United States
Department of
Agriculture

Soil
Conservation
Service

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

Soil Survey of Jackson County, Indiana

How To Use This Soil Survey

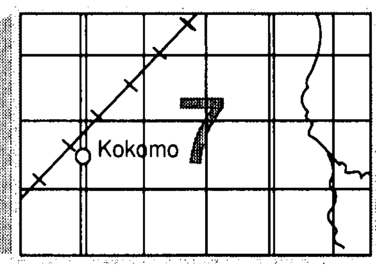
General Soil Map

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

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

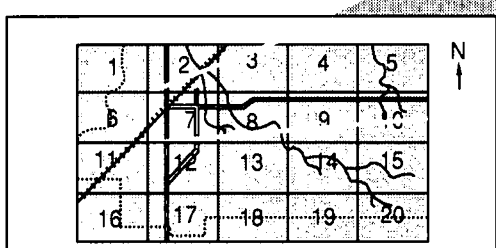
Detailed Soil Maps

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



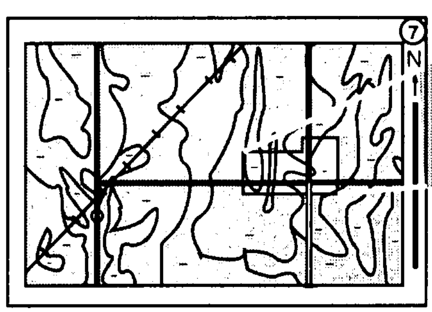
MAP SHEET

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

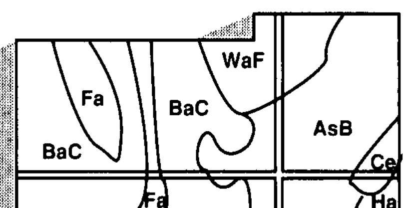


INDEX TO MAP SHEETS

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



MAP SHEET



AREA OF INTEREST

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

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

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

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This survey was made cooperatively by the United States Department of Agriculture, Soil Conservation Service and Forest Service; the Purdue University Agricultural Experiment Station; and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Jackson County Soil and Water Conservation District. Financial assistance was made available by the Jackson County Commissioners.

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

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

Cover: Stock water pond in an area of Tilsit silt loam, 6 to 12 percent slopes, eroded. Pasture of fescue and bluegrass is on Haubstadt silt loam, 2 to 6 percent slopes, eroded, in the background.

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Soil Series

Issued October 1990

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Summary of Tables

Foreword

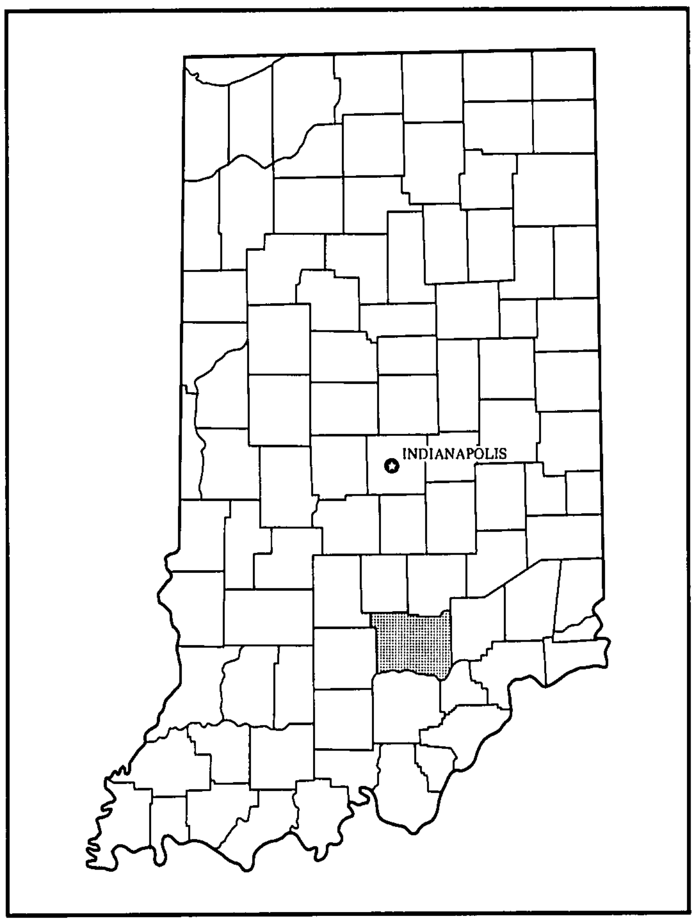
This soil survey contains information that can be used in land-planning programs in Jackson County, Indiana. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the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

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

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

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

Robert L. Eddleman
State Conservationist
Soil Conservation Service



Location of Jackson County in Indiana.

Soil Survey of Jackson County, Indiana

By Byron G. Nagel, Soil Conservation Service

Fieldwork by Byron G. Nagel, Robert C. Wingard, Jr., and Gary Struben, Soil Conservation Service, and Mark A. Eastman, R. Jeffery MacDonald, Dave Forston, and Timothy S. Jones, Indiana Department of Natural Resources, Soil and Water Conservation Committee

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

JACKSON COUNTY is in the south-central part of Indiana. It has a total land area of about 514 square miles, or 328,819 acres, which includes 3,724 acres of water. It extends about 20 miles from north to south and 26 miles from west to east. Brownstown is the county seat, and Seymour is the largest town.

The main farm enterprises are growing cash-grain crops and raising livestock. The main cash-grain crops are corn, soybeans, and winter wheat. Some cantaloups and watermelons are grown in the county, and tobacco is grown on a few acres. The chief kinds of livestock are poultry, hogs, and beef cattle. Several dairy farms are in the county, and a few sheep are raised (*7*). The majority of the hogs are raised in confinement operations. A large poultry operation in the county provides eggs and meat to several large cities in neighboring states.

The Brownstown Hills, which are a part of the Jackson-Washington State Forest, are noted for their scenic value and recreation opportunities. About 21,800 acres in the northwestern part of the county is in the Hoosier National Forest.

General Nature of the County

This section gives general information about the county. It describes relief, water supply, transportation facilities, manufacturing and business services, trends in population and land use, and climate.

Relief

Relief varies considerably throughout Jackson County. The East Fork of the White River and its wide, flat valley dissect the county from the northeast corner to the southwest corner. South and east of the river are low, rolling, hummocky hills extending 1 to about 3 miles from the river valley. South and east of the hills is a relatively flat plain dissected by several streams. Chestnut Ridge, a prominent ridge south of Seymour, rises above this plain. An area known as the "Knobstone Escarpment" roughly parallels the East Fork of the White River on its north and west side. This escarpment and the Brownstown Hills are characterized by very steep hills and knolls. These areas are highly dissected by drainageways, and they have narrow ridgetops. West of the escarpment, the landscape consists mainly of narrow flats and ridgetops dissected by many deep, narrow valleys.

The highest elevation in the county, 966 feet above sea level, is the "Pinnacle" in the Brownstown Hills. The lowest elevation, about 500 feet above sea level, is the point where the East Fork of the White River leaves the county.

Water Supply

Wells and rural water lines are the main sources of water in Jackson County. Seymour obtains its water from wells in the river bottom. Most upland areas west of the valley of the East Fork of the White River have access to rural water lines. Many ponds have been built north and west of the valley to provide water for household uses and for livestock.

Transportation Facilities

One interstate highway, three U.S. Highways, and eight state roads form the primary road system in the county. Interstate 65 is the main north-south artery, and U.S. 50 is the main east-west artery. There are about 170 miles of state roads and about 914 miles of county roads (*4*).

Two rail lines are currently in use in Jackson County. Freeman Field, a public airfield in the southwest corner of Seymour, provides both freight and commuter services.

Manufacturing and Business Services

Jackson County has many different industries and manufacturing companies. The industries are mostly centered at Seymour, but a few are in Brownstown, Crothersville, and Medora. A brick company about 1 mile south of Medora markets its bricks in several surrounding counties. In 1971, the county had 35 manufacturing plants, which made automotive parts, wearing apparel, plastics, transportation equipment, leather goods, chemical products, paper products, clay products, electronic equipment, farm equipment, and household products (*4*).

Trends in Population and Land Use

The population of the county in 1980 was about 36,523 (*3*). About 55 percent of the population lives in urban areas and 45 percent on farms in rural areas. In the last decade, the urban population has steadily increased and the rural farm population has steadily decreased. Since about 1930, the overall population has steadily increased, mainly in the eastern half of the county.

From 1935 to 1980, the acreage of urban land increased approximately 300 percent, and the acreage of farmland decreased accordingly. About 65 percent of the county is farmland. The highest rate of urban expansion is expected around Seymour. Units of government own about 34,200 acres in the county.

Climate

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

Jackson County is cold in winter and quite hot in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes drought in summer on most soils. The normal annual precipitation is adequate for all of the crops that are adapted to the temperature and growing season in the county.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Seymour in the period 1951 to 1977. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 31 degrees F, and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Seymour on January 29, 1963, is -23 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred at Seymour on July 15, 1954, is 106 degrees.

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

The total annual precipitation is about 42 inches. Of this, 23 inches, or 55 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 4.25 inches at Seymour on May 24, 1968. Thunderstorms occur on about 45 days each year. Tornadoes and severe thunderstorms occur occasionally. They are usually local in extent and of short duration and cause damage in scattered small areas.

The average seasonal snowfall is nearly 14 inches. The greatest snow depth at any one time during the period of record was 13 inches. On the average, 9 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 10 miles per hour, in winter.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

The names, description, and delineations of soils on the general soil map of this county do not always agree or fully join with the soils on the maps of adjoining counties published at an earlier date. Some differences are the result of changes in concepts of soil series. Some result from variations in the extent of soils in counties. Other differences are the result of variations in the slope range allowed in the associations.

Soil Descriptions

Dominantly Nearly Level, Well Drained to Very Poorly Drained Soils; on Bottom Land and Low Terraces

This group of soils makes up about 26 percent of the survey area. Most areas are used for corn or soybeans. A few areas are used for wheat, for hay and pasture, or as woodland. These soils are well suited to cultivated crops. They are generally unsuitable for residential and urban development. Wetness and flooding are the main management concerns.

1. Genesee-Armiesburg-Stonelick Association

Deep, nearly level, well drained, moderately fine textured to moderately coarse textured soils that formed in alluvium; on bottom land

These soils are on bottom land adjacent to the East Fork of the White River and to Sand Creek. Slopes range from 0 to 2 percent.

This association makes up about 9 percent of the county. It is about 35 percent Genesee soils, 30 percent Armiesburg soils, 14 percent Stonelick soils, and 21 percent minor soils.

Genesee soils generally are slightly lower on the flood plains than Armiesburg soils. Typically, they have a surface layer of dark brown silt loam and a substratum of dark yellowish brown and yellowish brown silt loam and loam.

Armiesburg soils generally are in the higher positions on the flood plains. Typically, they have a surface layer of dark brown silty clay loam and a subsoil of dark yellowish brown silty clay loam.

Stonelick soils generally are adjacent to and in the bends of stream channels. Typically, they have a surface layer of dark brown fine sandy loam. The substratum is dark yellowish brown to light gray, stratified fine sand, very fine sandy loam, sand, and loam.

The minor soils are the somewhat poorly drained Shoals and poorly drained and very poorly drained Zipp Variant soils. These soils are generally in the lower meander scars and sloughs.

This association is used mainly for corn or soybeans. Some areas are used for wheat or are wooded.

The major soils are well suited to corn and soybeans and poorly suited to small grain. They are fairly well suited to specialty crops, such as cantaloups and watermelons. Flooding is the major hazard. It can damage or destroy crops. The soils are well suited to trees. Because of the flooding, they are poorly suited to building site development, to use as sites for septic tank absorption fields, and to intensive recreational uses.

2. Stendal-Birds-Piopolis Association

Deep, nearly level, somewhat poorly drained to very poorly drained, medium textured and moderately fine textured soils that formed in silty alluvium; on bottom land

These soils are on bottom land along the major streams and their smaller tributaries. They generally are in flat areas on the flood plains. Slopes range from 0 to 2 percent.

This association makes up about 13 percent of the county. It is about 33 percent Stendal soils, 30 percent Birds soils, 13 percent Piopolis soils, and 24 percent minor soils.

Stendal soils are somewhat poorly drained. Typically, they have a surface layer of dark brown silt loam. The substratum is brownish yellow and light gray, mottled silty clay loam.

Birds soils are poorly drained. Typically, they have a surface layer of brown silt loam. The substratum is light gray and gray, mottled silt loam that has strata of silty clay loam.

Piopolis soils are poorly drained and very poorly drained. Typically, they have a surface layer of brown silty clay loam. The substratum is light gray, mottled silty clay loam.

The minor soils are the well drained Haymond soils adjacent to and in the bends of stream channels, the moderately well drained Steff and Wilbur soils adjacent to the stream channels, the somewhat poorly drained Wakeland soils on narrow flats, and the very poorly drained Wilhite soils on broad flats.

This association is used mainly for corn or soybeans. Some areas are wooded.

The major soils are well suited to corn and soybeans. They are poorly suited to small grain and to specialty crops, such as cantaloups and watermelons. Flooding and wetness are the main management concerns. Floodwater can damage or destroy crops. These soils are well suited to timber. Because of the flooding and the wetness, they are poorly suited to building site development, to use as sites for septic tank absorption fields, and to intensive recreational uses.

3. Driftwood-Whitaker Association

Deep, nearly level, poorly drained and somewhat poorly drained, moderately fine textured and moderately coarse textured soils that formed in alluvium and outwash sediments; on bottom land and low terraces

These soils are on bottom land and low terraces, mainly along the East Fork of the White River. Slopes range from 0 to 2 percent.

This association makes up about 4 percent of the county. It is about 35 percent Driftwood soils, 30 percent Whitaker soils, and 35 percent minor soils.

Driftwood soils are poorly drained and are on broad bottom land. Typically, they have a surface layer of brown, mottled clay loam. The subsoil is light gray and gray, mottled sandy clay loam and clay.

Whitaker soils are somewhat poorly drained and are on narrow flats on the low terraces. Typically, they have a surface layer of dark brown sandy loam. The subsoil is grayish brown and yellowish brown, mottled sandy clay loam and sandy loam.

The minor soils are the well drained Nineveh Variant soils on the higher rises, the poorly drained Ruark Variant soils on the slightly lower flats, and the moderately well drained Whitaker Variant soils on the slightly higher rises.

This association is used mainly for corn, soybeans, or wheat. A few areas are used for hay and pasture.

The major soils are well suited to corn and soybeans. They are poorly suited to small grain and to specialty crops, such as cantaloups and watermelons. Flooding and wetness are the main management concerns. Floodwater can damage or destroy crops. These soils are well suited to trees. They are poorly suited to building site development, to use as sites for septic tank absorption fields, and to intensive recreational uses, mainly because of the flooding and the wetness. Slow permeability in the Driftwood soils is an additional limitation.

Dominantly Nearly Level to Very Steep, Somewhat Excessively Drained to Somewhat Poorly Drained Soils; on Terraces and Uplands

This group of soils makes up about 10 percent of the county. Most areas are used for corn, soybeans, or wheat, and some areas are used for specialty crops, such as cantaloups and watermelons. A few areas are used for hay and pasture. These soils are well suited to cultivated crops and are fairly well suited to residential and urban development. The main management concerns are flooding, erosion, and both seasonal wetness and seasonal droughtiness.

4. Alvin-Whitaker Association

Deep, nearly level, well drained and somewhat poorly drained, moderately coarse textured soils that formed in outwash sediments; on terraces

These soils are on terraces, mainly along the East Fork of the White River. They generally are on broad flats. Slopes range from 0 to 2 percent.

This association makes up about 3 percent of the county. It is about 39 percent Alvin and similar soils, 28 percent Whitaker and similar soils, and 33 percent minor soils.

Alvin soils are well drained. Typically, they have a surface layer of dark brown sandy loam. The subsoil is dark yellowish brown and dark brown loamy sand, sandy loam, and sandy clay loam.

Whitaker soils are somewhat poorly drained. Typically, they have a surface layer of dark brown sandy loam. The subsoil is pale brown and light brownish gray, mottled sandy loam.

The minor soils are the well drained Fox and Ockley soils on narrow flats, the moderately well drained Roby Variant soils on the slightly higher rises, the poorly drained and very poorly drained Zipp Variant soils in depressional sloughs, and the poorly drained Ruark Variant soils on the lower flats.

This association is used mainly for corn, soybeans, or wheat. A few areas are used for hay and pasture.

The major soils are well suited to corn, soybeans, small grain, and specialty crops, such as cantaloups and watermelons; to trees; and to intensive recreational uses. They are fairly well suited to building site development and to use as sites for septic tank absorption fields. Wetness is the main limitation. Flooding is the major hazard.

5. Bloomfield-Alvin Association

Deep, nearly level to very steep, somewhat excessively drained and well drained, coarse textured soils that formed in eolian deposits; on uplands

These soils are on hummocky ridges and side slopes. They are mainly southeast of the East Fork of the White River. Slopes range from 1 to 45 percent.

This association makes up about 7 percent of the county. It is about 42 percent Bloomfield soils, 30 percent Alvin soils, and 28 percent minor soils (fig. 1).

Bloomfield soils are nearly level to very steep, are somewhat excessively drained and well drained, and are on ridges and narrow side slopes. Typically, they have a surface layer of dark brown fine sand. The subsoil is strong brown and light yellowish brown, banded loamy fine sand and fine sand.

Alvin soils are nearly level to strongly sloping, are well drained, and are on ridges and narrow side slopes. Typically, they have a surface layer of dark brown loamy sand. The subsoil is strong brown sandy clay loam, sandy loam, and sand.

The minor soils are the moderately well drained Bobtown soils on the slightly lower ridges, the somewhat poorly drained Ayrshire soils on flats, and the very poorly drained Lyles soils in slight depressions.

This association is used mainly for corn, soybeans, or wheat. Some areas are used for cantaloups or watermelons. A few areas are used for hay and pasture or are wooded. Several areas are used for residential and urban development.

The major soils are fairly well suited to corn, soybeans, and small grain. Droughtiness and the hazard of erosion are the main management concerns. These soils are well suited to specialty crops, such as cantaloups and watermelons. They are fairly well suited to trees, building site development, to use as sites for septic tank absorption fields, and to intensive recreational uses. Slope is the main limitation. Ground water pollution is a hazard if the soils are used as sites for septic tank absorption fields.

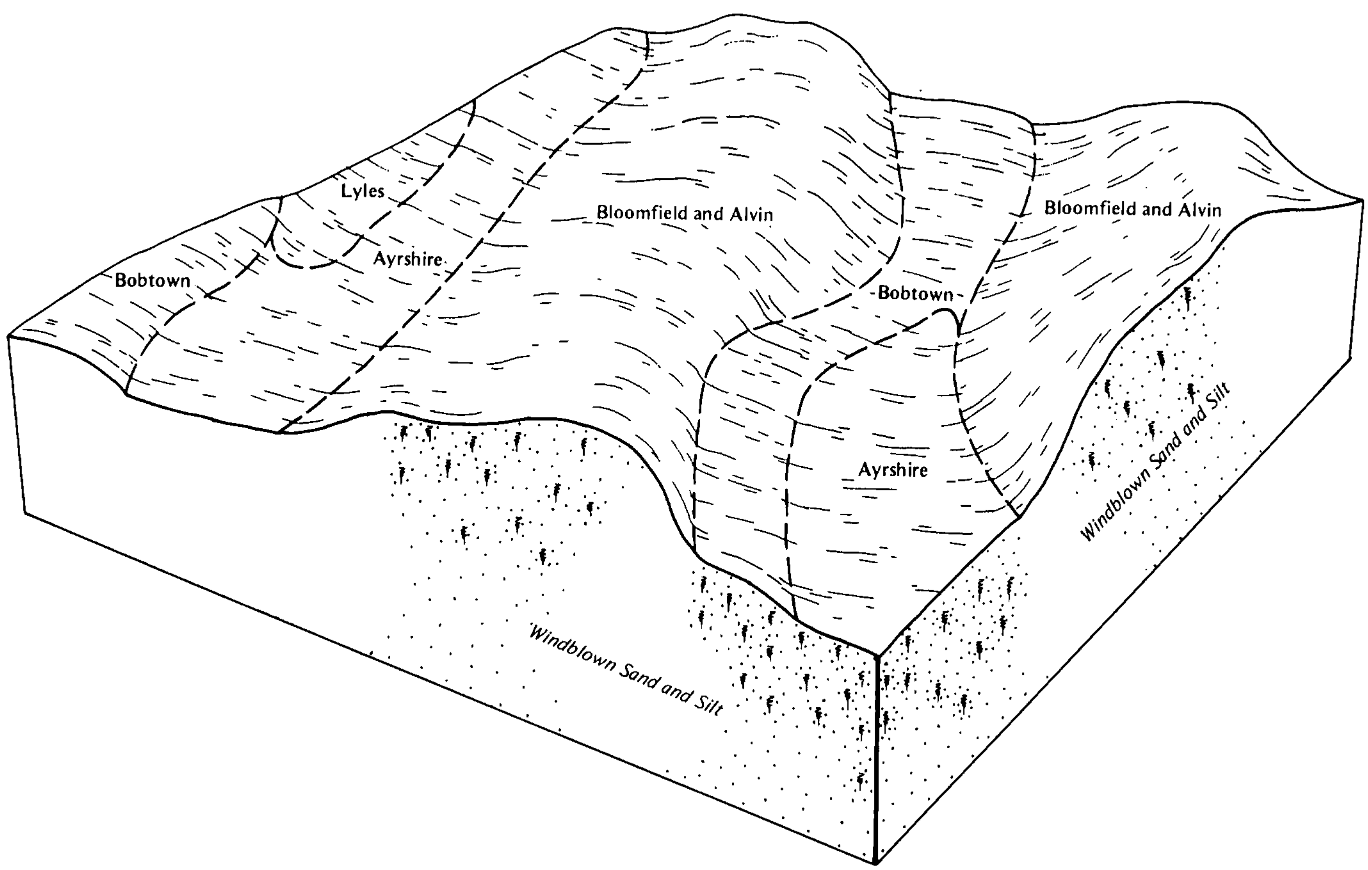


Figure 1.—Typical pattern of soils and parent material in the Bloomfield-Alvin association.

Dominantly Nearly Level and Gently Sloping, Moderately Well Drained to Very Poorly Drained Soils; on Terraces and Uplands

This group of soils makes up about 25 percent of the county. Most areas are used for corn, soybeans, or wheat. A few areas are used for hay and pasture or are wooded. These soils are well suited to cultivated crops and are poorly suited to residential and urban development. Wetness and the hazard of erosion are the main management concerns.

6. Dubois-Peoga-Haubstadt Association

Deep, nearly level and gently sloping, poorly drained to moderately well drained, medium textured soils that formed in loess and the underlying lacustrine sediments; on terraces

These soils are on flats and side slopes on lacustrine terraces. Slopes range from 0 to 6 percent.

This association makes up about 20 percent of the county. It is about 34 percent Dubois soils, 24 percent Peoga soils, 22 percent Haubstadt soils, and 20 percent minor soils (fig. 2).

