderate: seepage, wetness.	Severe: seepage, wetness.	Moderate: wetness.	Good.
WhB2----------------- Wheeling	Moderate: wetness, seepage.	Moderate: slope, seepage, wetness.	Severe: seepage, wetness.	Moderate: wetness.	Good.
Wm------------------- Wilbur	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Fair: wetness.
Wo------------------- Woodmere	Severe: percs slowly, wetness, floods.	Severe: floods, wetness.	Severe: wetness, too clayey, floods.	Severe: floods, wetness.	Fair: too clayey, wetness.
ZaB2----------------- Zanesville	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: depth to rock, wetness.	Moderate: wetness.	Good.
ZaC, ZaC3------------ Zanesville	Severe: percs slowly, wetness.	Severe: slope.	Severe: depth to rock, wetness.	Moderate: slope, wetness.	Fair: slope.
ZaD, ZaD3------------ Zanesville	Severe: slope.	Severe: slope.	Severe: depth to rock, wetness.	Severe: slope.	Poor: slope.
Zp------------------- Zipp	Severe: wetness, percs slowly, floods.	Slight------------	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: too clayey, wetness.

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

TABLE 8.--CONSTRUCTION MATERIALS

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AfB2: Alford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
AfC, AfC3: Alford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
AfD, AfD3, AfE: Alford	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Ba: Bartle	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Bd: Birds	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Bn: Bonnie	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Ev: Evansville	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
GnF, GpD*: Gilpin	Poor: thin layer, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
HeA: Henshaw	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
HoA, HoB, HoB3: Hosmer	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
HoC, HoC3: Hosmer	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
HoD, HoD3: Hosmer	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Hu: Huntington	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
IvA: Iva	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
JoA: Johnsburg	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
MkB2, MkC, MoC3: Markland	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
MrA: McGary	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
MuA, MuB2: Muren	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ne----- Newark	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
OrB*, OrD*, OrG*, OsF*, OsG*. Orthents				
Pa----- Patton	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
PeB2----- Pekin	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Pg----- Peoga	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
ScA----- Sciotoville	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Se----- Steff	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Sn----- Stendal	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
TtA, TtB2----- Tilsit	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
UnB2----- Uniontown	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
UnC----- Uniontown	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
UnD----- Uniontown	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	
UtC3----- Uniontown	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, too clayey.
Wa----- Wakeland	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
WbA----- Weinbach	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
WeD, WeD3, WeE2----- Wellston	Fair: low strength, slope, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
WhA, WhB2----- Wheeling	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Wm----- Wilbur	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Wo----- Woodmere	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
ZaB2------------------- Zanesville	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
ZaC, ZaC3-------------- Zanesville	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
ZaD, ZaD3-------------- Zanesville	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Zp--------------------- Zipp	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.

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

TABLE 9.--WATER MANAGEMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
AfB2----------------- Alford	Seepage---------	Favorable-------	No water--------	Not needed------	Favorable-------	Erodes easily.
AfC, AfC3------------ Alford	Seepage---------	Favorable-------	No water--------	Not needed------	Favorable-------	Slope, erodes easily.
AfD, AfD3, AfE------- Alford	Seepage---------	Favorable-------	No water--------	Not needed------	Slope-----------	Slope, erodes easily.
Ba------------------- Bartle	Favorable-------	Wetness---------	Slow refill-----	Percs slowly, frost action.	Not needed------	Wetness, percs slowly, erodes easily.
Bd------------------- Birds	Favorable-------	Wetness---------	Slow refill-----	Floods, frost action.	Not needed------	Wetness, erodes easily.
Bn------------------- Bonnie	Favorable-------	Wetness---------	Favorable-------	Floods, frost action.	Not needed------	Wetness, erodes easily.
Ev------------------- Evansville	Seepage---------	Wetness---------	Slow refill-----	Frost action----	Not needed------	Wetness, erodes easily.
GnF, GpD*------------ Gilpin	Slope, depth to rock, seepage.	Thin layer------	No water--------	Not needed------	Slope, depth to rock.	Slope, depth to rock.
HeA------------------ Henshaw	Favorable-------	Wetness---------	Favorable-------	Favorable-------	Wetness---------	Wetness.
HoA------------------ Hosmer	Favorable-------	Piping----------	Deep to water, slow refill.	Not needed------	Not needed------	Erodes easily, rooting depth.
HoB, HoB3------------ Hosmer	Favorable-------	Piping----------	Deep to water, slow refill.	Not needed------	Rooting depth, erodes easily.	Erodes easily, rooting depth.
HoC, HoC3------------ Hosmer	Favorable-------	Piping----------	Deep to water, slow refill.	Not needed------	Rooting depth, erodes easily.	Slope, erodes easily, rooting depth.
HoD, HoD3------------ Hosmer	Favorable-------	Piping----------	Deep to water, slow refill.	Not needed------	Slope, erodes easily, rooting depth.	Slope, erodes easily, rooting depth.
Hu------------------- Huntington	Slope, seepage.	Low strength, compressible, piping.	Deep to water	Not needed------	Not needed------	Not needed.
IvA------------------ Iva	Seepage---------	Wetness---------	Deep to water, slow refill.	Percs slowly, frost action.	Not needed------	Erodes easily, wetness, percs slowly.
JoA------------------ Johnsburg	Depth to rock, seepage.	Wetness---------	Slow refill-----	Percs slowly, frost action.	Not needed------	Wetness, percs slowly, rooting depth.
MkB2----------------- Markland	Favorable-------	Hard to pack----	Slow refill-----	Not needed------	Erodes easily, percs slowly.	Erodes easily, percs slowly.
MkC, MoC3------------ Markland	Favorable-------	Hard to pack----	Slow refill-----	Not needed------	Erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
MrA------------------ McGary	Favorable-------	Hard to pack----	Deep to water, slow refill.	Percs slowly----	Not needed------	Percs slowly, wetness, erodes easily.