Dubois soils are nearly level and gently sloping, are somewhat poorly drained, and are on narrow flats and side slopes. Typically, they have a surface layer of brown silt loam. The upper part of the subsoil is brownish yellow and gray, mottled silt loam and silty clay loam. The lower part is yellowish brown and gray, mottled silt loam and loam. The soils have a very slowly permeable fragipan.

Peoga soils are nearly level, are poorly drained, and are on broad flats. Typically, they have a surface layer of brown silt loam. The upper part of the subsoil is light brownish gray, mottled silt loam and silty clay loam. The lower part is light brownish gray, yellowish brown, and grayish brown, mottled silt loam and loam.

Haubstadt soils are nearly level and gently sloping, are moderately well drained, and are on narrow flats and side slopes. Typically, they have a surface layer of dark yellowish brown silt loam. The subsoil is yellowish brown and mottled. The upper part is silty clay loam, and the lower part is silt loam. The soils have a slowly permeable fragipan.

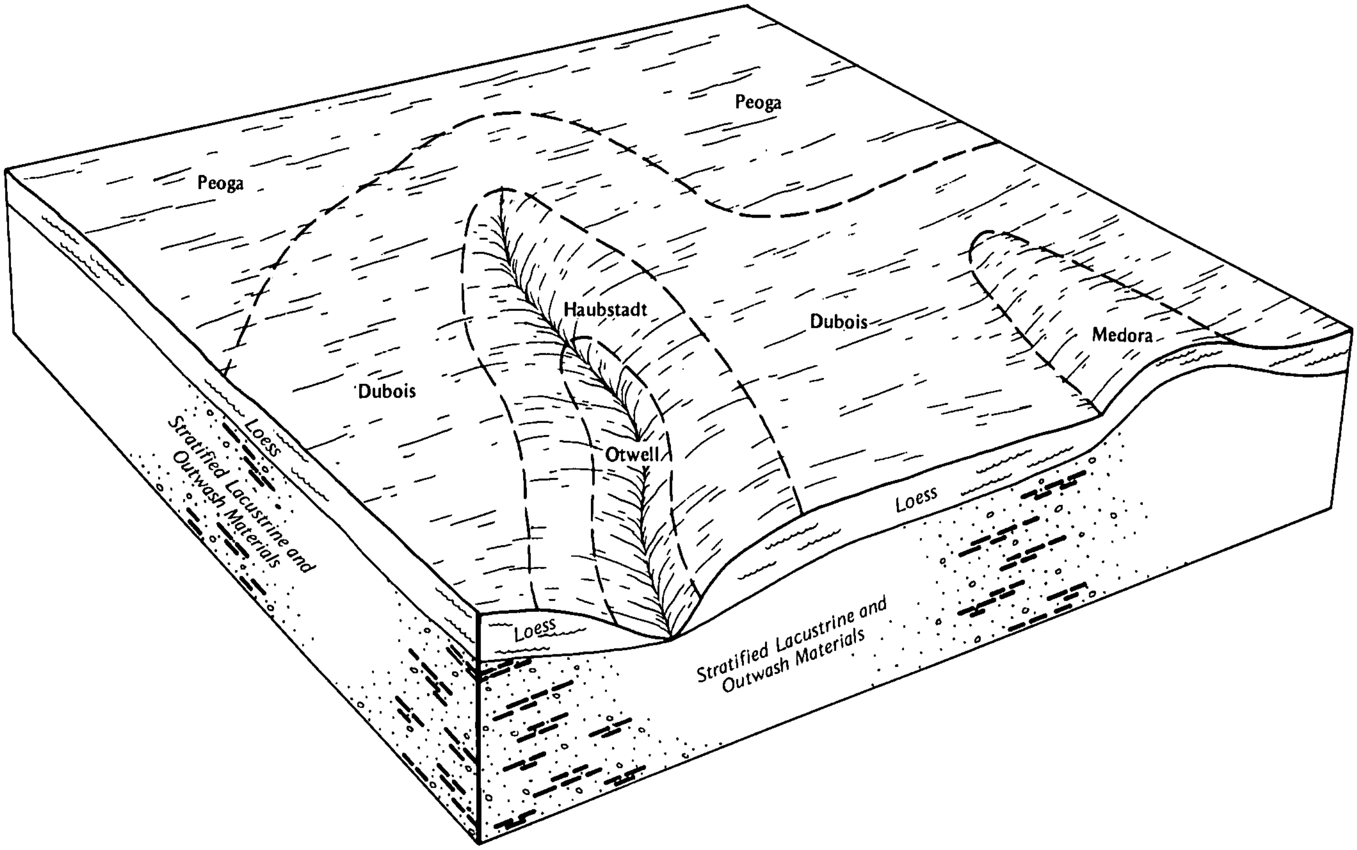


Figure 2.—Typical pattern of soils and parent material in the Dubois-Peoga-Haubstadt association.

The minor soils are the well drained and moderately well drained Otwell and well drained Negley soils on the lower side slopes and the moderately well drained Medora and well drained Parke soils on the higher ridges and side slopes.

This association is used mainly for corn, soybeans, or wheat. A few areas are used for hay and pasture or are wooded.

The major soils are well suited to corn, soybeans, and small grain. They are fairly well suited to specialty crops, such as cantaloups and watermelons. Wetness is the main limitation. Erosion is the main hazard. These soils are well suited to trees. They are poorly suited to building site development, to use as sites for septic tank absorption fields, and to intensive recreational uses, mainly because of the wetness and slow or very slow permeability.

7. Ayrshire-Lyles Association

Deep, nearly level, somewhat poorly drained and very poorly drained, moderately coarse textured soils that formed in eolian deposits; on uplands

These soils are on flats and in slight depressions. They are mainly southeast of the East Fork of the White River. Slopes range from 0 to 2 percent.

This association makes up about 5 percent of the county. It is about 40 percent Ayrshire soils, 30 percent Lyles soils, and 30 percent minor soils.

Ayrshire soils are somewhat poorly drained and are on flats. Typically, they have a surface layer of dark brown fine sandy loam. The subsoil is yellowish brown, light brownish gray, and light gray, mottled fine sandy loam and loam.

Lyles soils are very poorly drained and are in slight depressions. Typically, they have a surface layer of very dark gray fine sandy loam. The upper part of the subsoil is very dark gray, dark gray, and gray, mottled fine sandy loam and sandy clay loam. The lower part is light brownish gray and brownish yellow, mottled loamy sand.

The minor soils are the somewhat excessively drained and well drained Bloomfield and well drained Alvin soils on ridges and side slopes and the moderately well drained Bobtown soils on the slightly higher ridges.

This association is used mainly for corn or soybeans. A few areas are used for wheat, hay, or pasture.

The major soils are well suited to corn, soybeans, and wheat and are fairly well suited to specialty crops, such as cantaloups and watermelons. Wetness is the main limitation. These soils are well suited to trees. Mainly because of the wetness, they are poorly suited to building site development, to use as sites for septic tank absorption fields, and to intensive recreational uses.

Dominantly Moderately Sloping to Very Steep, Well Drained Soils; on Uplands

This group of soils makes up about 24 percent of the county. Most areas are wooded. Some areas are used for hay and pasture, and a few are used for corn, soybeans, or wheat. These soils are poorly suited to cultivated crops and to residential and urban development. Slope, droughtiness, and the hazard of erosion are the main management concerns.

8. Berks-Gilpin-Wellston Association

Deep and moderately deep, moderately sloping to very steep, well drained, medium textured soils that formed in residuum of interbedded siltstone, fine grained sandstone, and shale; on uplands

These soils are on side slopes and ridgetops in the uplands. South- and west-facing slopes are generally less sloping than north- and east-facing slopes and are highly dissected by drainageways. Slopes range from 6 to 75 percent.

This association makes up about 24 percent of the county. It is about 30 percent Berks soils, 29 percent Gilpin soils, 9 percent Wellston soils, and 32 percent minor soils (fig. 3).

Berks soils are moderately deep, are steep and very steep, and are on side slopes and knolls. Typically, they have a surface layer of brown channery silt loam. The subsoil is brownish yellow channery silt loam and very flaggy silt loam.

Gilpin soils are moderately deep, are moderately sloping to very steep, and are on side slopes and ridgetops. Typically, they have a surface layer of dark brown silt loam. The subsoil is yellowish brown and light yellowish brown silt loam, channery silt loam, and very channery silt loam.

Wellston soils are deep, are moderately sloping to moderately steep, and are on side slopes. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown, brown, dark brown, and strong brown silt loam, silty clay loam, and channery silty clay loam.

The minor soils are the moderately well drained Coolville soils on side slopes, the moderately well drained Tilsit soils on side slopes and ridgetops, the moderately well drained Stonehead soils on ridgetops, the well drained Kurtz soils on side slopes, and the well drained and moderately well drained Burnside soils on narrow bottom land.

This association is used mainly as woodland. Some areas are used for hay and pasture. A few areas are used for corn, soybeans, or wheat.

The major soils are poorly suited to corn, soybeans, small grain, and specialty crops, such as cantaloups and watermelons. Slope and droughtiness are the main limitations. Erosion is the main hazard. The soils are fairly well suited to trees. They are poorly suited to building site development, to use as sites for septic tank absorption fields, and to intensive recreational uses, mainly because of the slope and the depth to bedrock.

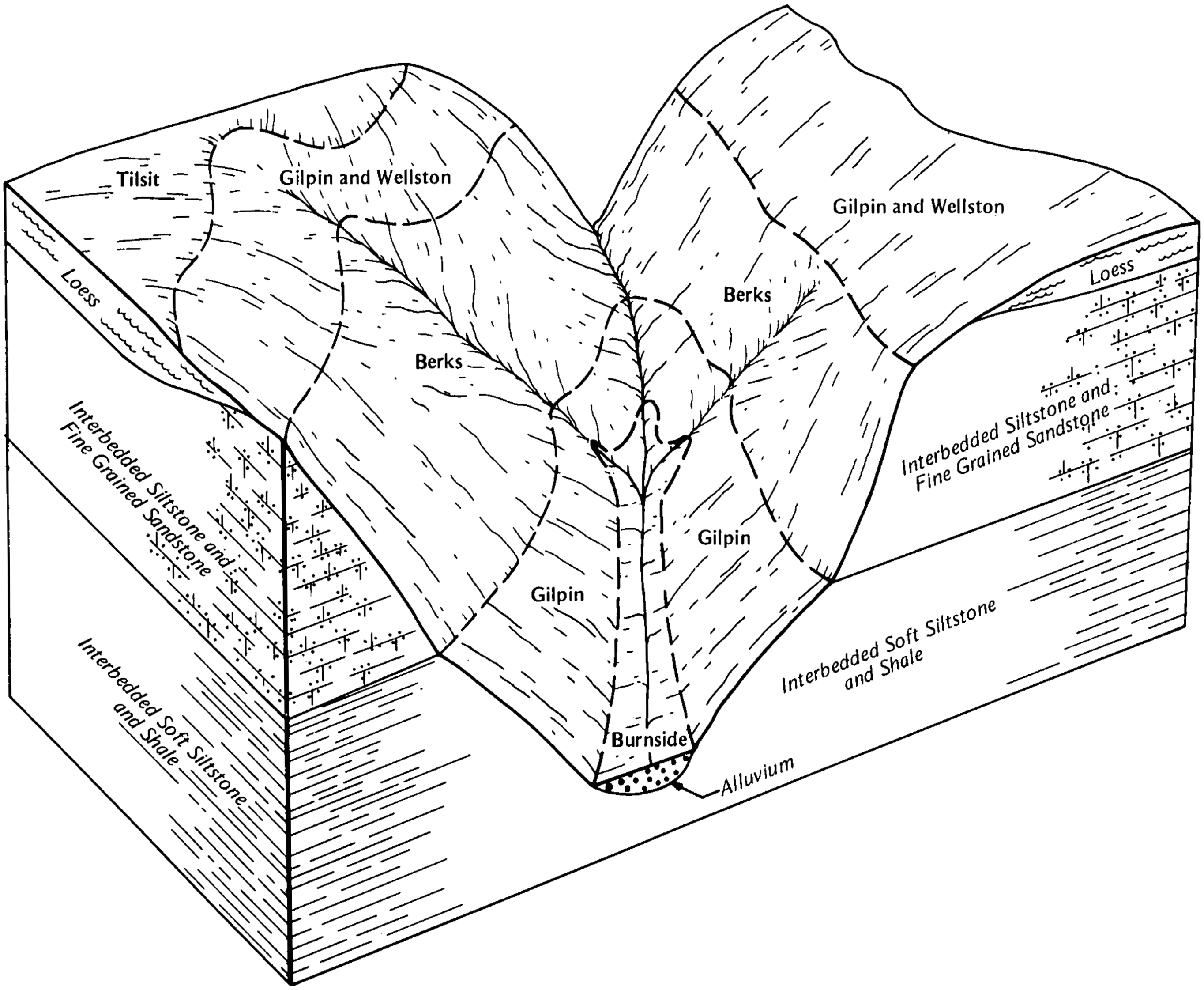


Figure 3.—Typical pattern of soils and parent material in the Berks-Gilpin-Wellston association.

Dominantly Nearly Level to Steep, Well Drained and Moderately Well Drained Soils; on Uplands and Eskers

This group of soils makes up about 15 percent of the county. Most areas are used for corn, soybeans, or wheat or for hay and pasture. A few areas are wooded. These soils are fairly well suited to cultivated crops and to residential and urban development. The main management concerns are the slope and the hazard of erosion.

9. Cincinnati-Rossmoyne-Bonnell Association

Deep, nearly level to strongly sloping, well drained and moderately well drained, medium textured soils that formed in loess and the underlying glacial drift or glacial till; on uplands

These soils are on side slopes and ridgetops in the uplands. Slopes range from 0 to 18 percent.

This association makes up about 9 percent of the county. It is about 37 percent Cincinnati soils, 25 percent Rossmoyne soils, 12 percent Bonnell soils, and 26 percent minor soils.

Cincinnati soils are gently sloping and moderately sloping, are well drained, and are on narrow ridgetops and side slopes. Typically, they have a surface layer of dark yellowish brown silt loam. The upper part of the subsoil is yellowish brown silt loam. The lower part is yellowish brown, mottled silt loam and clay loam. The soils have a moderately slowly permeable or slowly permeable fragipan.

Rossmoyne soils are nearly level and gently sloping, are moderately well drained, and are on narrow flats, ridgetops, and side slopes. Typically, they have a surface layer of dark yellowish brown silt loam. The upper part of the subsoil is brownish yellow, light yellowish brown, and brown, mottled silt loam. The lower part is brownish yellow and strong brown, mottled silt loam, clay loam, and loam. The soils have a moderately slowly permeable or slowly permeable fragipan.

Bonnell soils are moderately sloping and strongly sloping, are well drained, and are on side slopes. Typically, they have a surface layer of yellowish brown silt loam. The subsoil is strong brown and yellowish brown silt loam, silty clay loam, clay, and clay loam.

The minor soils are the somewhat poorly drained Avonburg and Stoy soils on narrow flats, the poorly drained Cobbsfork soils on broad flats, and the well drained Hickory soils on side slopes.

These soils are used for corn, soybeans, or wheat or for hay and pasture. Some small areas are wooded.

The major soils are fairly well suited to corn, soybeans, wheat, and specialty crops, such as cantaloups and watermelons. Slope is the main limitation. Erosion is the main hazard. The soils are well suited to trees. They are fairly well suited to building site development and poorly suited to use as sites for septic tank absorption fields and to intensive recreational uses. The slope, wetness, and moderately slow or slow permeability are the main limitations.

10. Medora-Parke-Negley Association

Deep, gently sloping to steep, moderately well drained and well drained, medium textured soils that formed in loess and the underlying outwash sediments; on eskers

These soils are on ridgetops and side slopes on eskers and outwash ridges. Slopes range from 2 to 35 percent.

This association makes up about 2 percent of the county. It is about 36 percent Medora soils, 24 percent Parke soils, 19 percent Negley soils, and 21 percent minor soils.

Medora soils are gently sloping and moderately sloping, are moderately well drained, and are on narrow ridgetops and side slopes on eskers and outwash ridges. Typically, they have a surface layer of dark yellowish brown silt loam. The upper part of the subsoil is yellowish brown, strong brown, and yellowish red, mottled silt loam and loam. The lower part is yellowish red and red clay loam and sandy clay. The soils have a very slowly permeable fragipan.

Parke soils are gently sloping and moderately sloping, are well drained, and are on narrow ridgetops and side slopes on eskers and outwash ridges. Typically, they have a surface layer of dark brown silt loam. The subsoil is yellowish brown, brown, strong brown, and yellowish red silty clay loam, loam, and sandy clay loam.

Negley soils are strongly sloping to steep, are well drained, and are on the lower side slopes on eskers and outwash ridges. Typically, they have a surface layer of dark yellowish brown silt loam. The subsoil is brown, yellowish red, and red loam, clay loam, and sandy clay loam.

The minor soils are the moderately well drained Haubstadt and somewhat poorly drained Dubois soils on the lower terraces.

This association is used mainly for corn, soybeans, or wheat. Some areas are used for hay and pasture, and a few are wooded.

The major soils are fairly well suited to corn, soybeans, small grain, and specialty crops, such as cantaloups and watermelons. The slope is the main limitation. Erosion is the main hazard. The soils are well suited to trees. They are fairly well suited to building site development, to use as sites for septic tank absorption fields, and to intensive recreational uses. The slope of all three soils and the wetness and very slow permeability of the Medora soils are the main limitations.

11. Frederick-Bedford-Crider Association

Deep, gently sloping to strongly sloping, well drained and moderately well drained, medium textured soils that formed in loess and the underlying limestone residuum; on uplands

These soils are on ridgetops and side slopes in the uplands in the western part of the county. Slopes range from 2 to 18 percent.

This association makes up about 4 percent of the county. It is about 25 percent Frederick soils, 22 percent Bedford soils, 20 percent Crider soils, and 33 percent minor soils.

Frederick soils are moderately sloping and strongly sloping, are well drained, and are on narrow side slopes. Typically, they have a surface layer of yellowish brown silt loam. The subsoil is yellowish red, strong brown, and dark red cherty clay and clay.

Bedford soils are gently sloping, are moderately well drained, and are on narrow ridgetops and side slopes. Typically, they have a surface layer of dark yellowish brown silt loam. The upper part of the subsoil is strong brown and yellowish brown, mottled silt loam and silty clay loam. The lower part is strong brown and dark red cherty silty clay loam, cherty clay, and clay. The soils have a very slowly permeable fragipan.

Crider soils are moderately sloping and strongly sloping, are well drained, and are on narrow side slopes. Typically, they have a surface layer of dark yellowish brown silt loam. The subsoil is strong brown, red, and yellowish red silt loam, silty clay loam, clay, and silty clay.

The minor soils are the well drained Berks, Gilpin, and Wellston soils on the lower part of side slopes and the somewhat poorly drained Stoy soils on the higher flats.

This association is used mainly for hay and pasture. Some areas are used for corn, soybeans, or wheat or are wooded.

The major soils are fairly well suited to corn, soybeans, small grain, and specialty crops, such as cantaloups and watermelons. The slope is the main limitation. Erosion is the main hazard. The soils are well suited to trees. They are fairly well suited to building site development and to use as sites for septic tank absorption fields and are poorly suited to intensive recreational uses. The slope of the Crider and Frederick soils and the wetness and very slow permeability of the Bedford soils are the main limitations.

Broad Land Use Considerations

The soils in Jackson County vary widely in their suitability for major land uses. Approximately 55 percent of the acreage is used for cultivated crops, mainly corn and soybeans, and 30 percent is woodland.

Cropland is distributed in every association, except for association 8. In associations 1 to 3, flooding and wetness are the main management concerns. In associations 4 and 5, erosion and both seasonal wetness and seasonal droughtiness are the main management concerns. In associations 6 and 7, wetness is a limitation, and in associations 9 to 11, erosion is a hazard. A drainage system has been installed on a large portion of associations 1, 2, 3, 4, 6, and 7. If drained, some areas in these associations are well suited to cropland. The soils in associations 5, 9, 10, and 11 are well suited to cropland if conservation tillage and other conservation measures are applied. Droughtiness is a limitation in some soils in associations 4 and 5. In some areas of these associations, irrigation systems can increase productivity.

Some specialty crops, dominantly cantaloups and watermelons, are grown in the county, mainly in areas of association 5. Associations 4 and 5 are well suited to these crops.

The soils in all of the associations, except for associations 5 and 8, are well suited to woodland. The Bloomfield soils in association 5 are only fairly well suited because of droughtiness. The Berks and Gilpin soils in association 8 are only fairly well suited because of a moderate depth to bedrock. Trees grow slowly on soils that have a low available water capacity or are moderately deep. Also, some trees grow slowly on soils that have a fragipan.

The soils in the county are generally unsuited, poorly suited, or fairly well suited to urban development. The soils in associations 1 to 3 are generally unsuited because of flooding and wetness. Most of the soils in associations 6 and 7 are poorly suited because of wetness. The soils in association 8 are poorly suited because of the slope and the depth to bedrock. Associations 4, 5, 9, 10, and 11 are fairly well suited to urban development. The major limitations in areas of these associations are slope, wetness, and flooding.

The suitability of the soils for recreational uses ranges from good to poor, depending on the intensity of the anticipated use and the soil properties. Associations 1, 2, 3, 6, 7, and 8 are poorly suited to intensive recreational uses, such as playgrounds and camping areas. Flooding, wetness, slow or very slow permeability, slope, and stoniness are the main limitations. Associations 5, 9, 10, and 11 are only fairly well suited to these uses because of slope, wetness, and slow or very slow permeability. Association 4 is well suited to intensive recreational uses.

Association 3, 8, 9, and 10 are poorly suited to extensive recreational uses, such as hiking trails, because of slope, wetness, and the hazard of erosion. Associations 1, 2, 5, 6, 7, and 11 are only fairly well suited because of flooding, wetness, slope, and the hazard of erosion. Association 4 is well suited to these uses.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Cincinnati silt loam, 6 to 12 percent slopes, eroded, is a phase of the Cincinnati series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Bloomfield-Alvin complex, 6 to 15 percent slopes, eroded, is an example.

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

The names, descriptions, and delineations of the soils on the detailed soil maps in this survey do not always agree or fully join with those of the soils on the maps of adjoining counties published at an earlier date. Some differences are the result of decisions made during correlation of the surveys, changes in concepts of the soil series, or variations in the composition of the map units or in the slope range allowed in the map units.

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

Soil Descriptions

AnA—Alvin sandy loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on stream terraces. Areas are broad and irregularly shaped and are 10 to several hundred acres in size.

In a typical profile, the surface layer is dark brown sandy loam about 10 inches thick. The subsoil is about 50 inches thick. The upper part is dark yellowish brown, friable sandy loam; the next part is dark brown, firm sandy clay loam; and the lower part is dark brown, strong brown, and light yellowish brown, friable and very friable sandy loam and loamy sand. The substratum to a depth of 80 inches is pale brown and light gray, stratified sand and gravelly coarse sand. In a few areas the surface layer and the upper part of the subsoil are loamy sand. In a few small areas, the surface layer is silt loam or loam. In a few places the subsoil has gravel.

Included with this soil in mapping are a few small areas of the moderately well drained Roby Variant soils in slight swales. Also included are the well drained Bloomfield soils on small knolls and a few areas where the soil is subject to rare flooding. Bloomfield soils are more sandy than the Alvin soil. Included soils make up about 5 to 8 percent of the unit.

Available water capacity is moderate in the Alvin soil, and permeability is moderate or moderately rapid. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops. A few areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. During long dry periods, yields are reduced because the available water capacity is moderate. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content and help to protect the surface against soil blowing. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to grasses and legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include alfalfa and red clover. Overgrazing reduces plant density and forage yields. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

This soil is suitable as a site for dwellings and septic tank absorption fields. It is moderately limited as a site for local roads and streets because of frost action. Strengthening the base with better suited material helps to prevent the damage caused by frost action.

The land capability classification is IIs. The woodland ordination symbol is 4A.

Ar—Armiesburg silty clay loam, sandy substratum, frequently flooded. This nearly level, deep, well drained soil is on bottom land. It is frequently flooded for brief to long periods, especially in late fall, winter, and spring. Areas are broad and irregularly shaped and are 10 to several hundred acres in size.

In a typical profile, the surface layer is dark brown silty clay loam about 15 inches thick. The subsoil is dark yellowish brown, firm silty clay loam about 20 inches thick. The upper 13 inches of the substratum is dark yellowish brown silty clay loam; the next 10 inches is yellowish brown loam; and the lower part to a depth of about 70 inches is light yellowish brown sand. In a few places the soil is not underlain by loamy sand or sand within a depth of 60 inches. In some areas the soil has a surface layer of loam or clay loam and has layers of loam or clay loam in the subsoil. In a few areas gray mottles are below a depth of 24 inches. In places the substratum is gravelly sand below a depth of 40 inches.

Included with this soil in mapping are small areas of the well drained Genesee soils in the slightly lower landscape positions. These soils are less clayey than the Armiesburg soil. Also included, in the same landscape position as the Armiesburg soil, are a few areas of well drained soils that are underlain by sand or gravelly sand within a depth of 40 inches. Included soils make up 7 to 10 percent of the unit.

Available water capacity is high in the Armiesburg soil, and permeability is moderate. The organic matter content of the surface layer is moderate. Surface runoff is slow. If tilled when too wet, the surface layer becomes cloddy and cannot be easily worked.

Most areas are used for cultivated crops. This soil is well suited to corn and soybeans. It is poorly suited to small grain because of the flooding. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content. The soil is well suited to spring plowing and spring chisel tillage systems.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include timothy, reed canarygrass, and tall fescue, and suitable legumes include red clover and ladino clover. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding is a severe hazard, this soil is generally unsuited to dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of low strength, flooding, and frost action. Building up the roadbed and strengthening the base with better suited material increase the capacity of the roads and streets to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 8A.

AvA—Avonburg silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on flats in the glaciated uplands. Areas are narrow and irregularly shaped and are 10 to 200 acres in size.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. The subsoil is more than 71 inches thick. In sequence downward, it is brownish yellow, mottled, friable silt loam; light brownish gray, mottled, friable and firm silt loam and silty clay loam; a fragipan of yellowish brown, mottled, very firm and firm, brittle silt loam; and light yellowish brown, mottled, friable silt loam. In places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the poorly drained Cobbsfork soils on the slightly lower flats and in slight depressions. Also included are small areas of the moderately well drained Rossmoyne soils on narrow flats. Included soils make up 4 to 7 percent of the unit.

Available water capacity is high in the Avonburg soil, and permeability is very slow. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 1 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few areas are wooded.

This soil is well suited to corn, soybeans, and small grain. The wetness and the very slowly permeable fragipan are the major limitations. A drainage system is needed. Land smoothing and shallow surface drains help to remove excess water. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves crop residue on the surface help to maintain tilth and the organic matter content. Erosion is a hazard in the included areas that have slope of more than 2 percent.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include red clover and lespedeza. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Prolonged seasonal wetness hinders logging activities and the planting of seedlings. Seedling mortality, windthrow, and plant competition are management concerns. Installing shallow surface drains and furrowing before planting reduce the seedling mortality rate. Careful thinning of stands reduces the windthrow hazard. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness, this soil is severely limited as a site for dwellings and is generally unsuitable as a site for buildings with basements. Surface drains, open ditches, and subsurface drains help to lower the water table. In some areas suitable outlets are not readily available. Constructing the buildings on raised, well compacted fill helps to prevent the damage caused by wetness.

This soil is severely limited as a site for local roads and streets because of frost action and low strength. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Roadside drainage ditches help to lower the water table and help to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the very slow permeability and wetness. Installing the absorption field in a mound of suitable filtering material and providing subsurface drains help to ensure proper performance.

The land capability classification is IIw. The woodland ordination symbol is 4D.

AvB2—Avonburg silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, somewhat poorly drained soil is on side slopes in the glaciated uplands. Areas are narrow and irregularly shaped and are 3 to 20 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 7 inches thick. In most areas erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is more than 73 inches thick. In sequence downward, it is light yellowish brown, mottled, friable silt loam; light brownish gray, mottled, firm silty clay loam; a fragipan of yellowish brown, mottled, very firm, brittle silty clay loam and silt loam; and light brownish gray and gray, mottled, firm loam and clay loam. Some areas are not eroded.

Included with this soil in mapping are small areas of the moderately well drained Rossmoyne soils on the lower part of the side slopes. Also included are a few areas of the poorly drained Cobbsfork soils at the head of drainageways. Included soils make up 3 to 5 percent of the unit.

Available water capacity is moderate in the Avonburg soil, and permeability is very slow. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 1 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture. A few are wooded.

This soil is well suited to corn, soybeans, and small grain. The wetness and the very slowly permeable fragipan are the major limitations. Erosion is the major hazard. Installing subsurface drains in drainageways helps to remove excess water. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Yields are reduced during long dry periods. Conservation measures reduce the runoff rate and help to control erosion. Examples are a cropping sequence that includes forage crops, conservation tillage, terraces, diversions, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and maintain or improve tilth and the organic matter content.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Prolonged seasonal wetness hinders logging activities and the planting of seedlings. Seedling mortality, windthrow, and plant competition are management concerns. Installing shallow surface drains and furrowing before planting reduce the seedling mortality rate. Careful thinning of stands reduces the hazard of windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness, this soil is severely limited as a site for dwellings and is generally unsuited to buildings with basements. Open ditches and subsurface drains help to lower the water table. Constructing the buildings on raised, well compacted fill helps to prevent the damage caused by wetness.

This soil is severely limited as a site for local roads and streets because of frost action and low strength. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Roadside drainage ditches help to lower the water table and help to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the very slow permeability and wetness. Installing the absorption field in a mound of suitable filtering material and providing subsurface drains help to ensure proper performance.

The land capability classification is IIe. The woodland ordination symbol is 4D.

Ay—Ayrshire fine sandy loam, sandy substratum. This nearly level, deep, somewhat poorly drained soil is on flats in the uplands. Areas are irregularly shaped and are 5 to 100 acres in size.

In a typical profile, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown and light brownish gray, mottled, friable fine sandy loam, and the lower part is light gray, mottled, friable loam. The upper 28 inches of the substratum is light gray, mottled fine sandy loam that has thin layers of sandy clay loam and loamy fine sand. The lower part to a depth of about 80 inches is light gray, mottled fine sand. In a few areas the upper part of the subsoil is loamy sand.

Included with this soil in mapping are small areas of the moderately well drained Bobtown soils on slight rises. Also included are a few areas of the very poorly drained Lyles soils in slight depressions and some areas of poorly drained soils on the slightly lower flats. Included soils make up 12 to 15 percent of the unit.

Available water capacity is high in the Ayrshire soil, and permeability is moderate. The organic matter content of the surface layer is low or moderately low. Surface runoff is slow or very slow. The surface layer is friable and can be easily tilled. The soil has an apparent water table at a depth of 1 to 3 feet from December through April.

Most areas of this soil are used for cultivated crops. A few areas are used for pasture. A few are wooded. Some areas are developed for urban uses.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major limitation. A drainage system is needed. Excess water can be removed by subsurface drains with a sand guard and by open ditches. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content and help to protect the surface against soil blowing.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass, tall fescue, and timothy, and suitable legumes include red clover and ladino clover. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant species are favored in timber stands. Plant competition is severe. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

This soil is severely limited as a site for dwellings because of the wetness. It is generally unsuitable as a site for buildings with basements. Subsurface drains and open ditches help to lower the water table. Constructing the buildings on raised, well compacted fill material helps to prevent the damage caused by wetness.

This soil is severely limited as a site for local roads and streets because of frost action. Strengthening the base with better suited material and installing roadside drainage ditches help to lower the water table and help to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the wetness. Installing the absorption field in a mound of suitable filtering material and providing subsurface drains help to ensure proper performance.

The land capability classification is IIw. The woodland ordination symbol is 5A.

Ba—Bartle silt loam. This nearly level, deep, somewhat poorly drained soil is on flats on stream terraces. Areas are narrow and irregularly shaped and are 5 to 100 acres in size.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. The subsurface layer is light gray, mottled silt loam about 5 inches thick. The subsoil is about 59 inches thick. The upper part is yellowish brown and gray, mottled, friable and firm silt loam and silty clay loam, and the lower part is a fragipan of yellowish brown, mottled, firm, brittle silt loam. The substratum to a depth of 80 inches is yellowish brown, mottled silt loam. In places the slope is more than 2 percent. In a few areas, the surface layer is loam and the subsoil has layers of loam or clay loam.

Included with this soil in mapping are small areas of the moderately well drained Pekin soils on side slopes and narrow flats. These soils make up 3 to 6 percent of the unit.

Available water capacity is moderate in the Bartle soil, and permeability is very slow. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 1 to 2 feet from January through April.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. The wetness and the very slowly permeable fragipan are the major limitations. A drainage system is needed. Land smoothing and shallow surface drains help to remove excess water. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. During long dry periods, yields are reduced because the available water capacity is moderate. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to maintain tilth and the organic matter content. Erosion is a hazard in the included areas that have slope of more than 2 percent.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include red clover and lespedeza. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is severe. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

This soil is severely limited as a site for dwellings because of the wetness. It is generally unsuitable as a site for buildings with basements. Surface drains, open ditches, and subsurface drains help to lower the water table. In some areas suitable outlets are not readily available. Constructing the buildings on raised, well compacted fill material helps to prevent the damage caused by wetness.

This soil is severely limited as a site for local roads and streets because of frost action. Roadside drainage ditches help to lower the water table and help to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the very slow permeability and the wetness. Installing the absorption field in a mound of suitable filtering material and providing subsurface drains help to ensure proper performance.

The land capability classification is IIw. The woodland ordination symbol is 4A.

BdB—Bedford silt loam, 2 to 6 percent slopes. This gently sloping, deep, moderately well drained soil is on ridgetops and side slopes in the uplands. Areas are narrow and elongated and are 10 to 100 acres in size.

In a typical profile, the surface layer is dark yellowish brown silt loam about 9 inches thick. It has a small amount of strong brown silty clay loam. The subsoil is more than 71 inches thick. The upper part is strong brown and yellowish brown, friable silty clay loam; the next part is a fragipan of yellowish brown, mottled, firm, brittle silt loam; and the lower part is strong brown and dark red, firm and very firm cherty silty clay loam, cherty clay, and clay. In places the loess is more than 40 inches thick. In a few areas the slope is more than 6 percent. Some areas are moderately eroded. In places the upper part of the subsoil has gray mottles.

Included with this soil in mapping are some small areas of gently sloping, somewhat poorly drained soils at the head of drainageways. Also included are small areas of the well drained Crider soils on narrow ridgetops and on the lower part of side slopes. Included soils make up 7 to 10 percent of the unit.

Available water capacity is moderate in the Bedford soil. Permeability is moderate above the fragipan and very slow in the fragipan. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 1.5 to 3.5 feet in March and April.

Most areas of this soil are used for cultivated crops or for hay and pasture. A few small areas are wooded.

This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard. The very slowly permeable fragipan is the major limitation. Wetness in early spring also is a limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes forage crops, conservation tillage, terraces, diversions, grassed waterways, and grade-stabilization structures. The soil is well suited to no-till and till-plant cropping systems. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue, orchardgrass, and timothy, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Seedlings survive and grow well if livestock are excluded from the area.

This soil is moderately limited as a site for buildings without basements because of the wetness and shrinking and swelling. It is severely limited as a site for buildings with basements because of the wetness. Also, the slope is a moderate limitation on sites for small commercial buildings. Reinforcing foundations and footings and backfilling with coarse sand and gravel help to prevent the damage caused by shrinking and swelling. Subsurface drains around the foundations help to lower the water table. An adequate drainage system is required on sites for dwellings with basements. Land shaping can modify the slope.

This soil is severely limited as a site for local roads and streets because of frost action and low strength. Strengthening the base with better suited material improves the capacity of the roads to support vehicular traffic. Roadside drainage ditches help to lower the water table and help to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the very slow permeability in the fragipan and the wetness. Installing an enlarged absorption field in a mound of suitable filtering material and providing subsurface drains help to ensure proper performance.

The land capability classification is IIe. The woodland ordination symbol is 4A.

BeG—Berks channery silt loam, 25 to 75 percent slopes. This steep and very steep, moderately deep, well drained soil is on side slopes and knolls in the uplands. Areas are elongated and irregularly shaped and are 10 to several thousand acres in size.

In a typical profile, partly decomposed leaves and roots about 1 inch thick are at the surface. The surface layer is brown channery silt loam about 7 inches thick. The subsoil is brownish yellow, friable channery and very flaggy silt loam about 28 inches thick. Siltstone and fine grained sandstone bedrock is at a depth of about 35 inches. A few areas are moderately eroded. In a few small areas, the surface layer is channery loam.

Included with this soil in mapping are some small areas of rock outcrops and small areas of a shallow, well drained soil upslope from the rock outcrops. Also included are a few small areas of the well drained Gilpin and Wellston soils on the upper part of side slopes and on narrow ridges between the side slopes, small areas of well drained soils that formed in colluvial deposits at the base of side slopes, and small areas of the well drained and moderately well drained Burnside soils on narrow bottom land. Gilpin and Wellston soils are less channery than the Berks soil. Included soils make up about 10 to 13 percent of the unit.

Available water capacity is low in the Berks soil, and permeability is moderate or moderately rapid. The organic matter content of the surface layer is moderately low. Surface runoff is very rapid.

Most areas are wooded. Because of the steep and very steep slope, a severe hazard of erosion, and the rock fragments in the surface layer, this soil is generally unsuited to row crops and to grasses and legumes for hay and pasture. It is fairly well suited to trees. The equipment limitation, seedling mortality, and the erosion hazard are management concerns. Special harvest methods, such as yarding the logs uphill with a cable, minimize the use of crawler tractors and skidders. Overstocking helps to compensate for seedling mortality. Building logging roads and skid trails on the contour and constructing water bars help to control erosion. North aspects generally are more productive than south aspects.

This soil is generally unsuitable as a site for dwellings because of the slope. Alternative sites should be selected. The soil is severely limited as a site for local roads and streets because of the slope. Constructing the roads and streets on the contour and land shaping help to overcome the slope. The soil is generally unsuitable as a site for septic tank absorption fields because the slope and the depth to bedrock are severe limitations.

The land capability classification is VIIe. The woodland ordination symbol is 4R.

Bf—Birds silt loam, frequently flooded. This nearly level, deep, poorly drained soil is on bottom land. It is frequently flooded for brief to long periods, especially in late fall, winter, and spring, and is subject to ponding. Areas are broad and irregularly shaped and are 10 to several hundred acres in size.

In a typical profile, the surface layer is brown silt loam about 10 inches thick. The upper 31 inches of the substratum is light gray and gray, mottled, friable silt loam. The lower part to a depth of 60 inches is gray, mottled, firm, stratified silt loam and silty clay loam. In places the upper part of the substratum has strata of sandy loam and loam. In some small areas it is more acid. In a few small areas, the surface layer is silty clay loam and the upper part of the substratum has thin layers of silty clay loam.

Included with this soil in mapping are some small areas of the somewhat poorly drained Wakeland soils adjacent to meander scars in the slightly higher landscape positions. These soils make up about 4 to 7 percent of the unit.

Available water capacity is very high in the Birds soil, and permeability is moderately slow. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The soil has an apparent seasonal high water table near or above the surface from March through June.

Most areas of this soil are used for cultivated crops. Some areas are wooded.

If adequately drained, this soil is fairly well suited to corn and soybeans. The wetness is the major limitation, and the flooding is the major hazard. Open ditches and subsurface drains help to remove excess water. Measures that keep silt from filling subsurface drains lengthen the functional life of the system. In some areas existing natural channels should be deepened and widened so that they can be used as drainage outlets. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

If adequately drained, this soil is well suited to grasses for hay and pasture, but it is poorly suited to shallow-rooted legumes. Suitable grasses include tall fescue and reed canarygrass, and suitable legumes include red clover and ladino clover. Prolonged periods of flooding reduce forage yields. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant species are favored in timber stands. Prolonged seasonal wetness limits logging activities and the planting of seedlings. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Installing shallow surface drains and furrowing before planting reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by special harvest methods, by proper site preparation, and by spraying, cutting, and girdling.

Because the flooding and ponding are severe hazards, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of flooding, ponding, and low strength. Elevating the roadbed and strengthening or replacing the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

BlF—Bloomfield fine sand, 15 to 45 percent slopes. This strongly sloping to very steep, deep, well drained and somewhat excessively drained soil is on side slopes in the uplands. Areas are narrow and elongated and are 5 to 100 acres in size.

In a typical profile, the surface layer is dark brown fine sand about 7 inches thick. The subsurface layer is yellowish brown fine sand about 26 inches thick. The subsoil is about 39 inches thick. It is strong brown, very friable loamy fine sand that has interbands of brownish yellow, loose fine sand. The substratum to a depth of 80 inches is brownish yellow loamy fine sand. In some areas the subsoil has less clay. A few areas are moderately eroded or severely eroded.

Included with this soil in mapping are a few areas of the well drained Alvin soils on side slopes. These soils are less sandy than the Bloomfield soil. Also included are small areas of poorly drained, sandy soils on narrow bottom land. Included soils make up 6 to 9 percent of the unit.

Available water capacity is low in the Bloomfield soil, and permeability is moderately rapid or rapid. The organic matter content of the surface layer is moderately low or low. Surface runoff is rapid.

Most areas are wooded. A few small areas are used for pasture. Because of the strongly sloping to very steep slope, a severe hazard of erosion, and the low available water capacity, this soil is generally unsuited to row crops. It is poorly suited to grasses and legumes for pasture. Suitable grasses include tall fescue, timothy, and orchardgrass, and suitable legumes include red clover and lespedeza. During long dry periods, plant growth is severely restricted by the low available water capacity. The slope hinders the use of farm machinery. Overgrazing reduces plant density and forage yields and increases the susceptibility to erosion. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. The erosion hazard, the equipment limitation, and seedling mortality are management concerns. Building logging roads and skid trails on the contour and constructing water bars help to control erosion. Special harvest methods, such as yarding the logs uphill with a cable, minimize the use of crawler tractors and skidders. Overstocking helps to compensate for seedling mortality. Seedlings survive and grow well if livestock are excluded from the area.

Because the slope is a severe limitation, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. A poor filtering capacity also is a severe limitation on sites for septic tank absorption fields. It can result in the pollution of ground water. Because of the slope, the soil is severely limited as a site for local roads and streets. The slope can be modified.

The land capability classification is VIe. The woodland ordination symbol is 4R.

BmB—Bloomfield-Alvin complex, 1 to 6 percent slopes. These nearly level and gently sloping, deep, well drained and somewhat excessively drained soils are on ridgetops and side slopes in the uplands. Areas are narrow and irregularly shaped and are 3 to 100 acres in size. The Bloomfield soil makes up about 50 percent of the unit, and the Alvin soil makes up about 45 percent. Areas closer to the East Fork of the White River generally have a higher percentage of the Bloomfield soil and a lower percentage of the Alvin soil.

In a typical profile, the surface layer of the Bloomfield soil is dark yellowish brown sand about 8 inches thick. The subsurface layer is brown loamy sand 14 inches thick. The subsoil is more than 58 inches thick. The upper part is yellowish brown, loose sand that has bands of dark brown, very friable loamy sand. The lower part is dominantly dark brown, very friable loamy sand and sand. It has interbands of yellowish brown, loose sand. In places the surface layer is loamy sand or loamy fine sand. In some areas the subsoil has less clay. In other areas the slope is more than 6 percent. Some areas are moderately eroded.

In a typical profile, the surface layer of the Alvin soil is dark yellowish brown loamy sand about 7 inches thick. The subsurface layer is light yellowish brown sandy loam about 4 inches thick. The subsoil is more than 69 inches thick. The upper part is dark yellowish brown and strong brown, friable sandy loam, and the lower part is brown sand that has bands of dark brown loamy sand. Some areas are moderately eroded. In some places the soil is loamy sand to a depth of 20 to 40 inches. In other places the surface layer is fine sand, sand, fine sandy loam, or silt loam. In a few areas the slope is more than 6 percent. In some areas the subsoil has more clay.

Included with these soils in mapping are a few small areas of the moderately well drained Bobtown soils in swales. Also included are a few areas of well drained soils that formed in loess. Included soils make up about 5 percent of the unit.

Available water capacity is low in the Bloomfield soil and moderate in the Alvin soil. Permeability is moderately rapid or rapid in the Bloomfield soil and moderate or moderately rapid in the Alvin soil. The organic matter content of the surface layer in both soils is moderately low or low. Surface runoff is slow. The surface layer is very friable or loose and can be easily tilled.

Most areas of these soils are used for cultivated crops. Some areas are used for melons (fig. 4). A few areas are used for hay and pasture. Some are used for urban development.

These soils are suited to corn, soybeans, and small grain. They are well suited to melons. Erosion is the major hazard. The low or moderate available water capacity is the major limitation. During long dry periods, yields are reduced, especially on the Bloomfield soil. Fall-seeded crops, such as winter wheat, can make good use of the limited amount of available water. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes forage crops, conservation tillage, terraces, diversions, water- and sediment-control basins, grassed waterways, and winter cover crops. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain the organic matter content. The soils are well suited to a no-till cropping system.

These soils are well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue, orchardgrass, and timothy, and suitable legumes include alfalfa and red clover. During long dry periods, plant growth is restricted, especially on the Bloomfield soil. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Overgrazing reduces plant density and forage yields. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

These soils are well suited to trees. Seedling mortality and plant competition are management concerns. Overstocking helps to compensate for seedling mortality. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Figure 4.—Watermelons in an area of the Bloomfield-Alvin complex, 1 to 6 percent slopes.