See footnote at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
MuA----------------- Muren	Favorable-------	Favorable-------	Deep to water	Not needed------	Not needed------	Erodes easily.
MuB2---------------- Muren	Favorable-------	Favorable-------	Deep to water	Not needed------	Favorable-------	Erodes easily.
Ne------------------ Newark	Seepage---------	Low strength, piping.	Deep to water	Wetness, floods, poor outlets.	Not needed------	Wetness.
OrB*, OrD*, OrG*, OsF*, OsG*. Orthents						
Pa------------------ Patton	Seepage---------	Wetness---------	Slow refill-----	Frost action----	Not needed------	Wetness.
PeB2---------------- Pekin	Favorable-------	Favorable-------	Deep to water, slow refill.	Not needed------	Erodes easily, percs slowly.	Percs slowly, erodes easily.
Pg------------------ Peoga	Favorable-------	Wetness, hard to pack.	Slow refill-----	Percs slowly, frost action.	Not needed------	Wetness, percs slowly.
ScA----------------- Sciotoville	Seepage---------	Favorable-------	Deep to water, slow refill.	Percs slowly, frost action.	Not needed------	Erodes easily, rooting depth.
Se------------------ Steff	Seepage---------	Low strength, piping.	Deep to water	Floods----------	Not needed------	Not needed.
Sn------------------ Stendal	Seepage---------	Piping, wetness.	Deep to water, slow refill.		Not needed------	Erodes easily, wetness.
TtA, TtB2----------- Tilsit	Favorable-------	Hard to pack, piping.	Deep to water	Percs slowly, slope.	Slope, percs slowly.	Erodes easily, percs slowly.
UnB2, UnC, UnD, UtC3-------------- Uniontown	Slope-----------	Low strength, piping, hard to pack.	Deep to water	Not needed------	Erodes easily, slope.	Erodes easily, slope.
Wa------------------ Wakeland	Seepage---------	Piping, wetness.	Deep to water, slow refill.	Frost action, floods.	Not needed------	Wetness.
WbA----------------- Weinbach	Favorable-------	Wetness, piping.	Slow refill-----	Percs slowly, frost action.	Not needed------	Wetness, erodes easily, rooting depth.
WeD, WeD3, WeE2----- Wellston	Slope, seepage, depth to rock.	Thin layer------	No water--------	Not needed------	Slope-----------	Erodes easily, slope.
WhA, WhB2----------- Wheeling	Seepage---------	Seepage, piping, low strength.	No water--------	Not needed------	Slope, piping.	Erodes easily.
Wm------------------ Wilbur	Seepage---------	Favorable-------	Deep to water	Not needed------	Not needed------	Erodes easily.
Wo------------------ Woodmere	Favorable-------	Hard to pack----	Deep to water, slow refill.	Not needed------	Not needed------	Erodes easily.
ZaB2, ZaC, ZaC3, ZaD, ZaD3---------- Zanesville	Depth to rock, seepage.	Piping, thin layer.	Deep to water	Percs slowly, slope.	Percs slowly, wetness, erodes easily.	Percs slowly, erodes easily, wetness.
Zp------------------ Zipp	Favorable-------	Wetness, hard to pack.	Slow refill-----	Percs slowly----	Not needed------	Wetness.

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

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
AfB2-------------------- Alford	Slight-----------------	Slight-----------------	Moderate: slope.	Slight.
AfC, AfC3-------------- Alford	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
AfD, AfD3, AfE--------- Alford	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Ba---------------------- Bartle	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.
Bd---------------------- Birds	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Bn---------------------- Bonnie	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Ev---------------------- Evansville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
GnF, GpD*-------------- Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HeA--------------------- Henshaw	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, percs slowly.	Moderate: wetness.
HoA, HoB, HoB3--------- Hosmer	Severe: percs slowly.	Slight-----------------	Severe: percs slowly.	Slight.
HoC, HoC3-------------- Hosmer	Severe: percs slowly.	Moderate: slope.	Severe: percs slowly, slope.	Slight.
HoD, HoD3-------------- Hosmer	Severe: slope, percs slowly.	Severe: slope.	Severe: percs slowly, slope.	Moderate: slope.
Hu---------------------- Huntington	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
IvA--------------------- Iva	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
JoA--------------------- Johnsburg	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.
MkB2-------------------- Markland	Moderate: percs slowly.	Slight-----------------	Moderate: percs slowly, slope.	Slight.
MkC--------------------- Markland	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
MoC3-------------------- Markland	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
MrA-------------------- McGary	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.
MuA-------------------- Muren	Moderate: wetness, percs slowly.	Slight----------------	Moderate: wetness, percs slowly.	Slight.
MuB2-------------------- Muren	Moderate: wetness, percs slowly.	Slight----------------	Moderate: wetness, percs slowly, slope.	Slight.
Ne-------------------- Newark	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: floods, wetness.	Moderate: wetness.
OrB*, OrD*, OrG*, OsF*, OsG*. Orthents				
Pa-------------------- Patton	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
PeB2-------------------- Pekin	Severe: percs slowly.	Slight----------------	Severe: percs slowly.	Slight.
Pg-------------------- Peoga	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
ScA-------------------- Sciotoville	Moderate: wetness, percs slowly.	Slight----------------	Moderate: wetness, percs slowly.	Slight.
Se-------------------- Steff	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Sn-------------------- Stendal	Severe: floods.	Moderate: floods, wetness.	Severe: floods.	Slight.
TtA-------------------- Tilsit	Moderate: percs slowly.	Slight----------------	Moderate: percs slowly, wetness.	Slight.
TtB2-------------------- Tilsit	Moderate: percs slowly.	Slight----------------	Moderate: slope, wetness, percs slowly.	Slight.
UnB2-------------------- Uniontown	Slight----------------	Slight----------------	Moderate: slope.	Slight.
UnC-------------------- Uniontown	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
UnD-------------------- Uniontown	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
UtC3-------------------- Uniontown	Moderate: too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Wa----- Wakeland	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: floods, wetness.	Moderate: floods, wetness.
WbA----- Weinbach	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
WeD, WeD3, WeE2----- Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
WhA----- Wheeling	Slight-----	Slight-----	Slight-----	Slight.
WhB2----- Wheeling	Slight-----	Slight-----	Moderate: slope.	Slight.
Wm----- Wilbur	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Wo----- Woodmere	Severe: floods.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.
ZaB2----- Zanesville	Moderate: percs slowly.	Slight-----	Moderate: slope, percs slowly.	Slight.
ZaC, ZaC3----- Zanesville	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
ZaD, ZaD3----- Zanesville	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Zp----- Zipp	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.

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

TABLE 11.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates 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
AfB2 Alford	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AfC, AfC3 Alford	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AfD, AfD3, AfE Alford	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ba Bartle	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Bd Birds	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Bn Bonnie	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Ev Evansville	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
GnF, GpD* Gilpin	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
HeA Henshaw	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
HoA, HoB, HoB3 Hosmer	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
HoC, HoC3 Hosmer	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HoD, HoD3 Hosmer	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Hu Huntington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
IvA Iva	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
JoA Johnsburg	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
MkB2 Markland	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MkC, MoC3 Markland	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MrA McGary	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
MuA, MuB2 Muren	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ne Newark	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
OrB*, OrD*, OrG*, OsF*, OsG*. Orthents										
Pa----------------- Patton	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
PeB2--------------- Pekin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Pg----------------- Peoga	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
ScA---------------- Sciotoville	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Se----------------- Steff	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Sn----------------- Stendal	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
TtA---------------- Tilsit	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
TtB2--------------- Tilsit	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
UnB2--------------- Uniontown	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
UnC---------------- Uniontown	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
UnD---------------- Uniontown	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
UtC3--------------- Uniontown	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Wa----------------- Wakeland	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
WbA---------------- Weinbach	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
WeD, WeD3, WeE2---- Wellston	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
WhA---------------- Wheeling	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WhB2--------------- Wheeling	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Wm----------------- Wilbur	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Wo----------------- Woodmere	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
ZaB2--------------- Zanesville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ZaC, ZaC3---------- Zanesville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
ZaD, ZaD3: Zanesville	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Zp: Zipp	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.