These soils are well suited to dwellings. The Bloomfield soil is well suited to local roads and streets, but the Alvin soil is moderately limited because of frost action. Strengthening the base with better suited material helps to prevent the damage caused by frost action. The Alvin soil is well suited to septic tank absorption fields, but the Bloomfield soil is severely limited because it has a poor filtering capacity, which can result in the pollution of ground water.

The land capability classification is IIIs. The woodland ordination symbol assigned to the Bloomfield soil is 4S, and that assigned to the Alvin soil is 4A.

BmC2—Bloomfield-Alvin complex, 6 to 15 percent slopes, eroded. These moderately sloping and strongly sloping, deep, well drained and somewhat excessively drained soils are on side slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 120 acres in size. The Bloomfield soil makes up about 55 percent of the unit, and the Alvin soil makes up about 45 percent. Areas closer to the East Fork of the White River generally have a higher percentage of the Bloomfield soil and a lower percentage of the Alvin soil. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil.

In a typical profile, the surface layer of the Bloomfield soil is dark brown fine sand about 10 inches thick. The subsoil is about 70 inches thick. The upper part is strong brown, very friable loamy fine sand that has bands of yellowish brown, loose fine sand, and the lower part is yellowish brown, very friable fine sand that has bands of strong brown loamy fine sand and fine sand. The substratum to a depth of 90 inches or more is light yellowish brown fine sand. In places the surface layer is loamy sand or loamy fine sand. In some areas the subsoil has less clay. In other areas the slope is less than 6 or more than 15 percent. In a few places, the soil is severely eroded and the depth to the substratum is less than 48 inches.

In a typical profile, the surface layer of the Alvin soil is dark brown loamy sand about 10 inches thick. It has a small amount of strong brown sandy clay loam. The subsoil is about 59 inches thick. The upper part is strong brown, firm sandy clay loam; the next part is strong brown, friable sandy loam; and the lower part is strong brown, loose fine sand that has bands of very friable sand and loamy sand. The substratum to a depth of 80 inches is light yellowish brown fine sand. In some areas the soil is loamy sand between depths of 20 and 40 inches. In other areas it is severely eroded and has a surface layer of fine sandy loam. In places the slope is less than 6 or more than 15 percent. In a few areas the surface layer is fine sand or sand. In some places the depth to the substratum is less than 48 inches. In other places the subsoil has more clay.

Included with these soils in mapping are a few small areas of well drained soils that formed in loess. These included soils make up about 1 percent of the unit.

Available water capacity is low in the Bloomfield soil and moderate in the Alvin soil. Permeability is moderately rapid or rapid in the Bloomfield soil and moderate or moderately rapid in the Alvin soil. The organic matter content of the surface layer in both soils is moderately low or low. Surface runoff is medium. The surface layer is very friable or loose and can be easily tilled.

Most areas of these soils are used for cultivated crops (fig. 5). Some areas are used for melons. Some are used for hay and pasture. Some areas in the central and eastern parts of the county are used for urban development.

These soils are poorly suited to corn, soybeans, and small grain. They are fairly well suited to melons. Erosion is the major hazard. The low or moderate available water capacity is the major limitation. During long dry periods, crop yields are reduced, especially on the Bloomfield soil. Fall-seeded crops, such as winter wheat, can make good use of the limited amount of available water. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes forage crops, conservation tillage, terraces, diversions, grassed waterways, and winter cover crops. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain the organic matter content. The soils are well suited to a no-till cropping system.

These soils are fairly well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue, orchardgrass, and timothy, and suitable legumes include alfalfa and red clover. During long dry periods, plant growth is restricted, especially on the Bloomfield soil. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Overgrazing reduces plant density and forage yields. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

These soils are well suited to trees. Seedling mortality and plant competition are management concerns. Overstocking helps to compensate for seedling mortality. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the slope, these soils are moderately limited as sites for dwellings and for local roads and streets. Also, frost action is a moderate limitation if the Alvin soil is used as a site for local roads and streets. The slope can be modified. Strengthening the base with better suited material helps to prevent the damage caused by frost action.

The Bloomfield soil is severely limited as a site for septic tank absorption fields because it has a poor filtering capacity, which can result in the pollution of ground water. The Alvin soil is moderately limited because of the slope. Installing the absorption field on the contour helps to overcome the slope.

The land capability classification is IVe. The woodland ordination symbol assigned to the Bloomfield soil is 4S, and that assigned to the Alvin soil is 4A.

Bn—Bobtown loamy fine sand, 0 to 3 percent slopes. This nearly level and gently sloping, deep, moderately well drained soil is on flats and ridges in the uplands. Areas are narrow and irregularly shaped and are 5 to 40 acres in size.

In a typical profile, the surface layer is dark yellowish brown loamy fine sand about 9 inches thick. The subsurface layer is yellowish brown fine sandy loam about 4 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable fine sandy loam; the next part is strong brown and yellowish brown, mottled, firm fine sandy loam and sandy clay loam; and the lower part is pale brown, mottled, friable fine sandy loam and loamy sand. The substratum to a depth of 80 inches is yellowish brown, mottled, stratified loamy sand, loamy fine sand, and fine sand. In a few places the surface layer is fine sandy loam or loamy sand. In a few areas the soil is loamy fine sand between depths of 20 and 40 inches.

Figure 5.—Soybeans and corn on the Bloomfield-Alvin complex, 6 to 15 percent slopes, eroded.

Included with this soil in mapping are small areas of the somewhat poorly drained Ayrshire soils on the slightly lower flats. Also included are a few small areas of the well drained Bloomfield soils on the slightly higher ridges. Included soils make up 4 to 7 percent of the unit.

Available water capacity and permeability are moderate in the Bobtown soil. The organic matter content of the surface layer is moderately low or low. The surface layer is very friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 2 to 3 feet from December through April.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture. Some areas are used for urban development.

This soil is well suited to corn, soybeans, and small grain (fig. 6). Wetness in early spring is the major limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content and help to control soil blowing. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue, orchardgrass, and timothy, and suitable legumes include alfalfa and red clover. Overgrazing reduces plant density and forage yields. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness, this soil is moderately limited as a site for dwellings without basements and severely

Figure 6.—Corn on Bobtown loamy fine sand, 0 to 3 percent slopes. The woodland in the background is part of the Brownstown Hills.

limited as a site for dwellings with basements. Subsurface drains around the foundation and footings and open ditches help to lower the water table.

This soil is moderately limited as a site for local roads and streets because of the wetness and frost action. Strengthening the base with better suited material and installing roadside drainage ditches help to lower the water table and help to prevent the damage caused by frost action and wetness.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. Installing the absorption field in a mound of suitable filtering material and providing interceptor subsurface drains around the perimeter of the field help to ensure proper performance.

The land capability classification is IIs. The woodland ordination symbol is 5A.

BoD2—Bonnell silt loam, 10 to 18 percent slopes, eroded. This moderately sloping and strongly sloping, deep, well drained soil is on side slopes in the glaciated uplands. Areas are narrow and irregularly shaped and are 5 to 20 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 6 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is 56 inches thick. The upper part is yellowish brown and strong brown, friable and firm silt loam and silty clay loam, and the lower part is strong brown and yellowish brown, firm clay and clay loam. The substratum to a depth of 80 inches is yellowish brown and light yellowish brown clay loam. Some areas are not eroded, and some small areas are severely eroded. In some places the loess is more than 18 inches thick. In other places the slope is more than 18 percent. In a few areas gray mottles are in the lower part of the subsoil.

Included with this soil in mapping are small areas of the well drained Cincinnati soils on the upper part of the side slopes and the well drained Hickory soils on the lower part. Both of the included soils are less clayey than the Bonnell soil. They make up 4 to 7 percent of the unit.

Available water capacity is moderate in the Bonnell soil, and permeability is slow. The organic matter content of the surface layer is moderately low. Surface runoff is medium or rapid. The surface layer is friable and can be easily tilled.

Most areas of this soil are used for hay and pasture. A few areas are used for cultivated crops. A few are wooded.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a crop rotation that includes grasses and legumes, conservation tillage, terraces, diversions, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to a no-till cropping system.

This soil is fairly well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include alfalfa and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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 and plant competition are management concerns. The use of planting or logging equipment is limited during wet periods. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of shrinking and swelling, this soil is severely limited as a site for dwellings and small commercial buildings. Also, the slope is a severe limitation on sites for small commercial buildings. Reinforcing foundations, footings, and basement walls and backfilling with coarse sand and gravel help to prevent the damage caused by shrinking and swelling. The slope can be modified.

This soil is severely limited as a site for local roads and streets because of low strength and because of shrinking and swelling. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

Because of the slow permeability, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption field helps to ensure proper performance.

The land capability classification is IVe. The woodland ordination symbol is 4C.

BpD3—Bonnell silty clay loam, 10 to 18 percent slopes, severely eroded. This moderately sloping and strongly sloping, deep, well drained soil is on side slopes in the glaciated uplands. Areas are narrow and irregularly shaped and are 5 to 20 acres in size.

In a typical profile, the surface layer is strong brown silty clay loam about 6 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the subsoil. The subsoil is about 53 inches thick. The upper part is strong brown and yellowish brown, very firm clay and silty clay, and the lower part is yellowish brown, firm clay loam. The substratum to a depth of 80 inches is yellowish brown clay loam. In places the surface layer is clay loam or clay. Some areas are moderately eroded. In a few areas gray mottles are in the lower part of the subsoil. In some areas the subsoil has less clay. In other areas the slope is more than 18 percent.

Included with this soil in mapping are small areas of the well drained Cincinnati soils on the upper part of the side slopes and the well drained Hickory soils on the lower part. Both of these soils are less clayey than the Bonnell soil. Also included are a few small gullied areas. Included areas make up 3 to 5 percent of the unit.

Available water capacity is moderate in the Bonnell soil, and permeability is slow. The organic matter content of the surface layer is low or very low. Surface runoff is medium or rapid. The soil becomes very cloddy if tilled when too wet; consequently, preparing a good seedbed is difficult.

Most areas are used for hay and pasture. A few areas are used for cultivated crops. Because of poor tilth and the hazard of erosion, this soil is generally unsuited to row crops. It is poorly suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include alfalfa and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The equipment limitation, seeding mortality, and plant competition are management concerns. The use of planting or logging equipment is limited during wet periods. Overstocking helps to compensate for seedling mortality. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of shrinking and swelling, this soil is severely limited as a site for dwellings and small commercial buildings. Also, the slope is a severe limitation on sites for small commercial buildings. Reinforcing foundations, footings, and basement walls and backfilling with coarse sand and gravel help to prevent the damage caused by shrinking and swelling. The slope can be modified.

This soil is severely limited as a site for local roads and streets because of low strength and because of shrinking and swelling. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

Because of the slow permeability, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption field helps to ensure proper performance.

The land capability classification is VIe. The woodland ordination symbol is 3C.

Bu—Burnside silt loam, occasionally flooded. This nearly level, deep, well drained and moderately well drained soil is on bottom land. It is underlain by siltstone, shale, and fine grained sandstone bedrock. It is occasionally flooded for very brief periods, usually in late winter and in spring. Areas are narrow and elongated and are 5 to 100 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 5 inches thick. The subsoil is dark yellowish brown, friable silt loam about 19 inches thick. The substratum is brown and yellowish brown very channery and channery silt loam. Interbedded siltstone and fine grained sandstone bedrock is at a depth of about 54 inches. In some places the surface layer is loam or gravelly loam. In other places gray mottles are within a depth of 24 inches. A few areas are only rarely flooded.

Included with this soil in mapping are a few small areas of the well drained, nonchannery Haymond and moderately well drained, nonchannery Steff soils in the slightly higher landscape positions. These soils make up 4 to 7 percent of the unit.

Available water capacity and permeability are moderate in the Burnside soil. The organic matter content of the surface layer is moderately low or moderate. Surface runoff is slow. The surface layer is friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 3 to 5 feet from February through June.

Most of the acreage of this soil is idle land or woodland. Some areas are used for pasture. A few areas are used for cultivated crops.

This soil is well suited to corn, soybeans, and small grain. During long dry periods, yields are reduced because of the moderate available water capacity. The flooding is the major hazard. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content. The soil is well suited to a spring plowing or spring chisel tillage system and to a no-till cropping system.

This soil is well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the flooding, this soil is severely limited as a site for dwellings and for local roads and streets. Constructing the dwellings on raised, well compacted fill material and building up the roadbed help to prevent the damage caused by floodwater. The soil is generally unsuitable as a site for septic tank absorption fields because of the flooding and the wetness.

The land capability classification is IIs. The woodland ordination symbol is 7A.

CcB2—Cincinnati silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on ridgetops and side slopes in the glaciated uplands. Areas are narrow and elongated or irregularly shaped and are 5 to 50 acres in size.

In a typical profile, the surface layer is dark yellowish brown silt loam about 9 inches thick. It has a small amount of yellowish brown silt loam. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is more than 71 inches thick. The upper part is yellowish brown, friable silt loam; the next part is a fragipan of yellowish brown and light yellowish brown, mottled, very firm, brittle silt loam and loam; and the lower part is yellowish brown, mottled, firm clay loam. In some areas on the west side of the county, red silty clay is below the fragipan. In a few areas clay is below the fragipan. Some areas are not eroded. In places the slope is more than 6 percent.

Included with this soil in mapping are some small areas of the moderately well drained Rossmoyne soils at the head of drainageways and on narrow flats. These soils make up 7 to 10 percent of the unit.

Available water capacity is moderate in the Cincinnati soil. Permeability is moderate above the fragipan and moderately slow or slow in and below the fragipan. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 2.5 to 4.0 feet from January through April.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard. The moderately slowly permeable or slowly permeable fragipan is the major limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and timothy, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

This soil is suitable as a site for dwellings without basements. It is moderately limited as a site for dwellings with basements because of the wetness and as a site for small commercial buildings because of the slope. Installing subsurface drains around footings and basement walls helps to lower the water table. The slope can be modified.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

Because of the moderately slow or slow permeability in the fragipan and the wetness, this soil is severely limited as a site for septic tank absorption fields. Installing the absorption field in a mound of suitable filtering material, providing perimeter subsurface drains, and enlarging the absorption area help to ensure proper performance.

The land capability classification is IIe. The woodland ordination symbol is 4A.

CcC2—Cincinnati silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on side slopes in the glaciated uplands. Areas are narrow and elongated or irregularly shaped and are 10 to 60 acres in size.

In a typical profile, the surface layer is dark yellowish brown silt loam about 8 inches thick. It has a small amount of yellowish brown silt loam. In most areas, erosion has removed the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is more than 72 inches thick. The upper part is yellowish brown, friable silt loam; the next part is a fragipan of yellowish brown, very firm, brittle silt loam; and the lower part is yellowish brown, mottled, firm silt loam and clay loam. In places red silty clay is below the fragipan. In a few areas clay is below the fragipan. In some areas the slope is more than 12 percent. In a few places loamy material weathered from interbedded siltstone and fine grained sandstone is below the fragipan. Some areas are uneroded or severely eroded.

Included with this soil in mapping are a few areas of the moderately well drained Rossmoyne soils at the head of drainageways and small areas of the well drained Bonnell soils on the lower part of side slopes. Bonnell soils are more clayey than the Cincinnati soil. Included soils make up 7 to 10 percent of the unit.

Available water capacity is moderate in the Cincinnati soil. Permeability is moderate above the fragipan and moderately slow or slow in and below the fragipan. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 2.5 to 4.0 feet from January through April.

Most areas of this soil are used for cultivated crops or for hay and pasture. A few small areas are wooded.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major hazard. The moderately slowly permeable or slowly permeable fragipan is the major limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a crop rotation that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the slope, this soil is moderately limited as a site for dwellings and severely limited as a site for small commercial buildings. The wetness also is a limitation on sites for dwellings with basements. The slope can be modified. Installing subsurface drains around footings and basement walls helps to lower the water table.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

Because of the moderately slow or slow permeability in the fragipan and the wetness, this soil is severely limited as a site for septic tank absorption fields. Installing the absorption field in a mound of suitable filtering material, providing perimeter subsurface drains, and enlarging the absorption area help to ensure proper performance.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

CcC3—Cincinnati silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on side slopes in the glaciated uplands. Areas are narrow and elongated or irregularly shaped and are 10 to 40 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 8 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the subsoil. The subsoil is about 72 inches thick. The upper part is yellowish brown, friable silt loam; the next part is a fragipan of yellowish brown and light yellowish brown, mottled, very firm, brittle silt loam; and the lower part is brownish yellow, reddish yellow, and strong brown, mottled, firm silty clay loam and clay loam. A few small areas are moderately eroded. In a few places red silty clay is below the fragipan. In a few areas clay is below the fragipan. In places the slope is more than 12 percent. In a few areas loamy material weathered from interbedded siltstone and fine grained sandstone is below the fragipan.

Included with this soil in mapping are a few areas of the moderately well drained Rossmoyne soils at the head of drainageways and small areas of the well drained Bonnell soils on the lower part of side slopes. Bonnell soils are more clayey than the Cincinnati soil. Included soils make up 4 to 7 percent of the unit.

Available water capacity is moderate in the Cincinnati soil. Permeability is moderate above the fragipan and moderately slow or slow in and below the fragipan. The organic matter content of the surface layer is very low or low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 2.5 to 4.0 feet from January through April.

Most of the acreage of this soil is used for cultivated crops or for hay and pasture. The rest is idle land or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. The moderately slowly permeable or slowly permeable fragipan is the major limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that is dominated by grasses and legumes, terraces, diversions, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to a no-till cropping system.

This soil is fairly well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the slope, this soil is moderately limited as a site for dwellings and severely limited as a site for small commercial buildings. The wetness also is a limitation on sites for dwellings with basements. The slope can be modified. Installing subsurface drains around footings and basement walls helps to lower the water table.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

Because of the moderately slow or slow permeability in the fragipan and the wetness, this soil is severely limited as a site for septic tank absorption fields. Installing the absorption field in a mound of suitable filtering material, providing perimeter subsurface drains, and enlarging the absorption area help to ensure proper performance.

The land capability classification is IVe. The woodland ordination symbol is 4A.

Cm—Cobbsfork silt loam. This nearly level, deep, poorly drained soil is on flats in the glaciated uplands. It is subject to ponding. Areas are broad and irregularly shaped and are 20 to 200 acres in size.

In a typical profile, the surface layer is brown and grayish brown, mottled silt loam about 10 inches thick. The subsoil is more than 89 inches thick. The upper part is light brownish gray, mottled, friable and firm silt loam and silty clay loam; the next part is gray and light brownish gray, mottled, firm, brittle silt loam; and the lower part is light brownish gray, mottled, firm clay loam.

Included with this soil in mapping are the somewhat poorly drained Avonburg soils on the slightly higher flats. These soils make up 1 to 3 percent of the unit.

Available water capacity is high in the Cobbsfork soil, and permeability is very slow. The organic matter content of the surface layer is moderately low. Surface runoff is very slow. The surface layer is friable and can be easily tilled. The soil has a perched seasonal high water table near or above the surface from December through April.

Most areas of this soil are used for cultivated crops. A few areas are wooded or are used for hay and pasture.

This soil is fairly well suited to corn, soybeans, and small grain. The wetness is the major limitation. A drainage system is needed. Land smoothing and shallow surface drains help to remove excess surface water. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

If adequately drained, this soil is suited to grasses for hay and pasture. It is poorly suited to shallow-rooted legumes. Suitable grasses include tall fescue and reed canarygrass, and suitable legumes include red clover and lespedeza. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant tree species are favored in timber stands. Prolonged seasonal wetness limits logging activities and the planting of seedlings. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Installing shallow surface drains and furrowing before planting reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the ponding is a severe hazard, this soil is generally unsuitable as a site for dwellings. It is severely limited as a site for local roads and streets because of the ponding and frost action. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Installing roadside drainage ditches helps to prevent the damage caused by frost action and ponding. The soil is generally unsuitable as a site for septic tank absorption fields because of the very slow permeability and the ponding.

The land capability classification is IIIw. The woodland ordination symbol is 6W.

CoD—Coolville silt loam, 12 to 20 percent slopes. This strongly sloping and moderately steep, deep, moderately well drained soil is on side slopes in the uplands. Areas are irregularly shaped and are 5 to 300 acres in size.

In a typical profile, about 1 inch of partly decomposed leaves and roots is at the surface. The surface layer is grayish brown silt loam about 3 inches thick. The subsurface layer is light yellowish brown silt loam about 4 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown and strong brown, friable and firm silt loam and silty clay loam; the next part is yellowish red, mottled, very firm silty clay; and the lower part is strong brown, mottled, firm silty clay loam. Soft bedrock of interbedded shale and siltstone is at a depth of about 46 inches. Some areas are moderately eroded. In some places the surface layer is browner. In other places the loess is more than 24 inches thick.

Included with this soil in mapping are a few areas of the moderately well drained Stonehead soils on the upper part of side slopes and on ridgetops. These soils have a mantle of loess that is thicker than that of the Coolville soil. Also included are small areas of the well drained Gilpin and Kurtz soils on the lower part of side slopes and a few small areas of well drained soils that formed in colluvial deposits at the base of side slopes and interfluves. Included soils make up 10 to 14 percent of the unit.

Available water capacity is moderate in the Coolville soil. Permeability is moderate in the upper part of the subsoil and slow in the lower part. The organic matter content of the surface layer is moderately low. Surface runoff is rapid. The soil has a perched seasonal high water table at a depth of 2.0 to 3.5 feet from February through April.

Most areas are wooded or are used for hay and pasture. This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that is dominated by grasses and legumes, conservation tillage, grassed waterways, and grade-stabilization structures. The soil is well suited to a no-till cropping system. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is fairly well suited to grasses and legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The erosion hazard, the equipment limitation, and plant competition are management concerns. Building logging roads and skid trails on the contour and constructing water bars help to control erosion. Special harvest methods, such as yarding the logs uphill with a cable, minimize the use of crawler tractors and skidders. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

This soil is severely limited as a site for dwellings because of the slope and as a site for dwellings with basements because of the wetness. The slope can be modified, or the buildings can be designed so that they conform to the natural slope of the land. Installing subsurface drains around basement walls and footings helps to lower the water table.

Because of low strength, slope, and frost action, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. The slope can be modified.

Because of the slow or very slow permeability, the wetness, and the slope, this soil is severely limited as a site for septic tank absorption fields. Installing the absorption field on the contour, providing subsurface drains, and enlarging the absorption area help to ensure proper performance.

The land capability classification is IVe. The woodland ordination symbol is 3R.

Df—Driftwood clay loam, frequently flooded. This nearly level, deep, poorly drained soil is on bottom land. It is frequently flooded for brief to long periods, especially in late fall, winter, and spring, and is subject to ponding. Areas are broad and irregularly shaped and are 20 to several hundred acres in size.

In a typical profile, the surface layer is brown, mottled clay loam about 8 inches thick. The subsoil is about 55 inches thick. The upper part is light gray, mottled, firm sandy clay loam, and the lower part is light gray and gray, mottled, very firm clay. The substratum to a depth of 80 inches is gray, mottled clay loam that has thin layers of silty clay loam. In places the surface layer is sandy loam, loam, or sandy clay loam. In a few areas the subsoil has less clay. Some areas are only occasionally flooded.