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

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AfB2, AfC, AfC3, AfD, AfD3, AfE---- Alford	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	8-51	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	51-80	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
Ba------------------ Bartle	0-13	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-90	20-35	5-15
	13-29	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	29-55	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
	55-79	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
Bd------------------ Birds	0-10	Silt loam--------	CL	A-4, A-6	0	100	95-100	90-100	80-100	24-34	8-15
	10-80	Silt loam--------	CL	A-4, A-6	0	100	95-100	90-100	80-100	24-34	8-15
Bn------------------ Bonnie	0-5	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
	5-80	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
Ev------------------ Evansville	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	10-42	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-35
	42-60	Stratified silt loam to silty clay loam.	CL, ML	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
GnF, GpD*----------- Gilpin	0-9	Silt loam--------	ML, CL	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	9-22	Channery loam, shaly silt loam, silty clay loam.	GM, ML, CL	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	22-29	Channery loam, very channery silt loam, very shaly silt loam.	GM, GC, SM, SC	A-2, A-4	0-35	25-55	20-50	15-45	15-40	25-40	4-10
	29-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HeA----------------- Henshaw	0-9	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	80-100	25-35	3-10
	9-50	Silty clay loam, silt loam.	CL, ML	A-6, A-4	0	95-100	95-100	95-100	85-100	30-40	8-18
	50-70	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-15
HoA, HoB, HoB3, HoC, HoC3, HoD, HoD3--------------- Hosmer	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	9-30	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	30-65	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
Hu------------------ Huntington	0-11	Silt loam--------	ML, CL	A-4, A-6	0	95-100	95-100	85-100	60-95	25-35	5-15
	11-60	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6	0	95-100	95-100	85-100	60-95	25-35	5-15
IvA----------------- Iva	0-19	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	19-46	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	35-50	15-30
	46-71	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15

See footnote at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
JoA----------------- Johnsburg	0-13	Silt loam--------	CL, ML	A-4, A-6	0	100	100	90-100	70-95	30-40	5-15
	13-30	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	20-30
	30-58	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-95	60-85	20-35	5-15
	58-80	Loam, sandy loam, silt loam.	CL, CL-ML	A-4, A-6	5-10	90-95	85-90	60-90	50-70	20-30	5-15
MkB2, MkC----------- Markland	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	8-39	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	39-60	Stratified clay to silt loam.	CL, CH	A-6, A-7	0	100	100	90-100	75-95	35-60	20-35
MoC3---------------- Markland	0-4	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-35
	4-24	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	24-60	Stratified clay to silt loam.	CL, CH	A-6, A-7	0	100	100	90-100	75-95	35-60	20-35
MrA----------------- McGary	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-40	5-15
	9-36	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	36-60	Stratified silty clay loam to clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-35
MuA, MuB2----------- Muren	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	8-42	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-95	35-50	15-30
	42-66	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
Ne------------------ Newark	0-10	Silty clay loam	CL	A-6	0	95-100	90-100	85-100	80-95	30-40	11-20
	10-30	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	70-95	25-42	5-20
	30-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-3	75-100	70-100	65-100	55-95	25-42	5-20
OrB*, OrD*, OrG*, OsF*, OsG*. Orthents											
Pa------------------ Patton	0-10	Silty clay loam	CL	A-6	0	100	100	95-100	75-95	30-40	10-20
	10-42	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	80-100	40-55	15-25
	42-60	Stratified silt loam to silty clay loam.	CL	A-6	0	100	100	95-100	75-95	25-40	10-20
PeB2---------------- Pekin	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-100	20-35	5-15
	7-21	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	21-48	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	88-98	65-90	25-35	5-15
	48-66	Stratified silt loam to fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	80-95	50-85	20-30	5-15

See footnote at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
Pg----------------- Peoga	0-26	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	26-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-55	20-30
	60-80	Stratified silty clay loam to silt loam.	CL, ML	A-6, A-7	0	100	100	90-100	70-95	35-50	10-25
ScA---------------- Sciotoville	0-8	Silt loam--------	CL, CL-ML	A-4	0	95-100	90-100	85-100	60-95	25-35	4-10
	8-24	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6	0	90-100	85-100	80-100	65-90	20-35	4-15
	24-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	80-100	60-90	25-40	4-18
	60-80	Stratified silty clay loam to fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0-15	75-100	75-100	65-100	45-70	5-35	NP-15
Se----------------- Steff	0-9	Silt loam--------	ML, CL	A-4	0	95-100	90-100	80-100	55-95	<35	NP-10
	9-33	Silt loam--------	ML, CL	A-4, A-6	0	95-100	90-100	85-100	70-95	25-40	5-20
	33-60	Silt loam--------	ML	A-4	0-10	95-100	90-100	85-100	70-95	<35	NP-10
Sn----------------- Stendal	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-90	25-40	5-15
	6-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-90	25-40	5-15
TtA, TtB2----------- Tilsit	0-7	Silt loam--------	ML, CL, CL-ML	A-4	0	90-100	85-100	75-100	60-100	20-35	NP-10
	7-24	Silt loam, silty clay loam, loam.	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	75-100	65-100	25-40	5-20
	24-58	Silt loam, silty clay loam, loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	90-100	85-100	75-100	65-100	25-45	5-25
	58-80	Silt loam, silty clay loam, silty clay.	ML, CL, MH, CH	A-4, A-6, A-7	0-10	75-100	65-85	60-85	55-80	25-60	5-35
	80	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
UnB2, UnC, UnD------ Uniontown	0-9	Silt loam--------	ML, CL-ML	A-4	0	100	95-100	90-100	80-100	25-35	2-10
	9-40	Silt loam, silty clay loam.	CL, ML	A-6, A-4, A-7	0	100	95-100	90-100	85-100	30-45	7-20
	40-60	Silt loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	90-100	90-100	85-100	75-100	30-45	7-20
UtC3--------------- Uniontown	0-5	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-45	15-22
	5-30	Silt loam, silty clay loam.	CL, ML	A-6, A-4, A-7	0	100	95-100	90-100	85-100	30-45	7-20
	30-60	Silt loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	90-100	90-100	85-100	75-100	30-45	7-20
Wa----------------- Wakeland	0-10	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	10-60	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
WbA---------------- Weinbach	0-11	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-35	5-15
	11-25	Silt loam, silty clay loam.	CL	A-4, A-6	0	100	100	90-100	70-90	25-35	8-15
	25-58	Silty clay loam, silt loam, clay loam.	CL	A-6, A-7	0	100	100	90-100	80-95	30-45	15-25
	58-80	Stratified silty clay loam to fine sand.	CL, ML, SM, SC	A-6, A-7, A-2, A-4	0	100	100	90-100	20-95	25-45	NP-20

See footnote at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
WeD, WeD3, WeE2----- Wellston	0-10	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	10-20	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	20-44	Silt loam, loam, shaly loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	44-46	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WhA, WhB2----------- Wheeling	0-12	Silt loam--------	ML, CL, SM	A-4, A-6, A-7	0	90-100	90-100	85-100	45-90	20-50	1-25
	12-50	Silty clay loam, loam, gravelly sandy loam.	ML, CL, SM	A-4, A-6, A-7	0-5	90-100	80-100	75-100	45-80	20-50	1-25
	50-60	Stratified very fine sand to very gravelly sand.	GM, SM, GP	A-1, A-2, A-3, A-4	10-20	55-90	50-75	45-70	4-45	0-40	NP-10
Wm------------------ Wilbur	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	10-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
Wo------------------ Woodmere	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	75-95	30-50	10-25
	10-24	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-30
	24-76	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	76-84	Stratified silty clay to loamy sand.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-30
ZaB2, ZaC, ZaC3, ZaD, ZaD3---------- Zanesville	0-7	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	7-32	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	32-52	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	52-68	Sandy clay loam, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2	0-10	65-100	50-95	40-95	20-85	20-40	2-20
	68-70	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Zp------------------ Zipp	0-10	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	90-95	35-55	20-30
	10-48	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	48-60	Clay, silty clay	CL, CH	A-7	0	100	100	90-100	75-95	45-60	25-35