Included with this soil in mapping are small areas of the somewhat poorly drained Whitaker soils on slight swells. These soils make up about 2 to 4 percent of the unit.

Available water capacity is moderate in the Driftwood soil, and permeability is slow. The organic matter content of the surface layer is moderate or moderately low. Surface runoff is slow. If tilled when too wet, the surface layer becomes cloddy and cannot be easily worked; consequently, preparing a good seedbed is difficult (fig. 7). The soil has an apparent seasonal high water table near or above the surface from November through May.

Most areas of this soil are used for cultivated crops. A few areas are wooded.

This soil is fairly well suited to corn and soybeans. It is poorly suited to small grain because of the flooding and the wetness. A drainage system is needed. Shallow surface drains and subsurface drains help to remove excess water. Laterals of subsurface drains should be installed at close intervals because of the slow permeability. Suitable outlets commonly are not readily available. During long dry periods, yields are reduced because the available water capacity is moderate. Green manure crops and a conservation tillage system that

Figure 7.—Clods in an area of Driftwood clay loam, frequently flooded, that has been tilled when wet.

leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

If adequately drained, this soil is well suited to grasses for hay and pasture. It is poorly suited to shallow-rooted legumes. Suitable grasses include reed canarygrass and tall fescue, and suitable legumes include red clover and ladino clover. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Prolonged seasonal wetness limits logging activities and the planting of seedlings. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Shallow surface drains, open ditches, and furrowing before planting reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding and the ponding are severe hazards, this soil is generally unsuitable as a site for dwellings. It is severely limited as a site for local roads and streets because of low strength, flooding, and ponding. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Elevating the roadbed and establishing roadside drainage ditches help to prevent the damage caused by flooding and ponding. The soil is generally unsuitable as a site for septic tank absorption fields because of the flooding, the ponding, and the slow permeability.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

DuA—Dubois silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on flats on lacustrine terraces. Areas are narrow and irregularly shaped and are 5 to 1,000 acres in size.

In a typical profile, the surface layer is brown silt loam about 10 inches thick. The subsoil is about 70 inches thick. The upper part is brownish yellow, mottled, friable silt loam; the next part is light brownish gray, mottled, firm silty clay loam; and the lower part is a fragipan of yellowish brown, mottled, very firm, brittle silt loam and loam. The substratum to a depth of 90 inches is gray, mottled clay loam that has very thin layers of silty clay loam. In a few areas, the surface layer is loam and the upper part of the subsoil is loam or clay loam. In some places the slope is more than 2 percent. In other places the lower part of the subsoil and the substratum are sandy loam, loamy sand, silty clay, or clay.

Included with this soil in mapping are small areas of the poorly drained Peoga soils on the slightly lower flats and in slight depressions. Also included are small areas of the moderately well drained Haubstadt soils on the slightly higher flats. Included soils make up 4 to 7 percent of the unit.

Available water capacity is moderate in the Dubois soil. Permeability is moderate above the fragipan and very slow in the fragipan. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 1 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few areas are wooded.

This soil is well suited to corn, soybeans, and small grain. The wetness and the very slowly permeable fragipan are the major limitations. A drainage system is needed. Land smoothing and shallow surface drains help to remove excess surface water. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. During long dry periods, yields are reduced because the available water capacity is moderate. Green manure crops and a conservation tillage system that leaves crop residue on the surface improve or maintain tilth and the organic matter content. Erosion is a hazard in the included areas where the slope is more than 2 percent.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include lespedeza and red clover. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

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

Because of the wetness, this soil is severely limited as a site for dwellings. It is generally unsuitable as a site for buildings with basements. Surface drains, open ditches, and subsurface drains help to lower the water table. In some areas suitable drainage outlets are not readily available. Constructing the buildings on raised, well compacted fill material helps to prevent the damage caused by wetness.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Roadside drainage ditches help to lower the water table and help to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the very slow permeability and the wetness. Installing the absorption field in a mound of suitable filtering material and providing interceptor subsurface drains around the perimeter of the field help to ensure proper performance.

The land capability classification is IIw. The woodland ordination symbol is 3A.

DuB2—Dubois silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, somewhat poorly drained soil is on side slopes on lacustrine terraces. Areas are narrow and irregularly shaped and are 3 to 40 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 6 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is about 66 inches thick. The upper part is light yellowish brown, mottled, friable silt loam; the next part is light brownish gray, mottled, firm silty clay loam; and the lower part is a fragipan of yellowish brown and light yellowish brown, mottled, very firm, brittle silt loam. The substratum to a depth of 80 inches is gray, mottled clay loam that has thin layers of silty clay loam. In a few areas, the surface layer is loam and the upper part of the subsoil is loam or clay loam. Some areas are not eroded. In places the lower part of the subsoil and the substratum are sandy loam, loamy sand, silty clay, or clay.

Included with this soil in mapping are the moderately well drained Haubstadt soils on the lower part of side slopes. Also included are a few areas of the poorly drained Peoga soils at the head of drainageways. Included soils make up 3 to 5 percent of the unit.

Available water capacity is moderate in the Dubois soil. Permeability is moderate above the fragipan and very slow in the fragipan. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 1 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture. A few are wooded.

This soil is well suited to corn, soybeans, and small grain. The wetness and the very slowly permeable fragipan are the major limitations. Erosion is the major hazard. Installing subsurface drains in drainageways helps to remove excess water. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include lespedeza and red clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

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

Because of the wetness, this soil is severely limited as a site for dwellings. It is generally unsuitable as a site for buildings with basements. Open ditches and subsurface drains help to lower the water table. Constructing the buildings on raised, well compacted fill material helps to prevent the damage caused by wetness.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Roadside drainage ditches help to lower the water table and help to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the very slow permeability and the wetness. Installing the absorption field in a mound of suitable filtering material and providing interceptor subsurface drains around the perimeter of the field help to ensure proper performance.

The land capability classification is IIe. The woodland ordination symbol is 3A.

FoA—Fox-Ockley sandy loams, sandy substratums, 0 to 2 percent slopes. These nearly level, well drained soils are on stream terraces along the East Fork of the White River. The Fox soil is moderately deep over sand and gravel, and the Ockley soil is deep over sand and gravel. The Fox soil makes up about 45 percent of the unit, and the Ockley soil also makes up about 45 percent. Areas are irregularly shaped and are 10 to 240 acres in size.

In a typical profile, the surface layer of the Fox soil is dark brown sandy loam about 9 inches thick. The subsoil is dark reddish brown and dark brown, friable and firm gravelly sandy clay loam about 18 inches thick. The substratum to a depth of 60 inches is yellowish brown and pale brown, stratified gravelly coarse sand and coarse sand. In places the surface layer is loamy sand, gravelly sandy loam, gravelly loam, or loam. In a few areas the subsoil has more sand and less clay. In a few places the surface layer is slightly darker colored.

In a typical profile, the surface layer of the Ockley soil is dark yellowish brown sandy loam about 10 inches thick. The subsoil is about 40 inches thick. The upper part is dark brown, friable and firm fine sandy loam and sandy clay loam, and the lower part is dark brown and dark reddish brown, firm gravelly sandy clay loam. The substratum to a depth of 60 inches is light yellowish brown, stratified gravelly coarse sand and coarse sand. In places the surface layer is loamy sand or loam. In a few areas the subsoil has more sand and less clay. In a few places the surface layer is slightly darker colored.

Included with these soils in mapping are several areas that are subject to rare flooding and a few areas that are frequently flooded. Also included, in swales and meander scars, are small areas of deep, well drained and moderately well drained soils that are less gravelly than the Fox and Ockley soils. Included soils make up about 10 percent of the unit.

Available water capacity is low in the Fox soil and moderate in the Ockley soil. Permeability is moderate in the subsoil of both soils and rapid or very rapid in the substratum. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is very friable and can be easily tilled.

Most areas of these soils are used for cultivated crops. A few areas are used for hay and pasture.

These soils are well suited to corn, soybeans, and small grain. The low or moderate available water capacity is the major limitation. During long dry periods, yields are reduced, especially on the Fox soil. Fall-seeded crops, such as winter wheat, can make good use of the limited amount of available moisture. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content and help to protect the surface against soil blowing. The soils are well suited to a no-till cropping system.

These soils are well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue, timothy, and orchardgrass, and suitable legumes include red clover and alfalfa. Overgrazing reduces plant density and forage yields. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are well suited to trees. Plant competition is severe. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of shrinking and swelling, both soils are moderately limited as sites for dwellings without basements and the Ockley soil is moderately limited as a site for dwellings with basements. The Fox soil is suitable as a site for dwellings with basements. Reinforcing foundations, footings, and basement walls and backfilling with more stable material, such as coarse sand and gravel, help to prevent the damage caused by shrinking and swelling.

These soils are moderately limited as sites for local roads and streets because of frost action and because of shrinking and swelling. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

The Fox soil is severely limited as a site for septic tank absorption fields because it has a poor filtering capacity, which can result in the pollution of ground water. Installing the absorption field in a mound of better suited filtering material helps to ensure proper performance. The Ockley soil is moderately limited as a site for septic tank absorption fields because of the restricted permeability. Enlarging the absorption field helps to overcome this limitation.

The land capability classification is IIs. The woodland ordination symbol assigned to the Fox soil is 4A, and that assigned to the Ockley soil is 5A.

FrD2—Frederick-Crider-Gilpin silt loams, 6 to 18 percent slopes, eroded. These moderately sloping and strongly sloping, deep and moderately deep, well drained soils are on side slopes in the uplands. The Frederick soil makes up about 40 percent of the unit, the Crider soil makes up about 30 percent, and the Gilpin soil makes up about 20 percent. Areas are narrow and irregularly shaped and are 20 to several hundred acres in size. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil.

In a typical profile, the surface layer of the Frederick soil is yellowish brown silt loam about 9 inches thick. The subsoil is more than 71 inches thick. The upper part is yellowish red, firm cherty clay, and the lower part is strong brown, dark red, and red, firm clay. In places the surface layer is severely eroded and is cherty silty clay loam. Some areas are not eroded. In places the slope is more than 18 percent.

In a typical profile, the surface layer of the Crider soil is dark yellowish brown silt loam about 9 inches thick. It has a small amount of strong brown silt loam. The subsoil is more than 71 inches thick. The upper part is strong brown, friable and firm silt loam and silty clay loam, and the lower part is red and yellowish red, very firm and firm clay and silty clay. In some places the slope is less than 6 percent. In other places limestone bedrock is at a depth of 60 inches or less. Some areas are not eroded, and a few are severely eroded.

In a typical profile, the surface layer of the Gilpin soil is dark brown silt loam about 3 inches thick. The subsurface layer is yellowish brown silt loam about 6 inches thick. The subsoil is about 25 inches of strong brown, friable silt loam and very channery silt loam. Interbedded siltstone and fine grained sandstone bedrock is at a depth of about 34 inches. Some areas are not eroded. In places the slope is more than 18 percent.

Included with these soils in mapping are small areas of the moderately well drained Bedford soils on the upper part of side slopes and at the head of drainageways. Also included are small areas of the well drained Wellston soils on the lower part of side slopes. Included soils make up about 10 percent of the unit.

Available water capacity is moderate in the Frederick soil, high in the Crider soil, and low in the Gilpin soil. Permeability is moderate in all three soils. The organic matter content of the surface layer is moderately low. Surface runoff is medium or rapid. The surface layer is friable and can be easily tilled.

Most areas of these soils are used for hay and pasture. Some areas are used for cultivated crops. Some are wooded.

These soils are fairly well suited to corn, soybeans, and small grain. Erosion is the major hazard. During long dry periods, yields are reduced because of the moderate or low available water capacity of the Frederick and Gilpin soils. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, conservation tillage, terraces, diversions, grassed waterways, and grade-stabilization structures. The soils are well suited to a no-till cropping system.

Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and maintain or improve tilth and the organic matter content.

These soils are well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soils are wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are well suited to trees. The equipment limitation and plant competition are management concerns. The use of planting and logging equipment is limited on the Frederick soil. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the slope, these soils are moderately limited as sites for dwellings and severely limited as sites for small commercial buildings. Also, the Gilpin soil is moderately limited as a site for dwellings with basements because of the depth to bedrock, and the Frederick soil is moderately limited as a site for dwellings with or without basements because of shrinking and swelling. The slope can be modified, or the buildings can be designed so that they conform to the natural slope of the land. Excavating the bedrock underlying the Gilpin soil is difficult and expensive. Reinforcing foundations, footings, and basement walls and backfilling with more stable material, such as coarse sand and gravel, help to prevent the structural damage caused by shrinking and swelling of the Frederick soil.

The Crider and Frederick soils are severely limited as sites for local roads and streets because of low strength. The Gilpin soil is moderately limited by slope and frost action. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Constructing the roads and streets on the contour helps to overcome the slope.

The Crider and Frederick soils are moderately limited as sites for septic tank absorption fields because of the slope. Also, the Frederick soil is moderately limited because of the restricted permeability. Installing the absorption field on the contour helps to overcome the slope. Enlarging the absorption field helps overcome the restricted permeability of the Fredrick soil. The Gilpin soil should not be selected as a site for the absorption fields because the depth to bedrock is a severe limitation.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Fredrick soil is 4C, that assigned to the Crider soil is 7A, and that assigned to the Gilpin soil is 4A.

Ge—Genesee silt loam, frequently flooded. This nearly level, deep, well drained soil is on bottom land. It is frequently flooded for brief to long periods, especially in the late fall, winter, and spring (fig. 8). Areas are narrow to broad and are irregularly shaped. They are 20 to several hundred acres in size.

In a typical profile, the surface layer is dark brown silt loam about 9 inches thick. The upper 37 inches of the substratum is dark yellowish brown silt loam. The lower part to a depth of about 60 inches is yellowish brown loam that has thin layers of fine sandy loam and loamy fine sand. In places the surface layer is loam, sandy loam, loamy sand, or silty clay loam. In some areas the soil is calcareous within a depth of 20 inches. In a few areas it is not calcareous within a depth of 40 inches. In places the upper part of the substratum has more silt and less clay. In some small areas loamy sand and sand are below a depth of 40 inches.

Included with this soil in mapping are a few areas of the well drained Stonelick soils adjacent to meander scars and old oxbows. These soils are more sandy than the Genesee soil. Also included are a few small areas of the well drained Armiesburg soils in the slightly higher landscape positions and small areas of moderately well drained soils in drainageways and swales. Armiesburg soils are more clayey than the Genesee soil. Included soils make up 7 to 10 percent of the unit.

Available water capacity is very high in the Genesee soil, and permeability is moderate. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is friable and can be easily tilled.

Most areas of this soil are used for cultivated crops. A few small areas are wooded.

This soil is well suited to corn and soybeans. It is poorly suited to small grain because of the flooding. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content. The soil is well suited to spring plowing and spring chisel tillage systems.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include red clover and ladino clover. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Figure 8.—Corn damaged by floodwater in an area of Genesee silt loam, frequently flooded.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields and is severely limited as a site for local roads and streets. The roadbed should be built up above the normal flood stage.

The land capability classification is IIw. The woodland ordination symbol is 8A.

GnD3—Gilpin silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, moderately deep, well drained soil is on side slopes in the uplands. Severe erosion has resulted in lower fertility and poor tilth and has reduced the amount of water available for plant growth. Areas are narrow and irregularly shaped and are 10 to 60 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 7 inches thick. The subsoil is about 21 inches of yellowish brown and strong brown, firm silty clay loam and channery silty clay loam. Soft bedrock of interbedded siltstone is at a depth of about 28 inches. A few areas are moderately eroded. In a few small areas the surface layer is silty clay loam or channery silty clay loam.

Included with this soil in mapping are small areas of the well drained Wellston soils on the upper part of side slopes. Also included are some gullied areas. Included areas make up 10 to 13 percent of the unit.

Available water capacity is low in the Gilpin soil, and permeability is moderate. The organic matter content of the surface layer is low or very low. Surface runoff is medium.

Most of the acreage of this soil is woodland or idle land. A few areas are used for pasture. Because of the low available water capacity, the poor tilth, and the hazard of erosion, this soil is generally unsuited to row crops. It is poorly suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The erosion hazard, the equipment limitation, and plant competition are the main management concerns. Building logging roads and skid trails on the contour and installing water bars help to control erosion. The use of planting and harvesting equipment is limited. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the slope, this soil is severely limited as a site for dwellings and local roads and streets. The slope can be modified. Also, the buildings can be designed so that they conform to the natural slope of the land, and the roads and streets can be constructed on the contour. The soil is generally unsuitable to septic-tank absorption fields because the slope and the depth of bedrock are severe limitations.

The land capability classification is VIe. The woodland ordination symbol is 4R.

GnF—Gilpin silt loam, 25 to 55 percent slopes. This steep and very steep, moderately deep, well drained soil is on side slopes in the uplands. Areas are broad and irregularly shaped and are 15 to several hundred acres in size.

In a typical profile, a layer of partly decomposed leaves and roots is at the surface. The surface layer is yellowish brown silt loam about 7 inches thick. The subsoil is about 23 inches thick. The upper part is brownish yellow and light yellowish brown, friable silt loam and channery silt loam, and the lower part is light olive brown, friable very channery silt loam. Soft bedrock of interbedded siltstone is at a depth of about 30 inches. A few areas are moderately eroded. In some areas the upper part of the subsoil has fewer coarse fragments.

Included with this soil in mapping are small areas of the deep, well drained Wellston soils on the upper part of side slopes and on ridgetops and a few small areas of the well drained Berks soils on the upper part of side slopes. Wellston soils are less channery than the Gilpin soil, and Berks soils are more channery. Also included are small areas of deep, well drained soils that formed in colluvial deposits at the base of side slopes. Included soils make up 9 to 12 percent of the unit.

Available water capacity is low in the Gilpin soil, and permeability is moderate. The organic matter content of the surface layer is moderately low. Surface runoff is very rapid.

Most areas of this soil are wooded. A few areas are used for pasture. Because of the steep and very steep slope, the low available water capacity, and a severe hazard of erosion, this soil is generally unsuited to row crops and is poorly suited to grasses and legumes for pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and lespedeza. The slope limits the use of farm machinery. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The erosion hazard, the equipment limitation, and plant competition are management concerns. Building logging roads and skid trails on the contour and installing water bars help to control erosion. Special logging methods, such as yarding the logs uphill with a cable, minimize the use of crawler tractors and skidders. North aspects generally are more productive than south aspects. Also, seedling mortality is less severe on the north aspects. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

This soil is generally unsuitable as a site for dwellings because the slope is a severe limitation. Alternative building sites should be selected. The soil is severely limited as a site for local roads and streets because of the slope. Building the roads and streets on the contour and land shaping help to overcome this limitation. The soil is generally unsuitable as a site for septic tank absorption fields because the slope and the depth to bedrock are severe limitations.

The land capability classification is VIIe. The woodland ordination symbol is 4R.

GpD—Gilpin-Wellston silt loams, 10 to 25 percent slopes. These moderately sloping to moderately steep, moderately deep and deep, well drained soils are on side slopes and ridgetops in the uplands. The Gilpin soil makes up about 50 percent of the unit, and the Wellston soil makes up about 40 percent. Areas are narrow and irregularly shaped and are 15 to several hundred acres in size.

In a typical profile, about 1 inch of partly decomposed leaves and roots is at the surface of the Gilpin soil. The surface layer is dark brown silt loam about 5 inches thick. The subsoil is about 26 inches thick. The upper part is yellowish brown, friable silt loam and channery silt loam, and the lower part is light yellowish brown, friable very channery silt loam. Interbedded siltstone bedrock is at a depth of about 31 inches. A few areas are moderately eroded.

In a typical profile, about 1 inch of partly decomposed leaves and roots is at the surface of the Wellston soil. The surface layer is brown silt loam about 6 inches thick. The subsoil is about 60 inches thick. The upper part is yellowish brown, friable silt loam; the next part is brown and dark brown, firm silty clay loam; and the lower part is strong brown, firm silty clay loam and channery silty clay loam. Interbedded siltstone bedrock is at a depth of about 66 inches. In places the slope is less than 10 percent. A few areas are moderately eroded.

Included with these soils in mapping are small areas of the moderately well drained Tilsit soils on ridgetops and the upper part of side slopes and small areas of the well drained Berks soils on the lower part of side slopes. Berks soils are more channery than the Gilpin and Wellston soils. Included soils make up about 10 percent of the unit.

Available water capacity is low in the Gilpin soil and high in the Wellston soil. Permeability is moderate in both soils. The organic matter content of the surface layer is moderately low. Surface runoff is medium or rapid.

Most areas of these soils are wooded. Some areas are used for pasture. A few areas are developed as habitat for woodland wildlife.

These soils are poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. The slope is the major limitation. During long dry periods, yields are reduced because the available water capacity of the Gilpin soil is low. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that is dominated by grasses and legumes, conservation tillage, grassed waterways, and grade-stabilization structures. The soils are well suited to a no-till cropping system. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

These soils are fairly well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soils are wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are well suited to trees. The erosion hazard, the equipment limitation, and plant competition are the main management concerns. Building logging roads and skid trails on the contour and installing water bars help to control erosion. The slope limits the use of planting and logging equipment. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the slope, these soils are severely limited as sites for dwellings and small commercial buildings. Also, the Gilpin soil is moderately limited as a site for dwellings with basements because of the depth to bedrock. The slope can be modified, or the buildings can be designed so that they conform to the natural slope of the land. Excavating the bedrock underlying the Gilpin soil is difficult and expensive.

The Gilpin soil is moderately limited as a site for local roads and streets because of the slope and frost action. The Wellston soil is severely limited by frost action. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. The slope can be modified, or the roads and streets can be built on the contour.

Because of the slope, these soils are severely limited as sites for septic tank absorption fields. The depth to bedrock in the Gilpin soil also is a severe limitation. Alternative sites should be selected. In areas of the Wellston soil, the absorption field should be installed on the contour and the absroption area should be enlarged.

The land capability classification is IVe. The woodland ordination symbol is 4R.

HdA—Haubstadt silt loam, 0 to 2 percent slopes. This nearly level, deep, moderately well drained soil is on flats on lacustrine terraces. Areas are narrow and irregularly shaped and are 5 to 25 acres in size.

In a typical profile, the surface layer is dark yellowish brown silt loam about 10 inches thick. The subsoil is about 60 inches thick. The upper part is brownish yellow, friable silt loam; the next part is yellowish brown, mottled, firm silty clay loam; and the lower part is a fragipan of yellowish brown and strong brown, mottled, very firm, brittle silt loam and loam. The substratum to a depth of 80 inches is strong brown, mottled clay loam. In a few areas, the surface layer is loam and the upper part of the subsoil is loam or clay loam. In places the lower part of the subsoil and the substratum are sandy loam, loamy sand, silty clay, or clay.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Dubois soils at the head of drainageways and in the middle of large flats. These soils make up 3 to 5 percent of the unit.