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

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Wind erodibility group is for the surface layer. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
AfB2, AfC, AfC3, AfD, AfD3, AfE--Alford	0-8	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	5-4	5
	8-51	0.6-2.0	0.18-0.20	4.5-6.5	Moderate------	0.37		
	51-80	0.6-2.0	0.20-0.22	4.5-7.3	Low-----------	0.37		
Ba---------------Bartle	0-13	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.43	4	5
	13-29	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.43		
	29-55	<0.06	0.06-0.08	4.5-5.5	Low-----------	0.43		
	55-79	0.2-0.6	0.15-0.18	5.1-7.3	Low-----------	0.43		
Bd---------------Birds	0-10	0.2-0.6	0.22-0.24	5.6-7.8	Low-----------	0.43	5	6
	10-80	0.2-0.6	0.20-0.22	5.1-7.8	Low-----------	0.43		
Bn---------------Bonnie	0-5	0.6-2.0	0.22-0.24	6.6-7.3	Low-----------	0.43	5	6
	5-80	0.06-2.0	0.20-0.22	4.5-5.5	Low-----------	0.43		
Ev---------------Evansville	0-10	0.6-2.0	0.20-0.24	6.1-7.3	Low-----------	0.37	5	5
	10-42	0.6-2.0	0.18-0.20	6.1-7.8	Moderate------	0.37		
	42-60	0.6-2.0	0.19-0.21	6.6-8.4	Low-----------	0.37		
GnF, GpD*--------Gilpin	0-9	0.6-2.0	0.12-0.18	3.6-5.5	Low-----------	0.32	3	---
	9-22	0.6-2.0	0.10-0.16	3.6-5.5	Low-----------	0.28		
	22-29	0.6-2.0	0.06-0.10	3.6-5.5	Low-----------	0.28		
	29-60	---	---	---	--------------	---		
HeA--------------Henshaw	0-9	0.6-2.0	0.18-0.23	5.6-6.5	Low-----------	0.43	4	---
	9-50	0.2-0.6	0.15-0.19	5.1-7.3	Low-----------	0.43		
	50-70	0.2-0.6	0.17-0.22	6.6-8.4	Low-----------	0.43		
HoA, HoB, HoB3, HoC, HoC3, HoD, HoD3-------------Hosmer	0-9	0.6-2.0	0.20-0.24	4.5-6.0	Low-----------	0.43	4	5
	9-30	0.6-2.0	0.18-0.22	4.5-5.5	Low-----------	0.43		
	30-65	<0.06	0.06-0.08	4.5-5.0	Low-----------	0.43		
Hu---------------Huntington	0-11	0.6-2.0	0.18-0.24	5.6-7.8	Low-----------	---	---	---
	11-60	0.6-2.0	0.10-0.16	5.6-7.8	Low-----------	---		
IvA--------------Iva	0-19	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.43	4	5
	19-46	0.06-0.2	0.18-0.20	5.1-6.5	Moderate------	0.43		
	46-71	0.6-2.0	0.20-0.22	5.6-6.5	Low-----------	0.43		
JoA--------------Johnsburg	0-13	0.6-2.0	0.20-0.24	4.5-6.5	Low-----------	0.43	3	5
	13-30	<0.06	0.06-0.08	3.6-5.5	Moderate------	0.43		
	30-58	<0.06	0.06-0.08	3.6-5.5	Low-----------	0.43		
	58-80	0.6-2.0	0.06-0.08	3.6-5.0	Low-----------	0.43		
MkB2, MkC--------Markland	0-8	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.43	3	5
	8-39	0.06-0.2	0.11-0.13	5.1-6.5	High----------	0.32		
	39-60	0.06-0.2	0.09-0.11	7.9-8.4	High----------	0.32		
MoC3-------------Markland	0-4	0.2-0.6	0.18-0.20	5.6-7.3	Moderate------	0.43	2	7
	4-24	0.06-0.2	0.11-0.13	5.1-6.5	High----------	0.32		
	24-60	0.06-0.2	0.09-0.11	7.9-8.4	High----------	0.32		
MrA--------------McGary	0-9	0.6-2.0	0.22-0.24	6.6-7.3	Low-----------	0.43	3	5
	9-36	<0.2	0.11-0.13	5.6-7.8	High----------	0.32		
	36-60	<0.2	0.14-0.16	7.9-8.4	High----------	0.32		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
MuA, MuB2-------- Muren	0-8	0.6-2.0	0.22-0.24	5.1-6.0	Low-----------	0.37	5	5
	8-42	0.2-0.6	0.18-0.20	5.1-6.0	Moderate------	0.37		
	42-66	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37		
Ne--------------- Newark	0-10	0.6-2.0	0.18-0.22	5.6-7.8	Low-----------	0.43	5	---
	10-30	0.6-2.0	0.18-0.23	5.6-7.8	Low-----------	0.43		
	30-60	0.6-2.0	0.15-0.22	5.6-7.8	Low-----------	0.43		
OrB*, OrD*, OrG*, OsF*, OsG*. Orthents								
Pa--------------- Patton	0-10	0.6-2.0	0.21-0.23	6.6-7.3	Moderate------	0.28	5	7
	10-42	0.6-2.0	0.18-0.20	6.1-7.8	Moderate------	0.28		
	42-60	0.6-2.0	0.18-0.22	7.4-7.8	Moderate------	0.28		
PeB2------------- Pekin	0-7	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.43	4	5
	7-21	0.6-2.0	0.20-0.22	4.5-6.5	Low-----------	0.43		
	21-48	<0.06	0.06-0.08	4.5-6.0	Low-----------	0.43		
	48-66	0.6-2.0	0.06-0.08	5.6-7.3	Low-----------	0.43		
Pg--------------- Peoga	0-26	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.43	5	5
	26-60	0.06-0.2	0.18-0.20	4.5-5.5	Moderate------	0.43		
	60-80	0.06-0.2	0.19-0.21	4.5-6.5	Low-----------	0.43		
ScA-------------- Sciotoville	0-8	0.6-2.0	0.18-0.22	5.1-6.5	Low-----------	0.37	4	6
	8-24	0.6-2.0	0.17-0.21	4.5-5.5	Low-----------	0.37		
	24-60	0.06-0.6	0.10-0.14	4.5-6.0	Low-----------	0.37		
	60-80	2.0-6.0	0.10-0.14	5.6-6.5	Low-----------	0.37		
Se--------------- Steff	0-9	0.6-2.0	0.15-0.23	4.5-5.5	Low-----------	0.43	---	---
	9-33	0.6-2.0	0.18-0.23	4.5-5.5	Low-----------	0.43		
	33-60	0.6-6.0	0.08-0.21	4.5-5.5	Low-----------	0.43		
Sn--------------- Stendal	0-6	0.6-2.0	0.22-0.24	4.5-6.5	Low-----------	0.37	5	5
	6-60	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.37		
TtA, TtB2-------- Tilsit	0-7	0.6-2.0	0.16-0.22	3.6-5.5	Low-----------	0.43	3	---
	7-24	0.6-2.0	0.16-0.22	3.6-5.5	Low-----------	0.43		
	24-58	0.06-0.2	0.08-0.12	3.6-5.5	Low-----------	0.43		
	58-80	0.06-0.6	0.08-0.12	3.6-5.5	Low-----------	0.43		
	80	---	---	---	--------------	---		
UnB2, UnC, UnD--- Uniontown	0-9	0.6-2.0	0.19-0.33	5.1-7.3	Low-----------	0.37	4	---
	9-40	0.6-2.0	0.18-0.22	5.1-7.8	Low-----------	0.37		
	40-60	0.2-2.0	0.18-0.22	6.6-8.4	Low-----------	0.37		
UtC3------------- Uniontown	0-5	0.6-2.0	0.18-0.22	5.1-7.3	Low-----------	0.37	3	---
	5-30	0.6-2.0	0.18-0.22	5.1-7.8	Low-----------	0.37		
	30-60	0.2-2.0	0.18-0.22	6.6-8.4	Low-----------	0.37		
Wa--------------- Wakeland	0-10	0.6-2.0	0.22-0.24	6.6-7.3	Low-----------	0.37	5	5
	10-60	0.6-2.0	0.20-0.22	6.6-7.3	Low-----------	0.37		
WbA-------------- Weinbach	0-11	0.6-2.0	0.20-0.24	4.5-7.3	Low-----------	0.43	4	5
	11-25	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.43		
	25-58	<0.06	0.14-0.18	4.5-5.5	Low-----------	0.43		
	58-80	0.2-0.6	0.19-0.21	4.5-6.0	Low-----------	0.43		
WeD, WeD3, WeE2-- Wellston	0-10	0.6-2.0	0.18-0.22	5.1-6.5	Low-----------	0.37	4	6
	10-20	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37		
	20-44	0.6-2.0	0.12-0.17	4.5-6.0	Low-----------	0.37		
	44-46	---	---	---	--------------	---		
WhA, WhB2-------- Wheeling	0-12	0.6-6.0	0.12-0.18	5.1-6.0	Low-----------	0.32	4	---
	12-50	0.6-2.0	0.08-0.12	5.1-6.0	Low-----------	0.28		
	50-60	6.0-20	0.04-0.08	5.1-6.0	Low-----------	0.24		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
Wm------------------ Wilbur	0-10	0.6-2.0	0.22-0.24	5.6-7.3	Low------------	0.37	5	5
	10-60	0.6-2.0	0.20-0.22	5.6-7.3	Low------------	0.37		
Wo------------------ Woodmere	0-10	0.6-2.0	0.21-0.23	6.1-7.3	Moderate------	0.43	5	5
	10-24	0.2-0.6	0.18-0.20	6.1-7.3	Moderate------	0.43		
	24-76	0.2-0.6	0.11-0.13	4.5-6.0	High-----------	0.43		
	76-84	0.2-0.6	0.18-0.20	4.5-6.0	Moderate------	0.43		
ZaB2, ZaC, ZaC3, ZaD, ZaD3-------- Zanesville	0-7	0.6-2.0	0.19-0.23	4.5-5.5	Low------------	0.37	3	---
	7-32	0.6-2.0	0.17-0.22	4.5-5.5	Low------------	0.37		
	32-52	0.06-0.6	0.08-0.12	4.5-5.5	Low------------	0.37		
	52-68	0.2-2.0	0.08-0.12	4.5-5.5	Low------------	0.28		
	68-70	---	---	---	---------------	---		
Zp------------------ Zipp	0-10	0.2-2.0	0.12-0.21	6.1-7.3	High-----------	0.28	5	4
	10-48	<0.2	0.11-0.13	6.1-7.3	High-----------	0.28		
	48-60	<0.2	0.08-0.10	7.9-8.4	High-----------	0.28		