Available water capacity is moderate in the Haubstadt soil, and permeability is slow. The organic matter content of the surface layer is moderately low or low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 1.5 to 3.0 feet from January through April.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. The slowly permeable fragipan is the major limitation. Wetness in early spring also is a limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue, timothy, and orchardgrass, and suitable legumes include red clover and lespedeza. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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 windthrow hazard and plant competition are management concerns. Careful thinning and harvesting methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements and for small commercial buildings. It is severely limited as a site for dwellings with basements because of the wetness. Reinforcing foundations and footings and backfilling with more stable material, such as coarse sand and gravel, help to prevent the damage caused by shrinking and swelling. Shallow surface drains and subsurface drains around footings and foundations help to lower the water table.

Because of low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the slow permeability and the wetness. Installing the absorption field in a mound of suitable filtering material, enlarging the absorption area, and providing subsurface drains help to ensure proper performance.

The land capability classification is IIw. The woodland ordination symbol is 4D.

HdB2—Haubstadt silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on ridgetops and side slopes on lacustrine terraces. Areas are narrow and elongated or are irregularly shaped. They are 5 to 100 acres in size.

In a typical profile, the surface layer is dark yellowish brown silt loam about 7 inches thick. It has a small amount of yellowish brown silty clay loam. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is about 60 inches thick. The upper part is yellowish brown, friable silty clay loam; the next part is yellowish brown, mottled, firm silty clay loam; and the lower part is a fragipan of yellowish brown, mottled, very firm, brittle silt loam. The substratum to a depth of 88 inches is light yellowish brown and strong brown, mottled clay loam. Some areas are not eroded. In a few areas, the surface layer is loam and the upper part of the subsoil is loam or clay loam. In some places the lower part of the subsoil and the substratum are sandy loam, loamy sand, silty clay, or clay. In other places the slope is more than 6 percent. In some areas the upper part of the subsoil does not have gray mottles.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Dubois soils at the head of drainageways. Also included are small areas of the well drained and moderately well drained Otwell soils on the lower, more sloping part of side slopes. Included soils make up 4 to 7 percent of the unit.

Available water capacity is moderate in the Haubstadt soil, and permeability is slow. The organic matter content of the surface layer is moderately low or low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 1.5 to 3.0 feet from January through April.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few small areas are wooded.

This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard. The slowly permeable fragipan is the major limitation. Wetness in early spring also is a limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures are needed to reduce the runoff rate and to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures (fig. 9). Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems. In seepy areas in some of the drainageways, subsurface tile needed.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue, timothy, and orchardgrass, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil

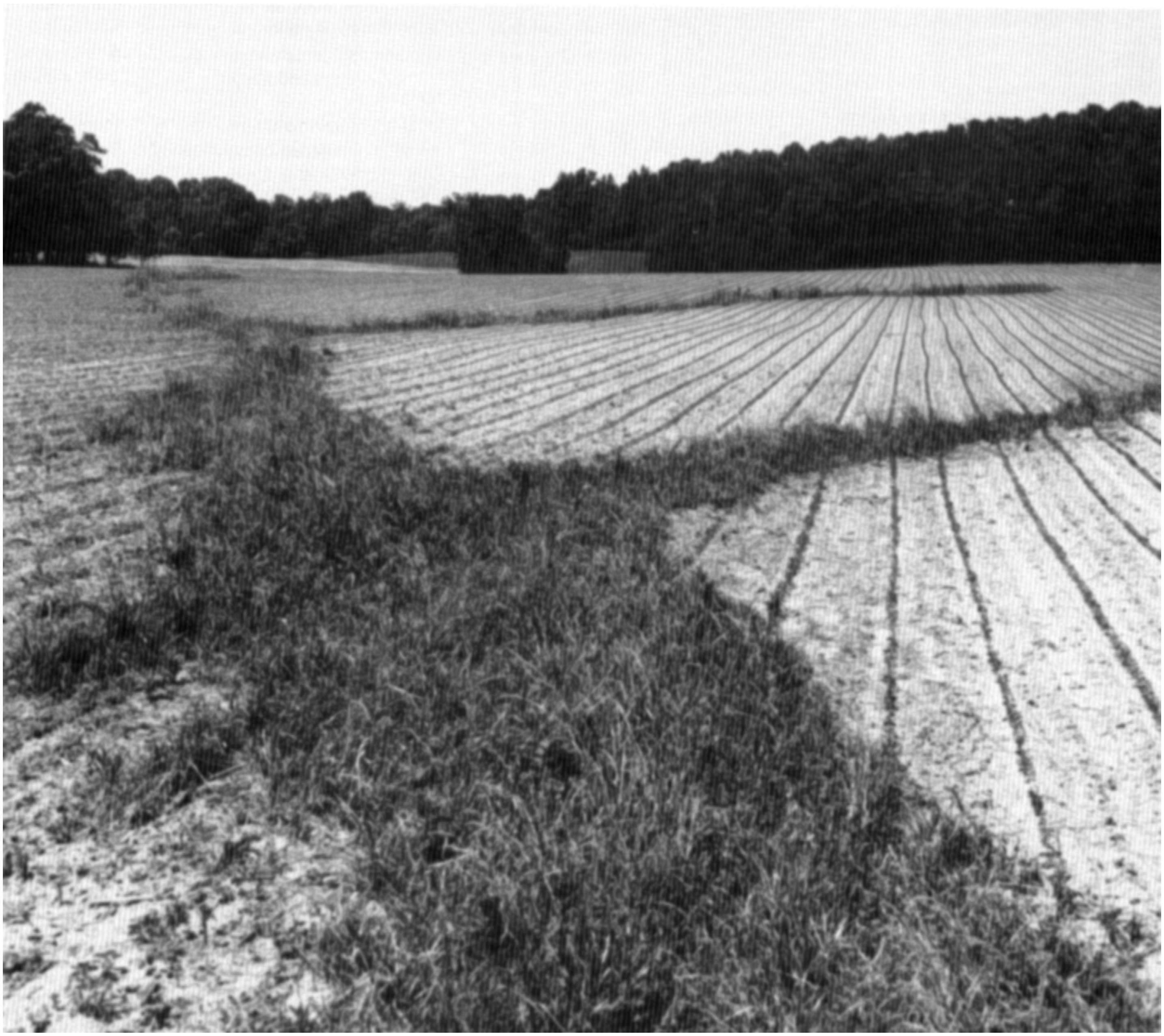


Figure 9.—Grassed waterways in an area of Haubstadt silt loam, 2 to 6 percent slopes, eroded.

is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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 windthrow hazard and plant competition are management concerns. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements and for small commercial buildings. It is severely limited as a site for dwellings with basements because of the wetness. The slope is a moderate limitation on sites for small commercial buildings. It can be modified. Reinforcing foundations and footings and backfilling with more stable material, such as coarse sand and gravel, help to prevent the damage caused by shrinking and swelling. Shallow surface drains and subsurface drains around footings and foundations help to lower the water table.

Because of low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the slow permeability and the wetness. Installing the absorption field in a mound of suitable filtering material, enlarging the absorption area, and providing subsurface drains help to ensure proper performance.

The land capability classification is IIe. The woodland ordination symbol is 4D.

Hm—Haymond silt loam, frequently flooded. This nearly level, deep, well drained soil is on bottom land. In several areas it is in the bends of stream channels. It is frequently flooded for brief periods, especially in winter and spring. Areas are narrow and elongated and are 10 to 90 acres in size.

In a typical profile, the surface layer is brown silt loam about 12 inches thick. The upper 22 inches of the substratum is dark yellowish brown silt loam. The lower part to a depth of about 60 inches is dark yellowish brown, stratified loam and fine sandy loam. In places the upper 40 inches is loam or fine sandy loam. In a few areas coarse fragments or gray mottles are below a depth of 40 inches. In some areas the substratum is more acid to a depth of 40 inches. In a few small areas it has more clay to a depth of 40 inches. A few areas are only occasionally or rarely flooded.

Included with this soil in mapping are a few small areas of the moderately well drained Wilbur soils in swales and small areas of the moderately well drained and well drained Burnside soils adjacent to stream channels that drain areas of siltstone, sandstone, and shale bedrock. Burnside soils are more channery than the Haymond soil. Included soils make up 4 to 7 percent of the unit.

Available water capacity is high in the Haymond soil, and permeability is moderate. The organic matter content of the surface layer is moderate or moderately low. Surface runoff is very slow. The surface layer is friable and can be easily tilled.

Most areas of this soil are used for cultivated crops. Some small areas are used for hay and pasture. A few areas are wooded.

This soil is well suited to corn and soybeans. It is poorly suited to small grain because of the flooding. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content. The soil is well suited to spring plowing and spring chisel tillage systems.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and reed canarygrass, and suitable legumes include red clover and ladino clover. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding is a severe hazard, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of flooding and frost action. The roads should be built up above the normal flood stage. Strengthening the base with better suited material helps to prevent the damage caused by flooding and frost action.

The land capability classification is IIw. The woodland ordination symbol is 8A.

HrE—Hickory loam, 15 to 45 percent slopes. This strongly sloping to very steep, deep, well drained soil is on side slopes in the glaciated uplands. Areas are narrow and irregularly shaped and are 10 to 160 acres in size.

In a typical profile, the surface layer is very dark grayish brown loam about 4 inches thick. The subsurface layer is yellowish brown loam about 6 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable loam, and the lower part is strong brown and yellowish brown, firm clay loam. The substratum to a depth of 60 inches is yellowish brown loam. In places the slope is less than 15 percent. Some areas are moderately eroded, and a few small areas are severely eroded. In a few places the subsoil has a redder hue and is sandy clay loam. In a few areas the substratum has pockets of loamy sand.

Included with this soil in mapping are small areas of the well drained Cincinnati and Bonnell soils on the upper part of side slopes. Cincinnati soils are more silty than the Hickory soil, and Bonnell soils are more clayey. Included soils make up 3 to 5 percent of the unit.

Available water capacity is high in the Hickory soil, and permeability is moderate. The organic matter content of the surface layer is moderately low. Surface runoff is rapid.

Most areas of this soil are wooded. A few small areas are used for pasture. Because of the strongly sloping to very steep slope and a severe hazard of erosion, this soil is generally unsuited to row crops. It is poorly suited to grasses and legumes for pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. The slope limits the use of farm machinery. Overgrazing reduces plant density and forage yields and increases the susceptibility to erosion. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. The erosion hazard, the equipment limitation, and plant competition are management concerns. Building logging roads and skid trails on the contour and constructing water bars help to control erosion. Special harvest methods, such as yarding the logs uphill with a cable, minimize the use of crawler tractors and skidders. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the slope is a severe limitation, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the slope and low strength. The roads and streets should be built across the slope, and cuts and fills should be made where necessary. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

The land capability classification is VIIe. The woodland ordination symbol is 5R.

KtF—Kurtz silt loam, 20 to 55 percent slopes. This moderately steep to very steep, deep, well drained soil is on side slopes in the uplands. Areas are narrow and irregularly shaped and are 10 to several hundred acres in size.

In a typical profile, about 1 inch of partly decomposed leaves and roots is at the surface. The surface layer is grayish brown silt loam about 2 inches thick. The subsurface layer is light yellowish brown silt loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is brownish yellow and yellowish brown, friable silt loam, and the lower part is strong brown, light yellowish brown, and light olive brown, mottled, firm silty clay loam and very shaly silty clay loam. Soft bedrock of interbedded siltstone and soft shale is at a depth of about 47 inches. Some areas are moderately eroded. In places the slope is more than 55 percent.

Included with this soil in mapping are small areas of the well drained and moderately well drained Coolville and Rarden soils on small ridgetops and the upper part of side slopes and small areas of the well drained Gilpin soils on the upper part of side slopes. Coolville and Rarden soils are more clayey than the Kurtz soil, and Gilpin soils are more channery. Also included are areas where 20 or more inches of loamy colluvium is at the base of side slopes. Included soils make up 7 to 10 percent of the unit.

Available water capacity and permeability are moderate in the Kurtz soil. The organic matter content of the surface layer is moderately low. Surface runoff is rapid or very rapid.

Most areas of this soil are wooded. A few areas are used for pasture.

Because of the moderately steep to very steep slope and a severe hazard of erosion, this soil is generally unsuited to row crops and is poorly suited to grasses and legumes for pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. The slope limits the use of farm machinery. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The erosion hazard, the equipment limitation, seedling mortality, and plant competition are management concerns. Building logging roads and skid trails on the contour and constructing water bars help to control erosion. Special harvest methods, such as yarding the logs uphill with a cable, minimize the use of crawler tractors and skidders. Overstocking helps to compensate for seedling mortality. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

This soil is generally unsuitable as a site for dwellings and septic tank absorption fields because the slope is a severe limitation. Alternative sites should be selected. The soil is severely limited as a site for local roads and streets because of low strength, slope, and frost action. The roads and streets can be built on the contour, or the slope can be modified. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

The land capability classification is VIIe. The woodland ordination symbol is 4R.

Ly—Lyles fine sandy loam. This nearly level, deep, very poorly drained soil is in depressions on uplands. It is subject to ponding. Areas are irregularly shaped and are 5 to 500 acres in size.

In a typical profile, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is very dark gray, mottled fine sandy loam about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark gray and gray, mottled, friable fine sandy loam and sandy clay loam, and the lower part is light brownish gray and brownish yellow, very friable loamy sand. The substratum to a depth of 60 inches is light brownish gray, mottled fine sand. In a few small areas, the surface layer is silt loam or silty clay loam. In some places it is dark grayish brown and is more than 24 inches thick. In other places it is lighter colored.

Included with this soil in mapping are the somewhat poorly drained Ayrshire soils on slightly convex swells. Also included, in some of the depressions, are small areas of soils that are ponded most of the year. Included soils make up 7 to 10 percent of the unit.

Available water capacity is high in the Lyles soil, and permeability is moderate. The organic matter content of the surface layer is moderate. The surface layer is very friable and can be easily tilled. Surface runoff is very slow or ponded. The soil has an apparent seasonal high water table near or above the surface from December through May.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture. A few small areas are wooded.

This soil is well suited to corn, soybeans, and small grain. The wetness is the major limitation. A drainage system is needed. Excess water can be removed by subsurface drains with a sand guard and by open ditches. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content and help to protect the surface against soil blowing.

If adequately drained, this soil is well suited to grasses for hay and pasture. It is poorly suited to shallow-rooted legumes. Suitable grasses include tall fescue, orchardgrass, and reed canarygrass, and suitable legumes include red clover and ladino clover. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant species are favored in timber stands. Seasonal wetness hinders logging activities and the planting of seedlings. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Shallow surface drains, open ditches, and furrowing before planting reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the ponding is a severe hazard, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the ponding and frost action. Strengthening the base with better suited material and installing roadside drainage ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

MkB2—Markland silt loam, 1 to 5 percent slopes, eroded. This nearly level and gently sloping, deep, moderately well drained and well drained soil is on flats, ridges, and side slopes on lacustrine terraces. Areas are narrow and irregularly shaped and are 5 to 50 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 6 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is dark yellowish brown and yellowish brown, firm and very firm silty clay about 26 inches thick. The substratum to a depth of 60 inches is light yellowish brown and yellowish brown, stratified silty clay, silty clay loam, silt loam, clay loam, and silt. In a few areas the soil has layers of loam or sandy clay loam in the subsoil and is underlain by loamy sand and sand below a depth of 40 inches. In places the slope is more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained McGary soils at the head of drainageways. Also included, on the lower part of side slopes, are a few small areas of the severely eroded Markland soils, which have a surface layer of silty clay loam. Included soils make up 3 to 5 percent of the unit.

Available water capacity is moderate in the Markland soil, and permeability is slow. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The soil has a perched seasonal high water table at a depth of 3 to 6 feet in March and April.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major hazard. Wetness in early spring also is a limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures help to control surface runoff and prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and maintain or improve tilth and the organic matter content. The soil is well suited to a no-till cropping system if winter cover crops are grown.

This soil is well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue, orchardgrass, and timothy, and suitable legumes include alfalfa and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Seedling mortality, the windthrow hazard, and plant competition are management concerns. Overstocking helps to compensate for seedling mortality. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of shrinking and swelling, this soil is severely limited as a site for dwellings. Reinforcing foundations, footings, and basement walls and backfilling with coarse sand and gravel help to prevent the damage caused by shrinking and swelling.

This soil is severely limited as a site for local roads and streets because of low strength and because of shrinking and swelling. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

Because of the slow permeability and the wetness, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption area, installing the absorption field in a mound of suitable filtering material, and providing subsurface drains help to ensure proper performance.

The land capability classification is IIIe. The woodland ordination symbol is 4C.

MmC3—Markland silty clay loam, 4 to 12 percent slopes, severely eroded. This gently sloping and moderately sloping, deep, well drained soil is on side slopes on lacustrine terraces. Areas are narrow and irregularly shaped and are 5 to 75 acres in size.

In a typical profile, the surface layer is dark yellowish brown silty clay loam about 9 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the subsoil. The subsoil is yellowish brown, very firm silty clay about 7 inches thick. The substratum to a depth of 60 inches is light yellowish brown and yellowish brown, stratified silty clay loam, silt loam, and silt. In a few areas the soil has layers of clay loam and sandy clay loam in the subsoil and is underlain by loamy sand and sand below a depth of 40 inches. A few areas are moderately eroded. In places the slope is more than 12 percent.

Included with this soil in mapping are areas of soils that have a slope of more than 18 percent and small areas of deep, well drained, sandy soils on the slightly lower slopes. Included soils make up 7 to 10 percent of the unit.

Available water capacity is moderate in the Markland soil, and permeability is slow. The organic matter content of the surface layer is low or very low. Surface runoff is medium. The soil becomes very cloddy if it is tilled when too wet; thus, preparing a good seedbed is difficult. The soil has a perched seasonal high water table at a depth of 3 to 6 feet in March and April.

Most areas of this soil are used for cultivated crops. A few areas are pastured. Because erosion is a severe hazard, this soil is generally unsuited to row crops. It is poorly suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Seedling mortality, the windthrow hazard, and plant competition are management concerns. Overstocking helps to compensate for seedling mortality. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of shrinking and swelling, this soil is severely limited as a site for dwellings. It is severely limited as a site for small commercial buildings because of the slope. Reinforcing foundations, footings, and basement walls and backfilling with coarse sand and gravel help to prevent the damage caused by shrinking and swelling. The slope can be modified.

This soil is severely limited as a site for local roads and streets because of low strength and because of shrinking and swelling. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

Because of the slow permeability and the wetness, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption area, installing the absorption field in a mound of suitable filtering material, and providing subsurface drains help to ensure proper performance.

The land capability classification is VIe. The woodland ordination symbol is 4C.

MrA—McGary silty clay loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on flats on lacustrine terraces. Areas are narrow and irregularly shaped and are 5 to 65 acres in size.

In a typical profile, the surface layer is dark brown silty clay loam about 10 inches thick. The subsoil is about 44 inches thick. The upper part is yellowish brown, mottled, friable silty clay loam, and the lower part is yellowish brown, mottled, firm and very firm silty clay. The substratum to a depth of 60 inches is yellowish brown, mottled, stratified silt loam and silty clay loam. In places the slope is more than 2 percent. In a few places the soil has layers of loam or clay loam in the subsoil and is underlain by loamy fine sand and fine sand below a depth of 40 inches. In a few small areas, the soil is not calcareous within a depth of 40 inches. In a few places the subsoil has less clay.

Included with this soil in mapping are a few small areas of the moderately well drained and well drained Markland soils on narrow flats. Also included are a few areas where the McGary soil is occasionally flooded. Included soils make up 7 to 10 percent of the unit.

Available water capacity is moderate in the McGary soil, and permeability is slow or very slow. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The soil has an apparent seasonal high water table at a depth of 1 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. A few areas are used for pasture.

This soil is fairly well suited to corn, soybeans, and small grain. The wetness is the major limitation. A drainage system is needed. Shallow surface drains and subsurface drains help to remove excess water. Laterals of subsurface drains should be installed at a close interval because of the slow or very slow permeability. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. During long dry periods, yields are reduced because the available water capacity is moderate. Green manure crops and a conservation tillage system that leaves crop residue on the surface help to maintain or improve tilth and the organic matter content. The soil is well suited to fall-chisel and ridge-plant tillage systems.

If adequately drained, this soil is suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and reed canarygrass, and suitable legumes include red clover and ladino clover. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Prolonged seasonal wetness hinders logging activities and the planting of seedlings. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Shallow surface drains, open ditches, and furrowing before planting reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness and the shrink-swell potential, this soil is severely limited as a site for dwellings. Subsurface drains around footings and foundation walls and open ditches help to prevent the damage caused by wetness. Constructing the buildings on raised, well compacted fill, reinforcing foundations and footings, and backfilling with coarse sand and gravel help to prevent the damage caused by shrinking and swelling.

Because of low strength and the shrink-swell potential, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

Because of the slow or very slow permeability and the wetness, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption area, installing the absorption field in a mound of suitable filtering material, and providing interceptor subsurface drains around the perimeter of the field help to ensure proper performance.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

MtB2—Medora silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on the tops and side slopes of outwash ridges and eskers. Areas are narrow and elongated or irregularly shaped and are 5 to 50 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 8 inches thick. It has a small amount of yellowish brown silt loam. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is more than 72 inches thick. The upper part is yellowish brown, friable silt loam; the next part is a fragipan of dark brown and yellowish red, very firm, brittle silty clay loam; and the lower part is yellowish red and red, firm silty clay loam, clay loam, and gravelly clay loam. A few areas are not eroded. In some places the upper part of the subsoil has gray mottles. In other places the slope is more than 6 percent.

Included with this soil in mapping are a few areas of the well drained, moderately permeable Parke soils. These soils are in positions on the landscape similar to those of the Medora soil. They make up 4 to 7 percent of the unit.

Available water capacity is moderate in the Medora soil. Permeability is moderate above the fragipan and very slow in the fragipan. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 2 to 3 feet from December through April.

Most areas of this soil are used for cultivated crops. Several areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. The very slowly permeable fragipan is the main limitation. Erosion is the major hazard. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures are needed to control surface runoff and to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Seedling mortality, the windthrow hazard, and plant competition are management concerns. Overstocking helps to compensate for seedling mortality. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness, this soil is moderately limited as a site for dwellings without basements and severely limited as a site for dwellings with basements. It is moderately limited as a site for small commercial buildings because of the wetness and the slope. Subsurface drains around the footings and foundation walls help to lower the water table. The slope can be modified.

Because of frost action, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material helps to prevent the damage caused by frost action.

Because of the very slow permeability in the fragipan and the wetness, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption area, installing the absorption field in a mound of suitable filtering material, and providing subsurface drains help to ensure proper performance.

The land capability classification is IIe. The woodland ordination symbol is 5D.

MtC2—Medora silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, moderately well drained soil is on side slopes on outwash ridges and eskers. Areas are narrow and irregularly shaped and are 5 to 75 acres in size.

In a typical profile, the surface layer is dark yellowish brown silt loam about 8 inches thick. It has a small amount of yellowish brown silt loam. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is more than 72 inches thick. The upper part is yellowish brown, friable silt loam; the next part is a fragipan of yellowish brown, strong brown, and yellowish red, very firm, brittle silt loam and loam; and the lower part is yellowish red and red, firm clay loam and sandy clay. In places the slope is less than 6 percent. A few areas are severely eroded.

Included with this soil in mapping are a few small areas of the well drained, moderately permeable Negley and Parke soils. Negley soils are on the lower part of side slopes. Parke soils are in the same landscape position as the Medora soil. Included soils make up 9 to 12 percent of the unit.

Available water capacity is moderate in the Medora soil. Permeability is moderate above the fragipan and very slow in the fragipan. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 2 to 3 feet from December through April.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few areas are wooded.

This soil is fairly well suited to corn, soybeans, and small grain. The very slowly permeable fragipan is the main limitation. Erosion is the major hazard. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures are needed to reduce the runoff rate and to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, grade-stabilization structures, and contour farming (fig. 10). Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation

Figure 10.—Contour farming in an area of Medora silt loam, 6 to 12 percent slopes, eroded.

grazing, 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. Seedling mortality, the windthrow hazard, and plant competition are management concerns. Overstocking helps to compensate for seedling mortality. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness and slope, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness and is severely limited as a site for small commercial buildings because of the slope. Subsurface drains around footings and foundation walls help to lower the water table. The buildings should be designed so that they conform to the natural slope of the land.

This soil is severely limited as a site for local roads and streets because of frost action. Strengthening the base with better suited material helps to prevent the damage caused by frost action.

Because of the very slow permeability in the fragipan and the wetness, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption area, installing the absorption field in a mound of suitable filtering material, and providing subsurface drains help to ensure proper performance.

The land capability classification is IIIe. The woodland ordination symbol is 5D.

NeD2—Negley silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on side slopes on outwash ridges and eskers. Areas are narrow and elongated and are 5 to 20 acres in size.

In a typical profile, the surface layer is dark yellowish brown silt loam about 10 inches thick. It has a small amount of brown silt loam. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is more than 70 inches thick. The upper part is brown, friable loam; the next part is yellowish red and red, firm loam and clay loam; and the lower part is red and yellowish red, firm and friable sandy clay loam. In some places the subsoil is yellowish brown. In other places the loess is more than 18 inches thick. In some small areas the soil is severely eroded and has a surface layer of clay loam or gravelly clay loam. In a few small areas gray mottles are in the lower part of the subsoil. In places the slope is more than 18 or less than 12 percent.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface layer is moderately low. Surface runoff is rapid. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops or for hay and pasture. A few areas are wooded.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, conservation tillage, terraces, diversions, grassed waterways, and grade-stabilization structures. The soil is well suited to a no-till cropping system. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is fairly well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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 erosion hazard, the equipment limitation, and plant competition are management concerns. Building logging roads and skid trails on the contour and constructing water bars help to control erosion. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the slope, this soil is severely limited as a site for dwellings, local roads and streets, and septic tank absorption fields. This limitation can be overcome by designing dwellings so that they conform to the natural slope of the land, by constructing the roads and streets on the contour, and by installing the absorption fields on the contour.

The land capability classification is IVe. The woodland ordination symbol is 5R.

NgE—Negley loam, 18 to 35 percent slopes. This moderately steep and steep, deep, well drained soil is on side slopes on outwash ridges and eskers. Areas are narrow and elongated and are 5 to 25 acres in size.

In a typical profile, the surface layer is very dark grayish brown loam about 4 inches thick. The subsoil is more than 70 inches thick. The upper part is dark yellowish brown, friable loam, and the lower part is yellowish red and reddish brown, firm and friable sandy clay loam. In some areas the subsoil is yellowish brown.

In places the slope is more than 35 or less than 18 percent. In some small areas the soil is moderately eroded. In a few small areas, it is severely eroded and has a surface layer of clay loam or gravelly clay loam.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface layer is moderate or moderately low. Surface runoff is rapid.

Most areas of this soil are wooded. A few areas are used for hay and pasture. Because of the moderately steep and steep slope and a severe hazard of erosion, this soil is generally unsuited to row crops and is poorly suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. The slope limits the use of farm machinery. Grazing when the soil is wet reduces plant density and forage yields and increases the susceptibility to erosion. Proper stocking rates, rotation grazing, 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 erosion hazard, the equipment limitation, and plant competition are management concerns. Building logging roads and skid trails on the contour and constructing water bars help to control erosion. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Special harvest methods, such as yarding the logs uphill with a cable, minimize the use of crawler tractors and skidders. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the slope, this soil is severely limited as a site for dwellings, local roads and streets, and septic tank absorption fields. The slope can be modified on building sites. Building on the contour and cutting and filling help to overcome the slope on sites for roads and streets. Alternative sites for septic tank absorption fields should be selected.

The land capability classification is VIe. The woodland ordination symbol is 5R.

NnA—Nineveh Variant sandy loam, occasionally flooded, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on stream terraces. It is occasionally flooded for brief periods, especially in winter and spring. Areas are narrow and elongated and are 5 to 300 acres in size.

In a typical profile, the surface soil is dark brown sandy loam about 18 inches thick. The subsoil is about 37 inches thick. The upper part is dark brown, friable sandy loam and sandy clay loam, and the lower part is dark brown and dark yellowish brown, very friable and friable loamy sand and sandy clay loam. The substratum to a depth of 60 inches is pale brown sand. In some areas the subsoil has less clay. In a few areas calcareous sand is within a depth of 40 inches. In places the surface layer is loam or fine sandy loam. A few areas are frequently flooded. In some areas the soil has more gravel throughout.

Included with this soil in mapping are a few small areas of the moderately well drained Whitaker Variant soils in slight swales. These soils make up 3 to 5 percent of the unit.

Available water capacity is moderate in the Nineveh Variant soil. Permeability is moderate in the subsoil and rapid or very rapid in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is friable and can be easily tilled.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. The flooding is the major hazard. During long dry periods, yields are reduced because the available water capacity is moderate. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content and help to protect the surface against soil blowing. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue, orchardgrass, and timothy, and suitable legumes include alfalfa and red clover. Forage yields are reduced by prolonged periods of flooding. Overgrazing reduces plant density and forage yields. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities and is severely limited as a site for local roads and streets. Building up the roadbed above the normal flood stage and installing culverts help to prevent the road damage caused by floodwater.

The land capability classification is IIw. The woodland ordination symbol is 5A.

OtC2—Otwell silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained and moderately well drained soil is on side slopes on lacustrine terraces. Areas are narrow and elongated or irregularly shaped and are 10 to 60 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 7 inches thick. It has a small amount of yellowish brown silt loam. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is about 51 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is a fragipan of yellowish brown, mottled, very firm and firm, brittle loam. The substratum to a depth of 80 inches is yellowish brown and light brownish gray, mottled sandy clay loam that has thin strata of sandy loam and silty clay. In a few areas, the surface layer is loam and the upper part of the subsoil is loam or clay loam. In some small areas the lower part of the subsoil has redder hues. In some places the slope is more than 12 percent. In other places the upper part of the subsoil has gray mottles. Some areas are severely eroded. In some areas the lower part of the subsoil and the substratum are loamy sand or clay. In other areas the subsoil is more than 80 inches thick.

Included with this soil in mapping are a few areas of the moderately well drained Haubstadt soils at the head of drainageways and small areas of the well drained, moderately permeable Negley soils on the lower part of side slopes. Haubstadt soils are less sloping than the Otwell soil. Also included are a few small areas of somewhat poorly drained soils in the same position on the side slopes as the Otwell soil. Included soils make up 4 to 7 percent of the unit.

Available water capacity is moderate in the Otwell soil, and permeability is very slow. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 2.0 to 3.5 feet from January through April.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few small areas are wooded.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major hazard. The very slowly permeable fragipan is the major limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and maintain or improve tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems. In seepy areas in some of the drainageways, subsurface drains are needed.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality and the windthrow hazard are management concerns. Overstocking helps to compensate for seedling mortality. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if livestock are excluded from the area.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. Also, it is moderately limited as a site for dwellings with basements because of the wetness and is severely limited as a site for small commercial buildings because of the slope. Reinforcing foundations, footings, and basement walls help to prevent the damage caused by shrinking and swelling. The slope can be modified. Installing subsurface drains around footings and basement walls helps to lower the water table.

The soil is severely limited as a site for local roads and streets because of frost action and low strength. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

Because of the very slow permeability and the wetness, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption area and installing the absorption field in a mound of suitable filtering material help to ensure proper performance.

The land capability classification is IIIe. The woodland ordination symbol is 3D.

OtC3—Otwell silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained and moderately well drained soil is on side slopes on lacustrine terraces. Areas are narrow and elongated or irregularly shaped and are 10 to 40 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 5 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the subsoil. The subsoil is about 47 inches thick. The upper part is yellowish brown, friable and firm loam and clay loam; the next part is a fragipan of yellowish brown, mottled, very firm, brittle loam; and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of 80 inches is strong brown, mottled, stratified clay loam and sandy clay loam. A few small areas are moderately eroded. In some places the slope is more than 12 percent. In other places the upper part of the subsoil has gray mottles. In a few areas the surface layer is loam. In some areas the lower part of the subsoil has redder hues. In other areas the lower part of the subsoil and the substratum are loamy sand or clay. In places the subsoil is more than 80 inches thick.

Included with this soil in mapping are a few areas of the moderately well drained Haubstadt soils at the head of drainageways and small areas of the well drained, moderately permeable Negley soils on the lower part of side slopes. Haubstadt soils are less sloping than the Otwell soil. Also included are a few small areas of somewhat poorly drained soils in the same position on the side slopes as the Otwell soil. Included soils make up 4 to 7 percent of the unit.

Available water capacity is moderate in the Otwell soil, and permeability is very slow. The organic matter content of the surface layer is low. Surface runoff is medium. The surface layer is friable and can be easily tilled. Severe erosion has reduced the natural fertility of this soil by removing most of the organic matter that was in the original surface layer. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 2.0 to 3.5 feet from January through April.

Most areas are used for cultivated crops or for hay and pasture. It is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. The very slowly permeable fragipan is the major limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that is dominated by grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and maintain or improve tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems. In seepy areas in some of the drainageways, subsurface drains are needed for adequate drainage.

This soil is fairly well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality and the windthrow hazard are management concerns. Overstocking helps to compensate for seedling mortality. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if livestock are excluded from the area.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. It is moderately limited as a site for dwellings with basements because of the wetness and is severely limited as a site for small commercial buildings because of the slope. Reinforcing foundations, footings, and basement walls help to prevent the damage caused by shrinking and swelling. The slope can be modified. Curtain subsurface drains around footings and basement walls help to lower the water table.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

Because of the very slow permeability and the wetness, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption area and installing the absorption field in a mound of suitable filtering material help to ensure proper performance.

The land capability classification is IVe. The woodland ordination symbol is 3D.

PaB2—Parke silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on ridges on outwash plains and eskers. Areas are narrow and elongated or irregularly shaped and are 5 to 50 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 7 inches thick. It has a small amount of dark yellowish brown silt loam. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is more than 73 inches thick. The upper part is dark yellowish brown and yellowish brown, friable and firm silt loam and silty clay loam, and the lower part is strong brown and yellowish red, friable loam and sandy clay loam. A few areas are not eroded. In places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are a few areas of the well drained Medora soils. These soils have a very slowly permeable fragipan. They are in the same landscape position as the Parke soil. They make up 5 to 8 percent of the unit.

Available water capacity is high in the Parke soil, and permeability is moderate. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and maintain or improve tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue, timothy, and orchardgrass, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

This soil suitable as a site for dwellings with basements and for septic tank absorption fields. Because of shrinking and swelling, it is moderately limited as a site for dwellings without basements and for small commercial buildings. Also, it is moderately limited as a site for small commercial buildings because of the slope. Reinforcing foundations and footings helps to prevent the damage caused by shrinking and swelling. The slope can be modified.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

The land capability classification is IIe. The woodland ordination symbol is 5A.

PaC2—Parke silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on the sides of ridges and eskers on outwash plains. Areas are narrow and irregularly shaped and are 5 to 50 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 8 inches thick. It has a small amount of yellowish brown silty clay loam. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is more than 72 inches thick. The upper part is yellowish brown, firm silty clay loam; the next part is brown and strong brown, friable loam and sandy clay loam; and the lower part is yellowish red, firm sandy clay loam. In places the slope is less than 6 percent. Some small areas are severely eroded. In some areas the loess is less than 20 inches thick.

Included with this soil in mapping are a few areas of the well drained Medora soils. These soils have a very slowly permeable fragipan. They are in the same landscape position as the Parke soil. They make up 4 to 7 percent of the unit.

Available water capacity is high in the Parke soil, and permeability is moderate. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops or for hay and pasture. This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major hazard. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and maintain or improve tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue, timothy, and orchardgrass, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. It also is moderately limited as a site for dwellings without basements because of shrinking and swelling. It is severely limited as a site for small commercial buildings because of the slope. Reinforcing foundations and footings helps to prevent the damage caused by shrinking and swelling. The slope can be modified.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

This soil is moderately limited as a site for septic tank absorption fields because of the slope. Installing the absorption field on the contour helps to ensure proper performance.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

PeB2—Pekin silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on side slopes on stream terraces. Areas are narrow and irregularly shaped and are 5 to 30 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 8 inches thick. It has a small amount of yellowish brown silty clay loam. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is about 50 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam, and the lower part is a fragipan of light yellowish brown, mottled, very firm, brittle silt loam. The substratum to a depth of 80 inches is light yellowish brown, mottled silty clay loam. In some places the subsoil is neutral. In other places the slope is less than 2 percent. In a few areas it is more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Bartle soils at the head of drainageways. These soils make up 3 to 5 percent of the unit.

Available water capacity is moderate in the Pekin soil. Permeability is moderate above the fragipan and very slow in the fragipan. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 2 to 6 feet in March and April.

About half of the acreage is used for cultivated crops, and half is used for hay and pasture. This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard. The very slowly permeable fragipan is the major limitation. Wetness in the early spring also is a limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures help to reduce the runoff rate and prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage sytem that leaves protective amounts of crop residue on the surface help to control erosion and maintain or improve tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems. In seepy areas in some of the drainageways, subsurface drains are needed.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue, orchardgrass, and timothy, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. No major hazards or limitations affect planting or harvesting.

Because of the wetness, this soil is moderately limited as a site for dwellings without basements and severely limited as a site for dwellings with basements. It is moderately limited as a site for small commercial buildings because of the slope and the wetness. An adequate drainage system around footings and foundations is extremely important, especially on sites for dwellings with basements. Subsurface curtain drains help to lower the water table. The slope can be modified.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Installing roadside drainage ditches helps to lower the water table and helps to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the very slow permeability in the fragipan and the wetness. Enlarging the absorption area, installing the absorption field in a mound of suitable filtering material, and providing and subsurface curtain drains help to ensure proper performance.

The land capability classification is IIe. The woodland ordination symbol is 4A.

Pg—Peoga silt loam. This nearly level, deep, poorly drained soil is on lacustrine terraces. Areas are broad and irregularly shaped and are 20 to 3,000 acres in size.

In a typical profile, the surface layer is brown silt loam about 11 inches thick. The subsoil is more than 69 inches thick. The upper part is light brownish gray, mottled, friable silt loam; the next part is light brownish gray, mottled, firm silty clay loam; and the lower part is light brownish gray, yellowish brown, and grayish brown, firm, brittle silt loam and loam. In a few areas, the surface layer is loam and the upper part of the subsoil is loam or clay loam.

Included with this soil in mapping are the somewhat poorly drained Dubois soils on the slightly higher flats. These soils make up 1 to 3 percent of the unit.

Available water capacity is high in the Peoga soil, and permeability is slow. The organic matter content of the surface layer is moderately low or low. Surface runoff is very slow. The surface layer is friable and can be easily tilled. The soil has a perched seasonal high water table at or near the surface from January through May.

Most areas of this soil are used for cultivated crops. Some areas are wooded. A few areas are used for hay and pasture.

This soil is fairly well suited to corn, soybeans, and small grain. The wetness is the major limitation. A drainage system is needed. Land smoothing and shallow surface drains help to remove excess surface water. Tilling when the soil is wet causes compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to maintain or improve tilth and the organic matter content.

If adequately drained, this soil is fairly well suited to grasses for hay and pasture. It is poorly suited to shallow-rooted legumes. Suitable grasses include tall fescue and reed canarygrass, and suitable legumes include red clover and lespedeza. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Prolonged seasonal wetness hinders logging activities and the planting of seedlings. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Installing shallow surface drains and furrowing before planting reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. It is generally unsuitable as a site for buildings with basements. Surface drains, open ditches, and subsurface drains help to lower the water table. Also, constructing the building on raised, well compacted fill helps to prevent the damage caused by wetness.

Because of low strength, wetness, and frost action, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Roadside drainage ditches and culverts help to prevent the damage caused by frost action and wetness.

This soil is generally unsuitable as a site for septic tank absorption fields because the slow permeability and the wetness are severe limitations.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

Pp—Piopolis silty clay loam, frequently flooded. This nearly level, deep, poorly drained and very poorly drained soil is on bottom land. It is frequently flooded for brief to long periods, especially in late fall, winter, and spring, and is subject to ponding. Areas are broad and irregularly shaped and are 10 to 400 acres in size.

In a typical profile, the surface layer is brown, mottled silty clay loam about 10 inches thick. The substratum to a depth of 60 inches is light gray, mottled silty clay loam. In some places, the surface layer is loam and the substratum has textures of sandy loam, loam, and clay loam. In other places the substratum has less clay. In a few areas it is less acid. Some areas are only occasionally flooded, and a few are only rarely flooded.

Included with this soil in mapping are some small areas of the somewhat poorly drained Stendal soils adjacent to meander scars and stream channels in the slightly higher landscape positions. These soils make up about 3 to 5 percent of the unit.

Available water capacity is high in the Piopolis soil, and permeability is slow. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The soil becomes very cloddy if tilled when too wet; thus, preparing a good seedbed is difficult. The soil has an apparent seasonal high water table near or above the surface from March through June.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture or for woodland.

If adequately drained, this soil is fairly well suited to corn and soybeans. It is generally unsuited to small grain because of the flooding and the ponding. A drainage system is needed. Open ditches and subsurface drains help to remove excess water. Measures that keep silt from filling subsurface drains lengthen the functional life of the system. In some areas the existing natural channels should be deepened and widened so that they can be used as drainage outlets. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content. The soil is well suited to ridge planting if the ridges follow the natural pattern of drainage or streamflow.

If adequately drained, this soil is fairly well suited to grasses for hay and pasture. It is poorly suited to shallow-rooted legumes. Suitable grasses include tall fescue and reed canarygrass, and suitable legumes include ladino clover and lespedeza. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant species are favored in timber stands. Prolonged seasonal wetness hinders logging activities and the planting of seedlings. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Installing shallow surface drains and furrowing before planting reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the flooding and ponding, this soil is generally unsuitable as a site for dwellings. It is generally unsuitable as a site for septic tank absorption fields because of the flooding, the ponding, and the slow permeability. It is severely limited as a site for local roads and streets because of the flooding, the ponding, and low strength. Building up the roadbed with suitable material, establishing roadside drainage ditches, and installing culverts help to overcome these limitations and help to prevent the damage caused by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

RaC3—Rarden silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, moderately deep, well drained and moderately well drained soil is on side slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 30 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 6 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the subsoil. The subsoil is about 33 inches thick. The upper part is strong brown, mottled, firm silty clay loam, and the lower part is red, yellowish red, and yellowish brown, mottled, very firm silty clay and silty clay loam. Soft bedrock of interbedded siltstone and shale is at a depth of about 39 inches. Some areas are moderately eroded. In some small areas the surface layer is silty clay loam or channery silty clay loam. In places the slope is more than 12 percent.

Included with this soil in mapping are small areas of the deep, moderately well drained Stonehead soils on the upper part of side slopes and on ridgetops. Also included are some gullied areas. Included areas make up 6 to 9 percent of the unit.

Available water capacity is moderate in the Rarden soil, and permeability is slow. The organic matter content of the surface layer is low or very low. Surface runoff is medium. The soil has a perched seasonal high water table at a depth of 2 to 3 feet from January through April.

Most of the acreage of this soil is used for hay and pasture or is idle land. A few areas are used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to a no-till cropping system.

This soil is fairly well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Special harvest methods, such as yarding the logs uphill, minimize the use of crawler tractors and skidders. Overstocking helps to compensate for seedling mortality. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if livestock are excluded from the area.

Because of shrinking and swelling, this soil is severely limited as a site for buildings. Also, it is severely limited as a site for dwellings with basements because of the wetness and as a site for small commerical buildings because of the slope. Reinforcing foundations and footings helps to prevent the damage caused by shrinking and swelling. Subsurface drains around footings and basement walls help to lower the water table. The slope can be modified, or the buildings can be designed so that they conform to the natural slope of the land.

Because of low strength and frost action, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the wetness, the slow permeability, and the depth to bedrock. Enlarging the absorption area and installing the absorption field in a mound of suitable filtering material help to ensure proper performance.

The land capability classification is IVe. The woodland ordination symbol is 3C.

RdD3—Rarden silty clay loam, 12 to 20 percent slopes, severely eroded. This strongly sloping and moderately steep, moderately deep, well drained and moderately well drained soil is on side slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 20 acres in size.

In a typical profile, the surface layer is yellowish brown silty clay loam about 5 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the subsoil. The subsoil is about 27 inches of yellowish red, strong brown, and yellowish brown, mottled, firm silty clay and silty clay loam. Soft bedrock of interbedded shale and siltstone is at a depth of about 32 inches. In some small areas the surface layer is channery silty clay loam. In places the slope is less than 12 percent.

Included with this soil in mapping are small areas of the well drained Kurtz soils on the lower part of side slopes. These soils are less clayey than the Rarden soil. Also included are small areas of the deep, moderately well drained Coolville soils and some gullied areas. Coolville soils are in the same landscape position as the Rarden soil. Included areas make up 10 to 13 percent of the unit.

Available water capacity is moderate in the Rarden soil, and permeability is slow. The organic matter content of the surface layer is low or very low. Surface runoff is rapid. The soil has a perched seasonal high water table at a depth of 2 to 3 feet from January through April.

Most of the acreage of this soil is pasture or idle land. A few small areas are used for cultivated crops. Because of poor tilth and the hazard of erosion, this soil is generally unsuited to row crops. It is poorly suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the soil is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The erosion hazard, the equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Building logging roads and skid trails on the contour and constructing water bars help to control erosion. Special harvest methods, such as yarding the logs uphill with a cable, minimize the use of crawler tractors and skidders. Overstocking helps to compensate for seedling mortality. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if livestock are excluded from the area.

Because of the slope and the shrink-swell potential, this soil is severely limited as a site for dwellings. Also, it is severely limited as a site for dwellings with basements because of the wetness. The slope can be modified, or the buildings can be designed so that they conform to the natural slope of the land. Reinforcing foundations and footings helps to prevent the damage caused by shrinking and swelling. Installing subsurface drains around footings and basement walls helps to lower the water table.

Because of low strength, slope, and frost action, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. The slope can be modified.