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

TABLE 14.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AfB2, AfC, AfC3, AfD, AfD3, AfE: Alford	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	High.
Ba: Bartle	D	None	---	---	1.0-2.5	Perched	Dec-May	>60	---	High	High	High.
Bd: Birds	C/D	Frequent	Brief	Jan-Jun	0-1.0	Apparent	Dec-Jun	>60	---	High	High	Moderate.
Bn: Bonnie	C/D	Frequent	Long	Jan-Jun	0-1.0	Apparent	Dec-Jun	>60	---	High	High	High.
Ev: Evansville	B/D	Rare	---	---	0-1.0	Apparent	Jan-May	>60	---	High	High	Low.
GnF, GpD*: Gilpin	C	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low	High.
HeA: Henshaw	C	None to rare	---	---	1.0-2.0	Apparent	Nov-Mar	>60	---	---	High	Moderate.
HoA, HoB, HoB3, HoC, HoC3, HoD, HoD3: Hosmer	C	None	---	---	2.5-3.5	Perched	Mar-Apr	>60	---	High	Moderate	High.
Hu: Huntington	B	Frequent	Long	Dec-Jun	3.0-6.0	Apparent	Dec-Apr	>60	---	High	Low	Moderate.
IvA: Iva	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Moderate.
JoA: Johnsburg	D	None	---	---	1.0-3.0	Perched	Jan-Apr	48-72	Rippable	High	High	High.
MkB2, MkC, MoC3: Markland	C	None	---	---	3.0-6.0	Perched	Mar-Apr	>60	---	Moderate	High	Moderate.
MrA: McGary	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	Moderate	High	Low.
MuA, MuB2: Muren	B	None	---	---	3.0-6.0	Apparent	Mar-Apr	>60	---	High	High	Moderate.
Ne: Newark	C	Frequent	Long	Dec-Jun	0.5-1.5	Apparent	Dec-Apr	>60	---	High	High	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
OrB*, OrD*, OrG*, OsF*, OsG*. Orthents												
Pa: Patton	B/D	Rare	---	---	0-2.0	Apparent	Dec-Jun	>60	---	High	High	Low.
PeB2: Pekin	C	Rare	---	---	3.0-6.0	Perched	Mar-Apr	>60	---	High	Moderate	High.
Pg: Peoga	C	None	---	---	0.-1.0	Apparent	Dec-May	>60	---	High	High	High.
ScA: Sciotoville	C	Rare	---	---	1.5-2.5	Perched	Nov-Mar	>60	---	High	Moderate	High.
Se: Steff	C	Common	Brief	Jan-Jun	1.5-3.0	Apparent	Dec-Apr	>48	---	High	Moderate	High.
Sn: Stendal	C	Frequent	Brief	Jan-May	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	High.
TtA, TtB2: Tilsit	C	None	---	---	1.5-2.5	Perched	Jan-Apr	>40	Hard	---	High	High.
UnB2, UnC, UnD, UtC3: Uniontown	B	None to rare	---	---	2.5-6.0	Apparent	Nov-May	>60	---	---	Low	Moderate.
Wa: Wakeland	B/D	Frequent	Brief	Jan-May	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Low.
WbA: Weinbach	C	None to rare	---	---	1.0-3.0	Perched	Jan-Apr	>60	---	High	High	High.
WeD, WeD3, WeE2: Wellston	B	None	---	---	>6.0	---	---	>40	Rippable	High	Moderate	High.
WhA, WhB2: Wheeling	B	None	---	---	4.0-6.0	Apparent	Dec-Apr	>60	---	Moderate	Low	Moderate.
Wm: Wilbur	C	Frequent	Brief	Oct-Jun	3.0-6.0	Apparent	Mar-Apr	>60	---	High	Moderate	Moderate.
Wo: Woodmere	B	Frequent	Brief	Dec-May	3.0-6.0	Apparent	Mar-Apr	>60	---	High	High	High.
ZaB2, ZaC, ZaC3, ZaD, ZaD3: Zanesville	C	None	---	---	2.0-3.0	Perched	Dec-Apr	40-80	Hard	---	Moderate	High.
Zp: Zipp	C/D	Frequent	Very brief	Dec-May	0-1.0	Apparent	Dec-May	>60	---	Moderate	High	Low.

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

TABLE 15.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Alford	Fine-silty, mixed, mesic Typic Hapludalfs
Bartle	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Birds	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
Bonnie	Fine-silty, mixed, acid, mesic Typic Fluvaquents
Evansville	Fine-silty, mixed, nonacid, mesic Typic Haplaquepts
Gilpin	Fine-loamy, mixed, mesic Typic Hapludults
Henshaw	Fine-silty, mixed, mesic Aquic Hapludalfs
Hosmer	Fine-silty, mixed, mesic Typic Fragiudalfs
*Huntington	Fine-silty, mixed, mesic Fluventic Hapludolls
Iva	Fine-silty, mixed, mesic Aeric Ochraqualfs
*Johnsburg	Fine-silty, mixed, mesic Aquic Fragiudults
Markland	Fine, mixed, mesic Typic Hapludalfs
McGary	Fine, mixed, mesic Aeric Ochraqualfs
Muren	Fine-silty, mixed, mesic Aquic Hapludalfs
Newark	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Orthents	Loamy-skeletal, mixed, nonacid, mesic Udorthents
Patton	Fine-silty, mixed, mesic Typic Haplaquolls
Pekin	Fine-silty, mixed, mesic Aquic Fragiudalfs
Peoga	Fine-silty, mixed, mesic Typic Ochraqualfs
*Sciotoville	Fine-loamy, mixed, mesic Aquic Fragiudalfs
Steff	Fine-silty, mixed, mesic Fluvaquentic Dystrochrepts
Stendal	Fine-silty, mixed, acid, mesic Aeric Fluvaquents
*Tilsit	Fine-silty, mixed, mesic Typic Fragiudults
Uniontown	Fine-silty, mixed, mesic Typic Hapludalfs
Wakeland	Coarse-silty, mixed, nonacid, mesic Aeric Fluvaquents
Weinbach	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Wellston	Fine-silty, mixed, mesic Ultic Hapludalfs
*Wheeling	Fine-loamy, mixed, mesic Ultic Hapludalfs
Wilbur	Coarse-silty, mixed, nonacid, mesic Aquic Udifluvents
Woodmere	Fine, mixed, mesic Dystric Fluventic Eutrochrepts
Zanesville	Fine-silty, mixed, mesic Typic Fragiudalfs
Zipp	Fine, mixed, nonacid, mesic Typic Haplaquepts

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