This soil is severely limited as a site for septic tank absorption fields because of the slow permeability, the wetness, and the depth to bedrock. Alternative sites should be selected.

The land capability classification is VIe. The woodland ordination symbol is 3R.

RoA—Roby Variant sandy loam, rarely flooded, 0 to 2 percent slopes. This nearly level, deep, moderately well drained soil is on low stream terraces along the East Fork of the White River. Areas are narrow and elongated and are 5 to 300 acres in size.

In a typical profile, the surface layer is dark brown sandy loam about 9 inches thick. The subsoil is about 59 inches thick. The upper part is dark brown and brown, friable sandy loam; the next part is yellowish brown, mottled, friable and very friable sandy loam; and the lower part is dark yellowish brown, mottled, very friable loamy sand that has strata of sand. The substratum to a depth of 80 inches is pale brown sand. A few areas are not subject to flooding or are occasionally flooded.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Whitaker soils on the slightly lower flats. These soils make up 3 to 5 percent of the unit.

Available water capacity is moderate in the Roby Variant soil. Permeability is moderately rapid in the subsoil and rapid in the substratum. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is very friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 2 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. A few small areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. Wetness in early spring is the major limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Cover crops, green manure crops, and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content and help to protect the surface against soil blowing. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue, timothy, and orchardgrass, and suitable legumes include alfalfa, red clover, and lespedeza. Overgrazing reduces plant density and forage yields. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding is a severe hazard, this soil is generally unsuitable as a site for dwellings. It is severely limited as a site for local roads and streets because of frost action. Strengthening the base with better suited material helps to prevent the road damage caused by frost action. The soil is severely limited as a site for septic tank absorption fields because of the wetness. Installing the absorption field in a mound of suitable filtering material or providing subsurface drains helps to ensure proper performance.

The land capability classification is IIs. The woodland ordination symbol is 4A.

RsA—Rossmoyne silt loam, 0 to 2 percent slopes. This nearly level, deep, moderately well drained soil is on flats in the glaciated uplands. Areas are narrow and irregularly shaped and are 5 to 25 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is more than 71 inches thick. In sequence downward, it is brownish yellow, friable silt loam; yellowish brown and brownish yellow, mottled, friable and firm silty clay loam; a fragipan of yellowish brown and brownish yellow, mottled, very firm, brittle silt loam; and brownish yellow, mottled, firm clay loam. In some places the slope is more than 2 percent. In other places the loess is more than 40 inches thick.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Avonburg and Stoy soils at the head of drainageways and in the middle of the larger flats. These soils make up 3 to 5 percent of the unit.

Available water capacity is moderate in the Rossmoyne soil, and permeability is moderately slow or slow. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 1.5 to 3.0 feet from January through April.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. The moderately slowly permeable or slowly permeable fragipan is the major limitation. Wetness in early spring also is a limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue, timothy, and orchardgrass, and suitable legumes include red clover and ladino clover. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality, windthrow, and plant competition are management concerns. Special site preparation, such as furrowing before planting, reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements and for small commercial buildings. It is severely limited as a site for dwellings with basements because of the wetness. Reinforcing foundations and footings and backfilling with coarse sand and gravel help to prevent the structural damage caused by shrinking and swelling. Shallow surface drains and subsurface drains around footings and basement walls help to lower the water table.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Roadside drainage ditches help to lower the water table and thus help to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow or slow permeability and the wetness. Installing the absorption field in a mound of suitable filtering material and providing subsurface drains help to ensure proper performance.

The land capability classification is IIw. The woodland ordination symbol is 3D.

RsB2—Rossmoyne silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on ridgetops and side slopes in the glaciated uplands. Areas are narrow and elongated or irregularly shaped and are 5 to 50 acres in size.

In a typical profile, the surface layer is dark yellowish brown silt loam about 9 inches thick. It has a small amount of brownish yellow silt loam. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is more than 71 inches thick. In sequence downward, it is brownish yellow, friable silt loam; brownish yellow and light yellowish brown, mottled, friable silt loam; a fragipan of brown and brownish yellow, mottled, very firm, brittle silt loam; and brownish yellow and strong brown, mottled, firm clay loam and loam. In some places the slope is less than 2 percent. In other places the soil is not eroded.

Included with this soil in mapping are some small areas of the somewhat poorly drained Avonburg and Stoy soils at the head of drainageways. Also included are a few small areas of the well drained Cincinnati soils at the end of ridgetops and on the lower part of side slopes. Included soils make up 7 to 10 percent of the unit.

Available water capacity is moderate in the Rossmoyne soil, and permeability is moderately slow or slow. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 1.5 to 3.0 feet from January through April.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard. The moderately slowly permeable or slowly permeable fragipan is the major limitation. Wetness in early spring also is a limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures are needed to reduce the runoff rate and to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems. In seepy areas in some of the drainageways, subsurface tile is needed.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue, timothy, and orchardgrass, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality, windthrow, and plant competition are management concerns. Special site preparation, such as furrowing before planting, reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements and for small commercial buildings. It is severely limited as a site for dwellings with basements because of the wetness. The slope also is a limitation on sites for small commercial buildings. It can be modified. Reinforcing foundations and footings and backfilling with coarse sand and gravel help to prevent the structural damage caused by shrinking and swelling. Subsurface drains around footings and basement walls help to lower the water table.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Roadside drainage ditches help to lower the water table and thus help to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow or slow permeability and the wetness. Installing the absorption field in a mound of suitable filtering material and providing subsurface drains help to ensure proper performance.

The land capability classification is IIe. The woodland ordination symbol is 3D.

Ru—Ruark Variant sandy loam, occasionally flooded. This nearly level, deep, poorly drained soil is on flats on low stream terraces. It is occasionally flooded for brief periods, especially in winter and spring, and is subject to ponding. Areas are broad and irregularly shaped and are 40 to 300 acres in size.

In a typical profile, the surface layer is dark grayish brown sandy loam about 9 inches thick. The subsoil is dark gray and gray, mottled, firm and friable sandy clay loam about 55 inches thick. The upper 6 inches of the substratum is gray, mottled sandy loam. The lower part to a depth of about 80 inches is light brownish gray sand. A few areas are only rarely flooded. In a few places the surface layer is loam. In some areas the soil has a slightly darker surface layer and has stratified sand and gravelly sand within a depth of 60 inches.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Whitaker soils in the slightly higher landscape positions. These soils make up 3 to 5 percent of the unit.

Available water capacity is high in the Ruark Variant soil. Permeability is moderate in the subsoil and rapid in the substratum. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The soil has an apparent water table above or near the surface from December through May.

Most areas of this soil are used for cultivated crops. A few small areas are used for hay and pasture.

This soil is fairly well suited to corn, soybeans, and small grain. The wetness is the major limitation, and the flooding is the major hazard. A drainage system is needed. Excess water can be removed by subsurface drains with a sand guard and by open ditches. Tilling when the soil is wet causes compaction, which restricts root penetration and water infiltration. A crop rotation that includes meadow crops helps to prevent compaction. Cover crops, green manure crops, and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content and help to protect the surface against soil blowing.

If adequately drained, this soil is suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include reed canarygrass and tall fescue, and suitable legumes include red clover and ladino clover. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant species are favored in timber stands. Prolonged seasonal wetness hinders logging activities and the planting of seedlings. The equipment limitation, seedling mortality, windthrow, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Shallow surface drains, open ditches, and furrowing before planting reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding and the ponding are severe hazards, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the flooding, the ponding, and the potential for frost action. Building up the roadbed above the normal flood stage and providing roadside drainage ditches and culverts help to prevent the damage caused by floodwater.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

Sc—Shoals loam, frequently flooded. This nearly level, deep, somewhat poorly drained soil is on bottom land. It is frequently flooded for brief to long periods, especially in late fall, winter, and spring. Areas are narrow and irregularly shaped and are 5 to 100 acres in size.

In a typical profile, the surface layer is dark brown loam about 8 inches thick. The upper 5 inches of the substratum is yellowish brown, mottled, friable loam; the next 39 inches is dark gray and gray, mottled, firm clay loam that has strata of silty clay loam; and the lower part to a depth of 60 inches is reddish yellow, mottled, stratified silt loam and loam. In some small areas the surface layer is silty clay loam, clay loam, or fine sandy loam. In a few places the substratum has more sand and less clay.

Included with this soil in mapping are a few small areas of the poorly drained and very poorly drained Zipp Variant soils in swales. Also included are a few areas of poorly drained soils in the slightly lower landscape positions. Included soils make up 4 to 7 percent of the unit.

Available water capacity is high in the Shoals soil, and permeability is moderate. The organic matter content of the surface layer is moderate. Surface runoff is very slow. The surface layer is friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 0.5 foot to 1.5 feet from January through April.

Most areas are used for cultivated crops. This soil is well suited to corn and soybeans. It is generally unsuited to small grain. The flooding is the major hazard, and the wetness is the major limitation. A drainage system is needed. Open ditches and subsurface drains help to remove excess water. In some areas the existing natural channels should be deepened and widened so that they can be used as drainage outlets. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction.

Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and reed canarygrasses, and suitable legumes include red clover and lespedeza. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant species are favored in timber stands. Prolonged seasonal wetness hinders logging activities and the planting of seedlings. The equipment limitation, seeding mortality, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Installing shallow surface drains and furrowing before planting reduce the seedling mortality rate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding and the wetness are severe limitations, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the wetness, the potential for frost action, and the flooding. Building up the roadbed above the normal flood stage and providing roadside drainage ditches and culverts help to prevent the damage caused by floodwater, frost action, and wetness. Strengthening the base with better suited material helps to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Sf—Steff silt loam, frequently flooded. This nearly level, deep, moderately well drained soil is on bottom land. It is frequently flooded for brief periods, especially in winter and spring. Areas are narrow and elongated and are 5 to 100 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 7 inches thick. The substratum to a depth of 60 inches is light olive brown, light yellowish brown, and yellowish brown, mottled silt loam. In a few places it has strata of loam and fine sandy loam. A few areas are only occasionally flooded.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Stendal soils in the slightly lower landscape positions. Also included are small areas of the well drained Haymond soils in the slightly higher positions. Included soils make up 5 to 8 percent of the unit.

Available water capacity is very high in the Steff soil, and permeability is moderate. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 1.5 to 3.0 feet from December through April.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few areas are wooded.

This soil is well suited to corn and soybeans. It is poorly suited to small grain. The flooding is the major hazard. Wetness in early spring is a limitation. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and lespedeza. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is severe. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding is a severe hazard, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of low strength and the flooding. Elevating the roadbed above the normal flood stage and providing roadside ditches and culverts help to prevent the damage caused by floodwater. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 8A.

Sg—Steff silt loam, rarely flooded. This nearly level, deep, moderately well drained soil is on bottom land along small streams draining areas where the bedrock is siltstone and shale. The soil is subject to rare flooding of very brief duration, especially in winter and spring. Areas are narrow and elongated and are 5 to 200 acres in size.

In a typical profile, the surface layer is dark yellowish brown silt loam about 11 inches thick. The substratum to a depth of 60 inches is light yellowish brown, brownish yellow, and yellowish brown, mottled silt loam. In a few places it has strata of fine sandy loam and loam. A few areas are occasionally flooded.

Included with this soil in mapping are the somewhat poorly drained Stendal soils in the slightly lower landscape positions. Also included are a few areas of the well drained and moderately well drained, channery Burnside soils adjacent to stream channels draining areas where the bedrock is siltstone, shale, and fine grained sandstone. Included soils make up 7 to 10 percent of the unit.

Available water capacity is very high in the Steff soil, and permeability is moderate. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 1.5 to 3.0 feet from December through April.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. Wetness in early spring is the major limitation. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue, timothy, and orchardgrass, and suitable legumes include red clover and ladino clover. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is severe. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding is a severe hazard, this soil is generally unsuitable as a site for dwellings. It is severely limited as a site for local roads and streets because of low strength. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. The soil is severely limited as a site for septic tank absorption fields because of the wetness. Installing the absorption field in a mound of suitable filtering material and providing subsurface drains help to ensure proper performance.

The land capability classification is I. The woodland ordination symbol is 8A.

Sn—Stendal silt loam, frequently flooded. This nearly level, deep, somewhat poorly drained soil is on bottom land. It is frequently flooded for brief periods, especially in winter and spring. Areas are narrow and elongated and are 5 to 360 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 9 inches thick. The upper 8 inches of the substratum is brownish yellow, mottled silt loam, and the lower part to a depth of about 60 inches is light gray and gray, mottled silt loam and silty clay loam. In places the substratum has more silt and less clay. In a few places it has layers of loam. A few areas are occasionally flooded.

Included with this soil in mapping are the moderately well drained Steff soils in the slightly higher landscape positions. Also included are the poorly drained and very poorly drained Piopolis soils in the slightly lower positions. Included soils make up 7 to 10 percent of the unit.

Available water capacity is very high in the Stendal soil, and permeability is moderate. The organic matter content of the surface layer is low or moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 1 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture. A few are wooded.

This soil is well suited to corn and soybeans. It is poorly suited to small grain. The flooding is the major hazard. The wetness is the major limitation. A drainage system is needed. Open ditches and subsurface drains help to remove excess water. Measures that keep silt from filling subsurface drains lengthen the functional life of the system. In some areas the existing natural channels should be deepened and widened so that they can be used as drainage outlets. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include red clover and lespedeza. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant species are favored in timber stands. Prolonged seasonal wetness hinders logging activities and the planting of seedlings. The equipment limitation and plant competition are management concerns. Logging equipment should be used only during the drier periods. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding and the wetness are severe limitations, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the flooding and frost action. Building up the roadbed above the normal flood stage and providing roadside drainage ditches and culverts help to prevent the damage caused by floodwater. Strengthening the base with better suited material helps to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Sp—Stendal silt loam, rarely flooded. This nearly level, deep, somewhat poorly drained soil is on bottom land along small streams. It is subject to rare flooding of very brief duration, especially in winter and spring. Areas are broad and are 40 to several hundred acres in size.

In a typical profile, the surface layer is dark brown silt loam about 12 inches thick. The substratum is mottled silt loam. The upper 7 inches is brownish yellow, and the lower part to a depth of 60 inches is light gray. A few areas are occasionally flooded. In several areas the substratum has more silt and less clay.

Included with this soil in mapping are the moderately well drained Steff soils in the slightly higher landscape positions. Also included are the poorly drained and very poorly drained Piopolis soils in the slightly lower positions. Included soils make up 4 to 7 percent of the unit.

Available water capacity is high in the Stendal soil, and permeability is moderate. The organic matter content of the surface layer is low or moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 1 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. The wetness is the major limitation. Open ditches and subsurface drains help to remove excess water, but silt can fill the drains and thus shorten the functional life of the system. In some areas the existing natural channels should be deepened and widened so that they can be used as drainage outlets. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant species are favored in timber stands. Prolonged seasonal wetness hinders logging activities and the planting of seedlings. The equipment limitation and plant competition are management concerns. Logging equipment should be used only during the drier periods. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding and the wetness are severe limitations, this soil is generally unsuitable as a site for dwellings. It is severely limited as a site for local roads and streets because of the flooding and frost action. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Roadside drainage ditches and culverts help to lower the water table and help to prevent the damage caused by wetness and flooding. The soil is severely limited as a site for septic tank absorption fields because of the wetness. Installing the absorption field in a mound of suitable filtering material and providing subsurface drains help to ensure proper performance.

The land capability classification is IIw. The woodland ordination symbol is 5W.

SsC2—Stonehead silt loam, 4 to 12 percent slopes, eroded. This gently sloping and moderately sloping, deep, moderately well drained soil is on ridgetops and side slopes in the uplands. Areas are narrow and elongated or irregularly shaped and are 5 to 60 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 5 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is about 60 inches thick. In sequence downward, it is strong brown and yellowish brown, firm silty clay loam; dark brown and dark yellowish brown, mottled, firm silty clay loam; red and yellowish red, mottled, very firm silty clay; and light yellowish brown, yellowish brown, and light olive brown, mottled, firm silty clay loam and extremely shaly silty clay loam. Soft bedrock of interbedded shale and siltstone is at a depth of about 65 inches. In places the loess is more than 40 inches thick. Some areas of the soil are not eroded. In a few places the slope is less than 4 percent. In a few areas the upper part of the subsoil has a thin layer of firm, brittle material.

Included with this soil in mapping are a few areas of the moderately well drained Coolville soils. These soils have a mantle of loess that is thinner than that of the Stonehead soil. Also included are the moderately deep, well drained and moderately well drained Rarden soils on the lower part of side slopes. Included soils make up about 3 to 5 percent of the unit.

Available water capacity is high in the Stonehead soil. Permeability is moderate in the surface layer and in the upper part of the subsoil and slow in the lower part. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The soil has a perched seasonal high water table at a depth of 2.0 to 3.5 feet from January through April.

Most areas of this soil are used for hay and pasture (fig. 11). A few areas are used for cultivated crops. Some small areas are wooded.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major hazard. Conservation measures reduce the runoff rate and help to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to a no-till cropping system.

Figure 11.—Hay in an area of Stonehead silt loam, 4 to 12 percent slopes, eroded.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include alfalfa, red clover, and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness, this soil is moderately limited as a site for dwellings without basements and for small commercial buildings and is severely limited as a site for dwellings with basements. Also, the slope is a moderate limitation on sites for small commercial buildings. Subsurface drains around footings and basement walls help to lower the water table. The slope can be modified, or the buildings can be designed so that they conform to the natural slope of the land.

Because of low strength and frost action, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the slow permeability and the wetness. Enlarging the absorption area and installing the absorption field in a mound of suitable filtering material help to ensure proper performance.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

St—Stonelick fine sandy loam, frequently flooded. This nearly level, deep, well drained soil is on bottom land in the bends of old oxbows. It is frequently flooded for brief to long periods, especially in fall, winter, and spring. Areas are broad to narrow and are irregularly shaped. They are 10 to 200 acres in size.

In a typical profile, the surface layer is dark brown fine sandy loam about 11 inches thick. The substratum to a depth of 60 inches is stratified yellowish brown fine sand, dark yellowish brown very fine sandy loam, light gray and pale brown sand, and brown loam. In some places the content of gravel in the surface layer is 15 to 25 percent. In other places the surface layer is loamy sand or sand. In a few small areas, the soil is noncalcareous above a depth of 20 inches.

Included with this soil in mapping are small areas of riverwash bordering the river channel. Also included are scattered small areas of the well drained Genesee soils, which are more silty than the Stonelick soil. Included areas make up 7 to 10 percent of the unit.

Available water capacity is moderate in the Stonelick soil, and permeability is moderately rapid. The organic matter content of the surface layer is moderate or moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled.

Most areas of this soil are used for cultivated crops. Some areas are wooded. A few areas are used for hay and pasture.

This soil is fairly well suited to corn and soybeans. It is generally unsuited to small grain. The flooding is the major hazard. During long dry periods, yields are reduced because the available water capacity is moderate. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and most legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include lespedeza and red clover. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields and is severely limited as a site for local roads and streets. Building up the roadbed above the normal flood stage helps to prevent the road damage caused by floodwater.

The land capability classification is IIIw. The woodland ordination symbol is 4A.

SyA—Stoy silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on flats in the uplands. Areas are narrow and irregularly shaped and are 5 to 200 acres in size.

In a typical profile, the surface layer is brown silt loam about 10 inches thick. The subsoil is more than 70 inches thick. The upper part is light brownish gray and yellowish brown, mottled, friable silt loam; the next part is yellowish brown, mottled, firm silty clay loam; and the lower part is light brownish gray and yellowish brown, mottled, firm and very firm, brittle silt loam. In a few areas loamy glacial drift is below a depth of 48 inches. In some places the soil has a fragipan. In other places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the moderately well drained Rossmoyne soils on narrow flats. Also included are areas of poorly drained soils on the slightly lower flats and in slight depressions. Included soils make up 7 to 10 percent of the unit.

Available water capacity is high in the Stoy soil, and permeability is slow. The organic matter content of the surface layer is moderate or moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The soil has a perched seasonal high water table at a depth of 1 to 3 feet from February through April.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture. A few are wooded.

This soil is well suited to corn, soybeans, and small grain. The wetness is the major limitation. A drainage system is needed. Land smoothing and shallow surface drains help to remove excess surface water. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content. Erosion is a hazard in the included areas that have slope of more than 2 percent.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include red clover and ladino clover. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. No major hazards or limitations affect planting or harvesting.

Because of the wetness, this soil is severely limited as a site for dwellings. It is generally unsuitable as a site for dwellings with basements. Surface drains, open ditches, and subsurface drains around footings and foundation walls can help to lower the water table. In some areas, however, suitable outlets are not readily available. Constructing the buildings on raised, well compacted fill helps to prevent the damage caused by wetness.

Because of low strength and frost action, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. Installing roadside drainage ditches helps to lower the water table and thus helps to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the wetness and the slow permeability. Installing the absorption field in a mound of suitable filtering material and providing interceptor subsurface drains around the perimeter of the field help to ensure proper performance.

The land capability classification is IIw. The woodland ordination symbol is 4A.

TIB2—Tilsit silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on ridgetops and side slopes in the uplands. Areas are narrow and elongated or irregularly shaped and are 5 to 70 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 6 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is about 45 inches thick. The upper part is dark yellowish brown and yellowish brown, friable and firm silt loam and silty clay loam; the next part is a fragipan of dark yellowish brown, mottled, very firm, brittle silt loam; and the lower part is light yellowish brown, firm silty clay loam. Siltstone and fine grained sandstone bedrock is at a depth of about 51 inches. A few areas are not eroded. In places the slope is less than 2 or more than 6 percent. In a few areas the loess is more than 40 inches thick.

Available water capacity is moderate. Permeability is moderate above the fragipan and slow in the fragipan. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched seasonal high water table at a depth of 1.5 to 2.5 feet from January through April.

Most areas of this soil are used either as wildlife habitat or woodland. A few areas are used for hay and pasture. A few are used for cultivated crops.

This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard. The slowly permeable fragipan is the major limitation. Wetness in early spring also is a limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures are needed to reduce the runoff rate and to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and lespedeza. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness, this soil is moderately limited as a site for dwellings without basements and is severely limited as a site for dwellings with basements. It is moderately limited as a site for small commercial buildings because of the slope and the wetness. Subsurface drains around footings and basement walls help to lower the water table. The slope can be modified.

Because of low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the slow permeability in the fragipan and the wetness. Enlarging the absorption area, installing the absorption field in a mound of suitable filtering material, and providing subsurface drains help to ensure proper performance.

The land capability classification is IIe. The woodland ordination symbol is 8A.

TlC2—Tilsit silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, moderately well drained soil is on side slopes in the uplands. Areas are narrow and elongated or irregularly shaped and are 5 to 50 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 5 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is about 53 inches thick. The upper part is brown and yellowish brown, friable silty clay loam; the next part is a fragipan of yellowish brown, very firm, brittle silt loam; and the lower part is brownish yellow, firm silt loam. The substratum is brownish yellow channery silt loam about 8 inches thick. Siltstone bedrock is at a depth of about 64 inches. In places the slope is less than 6 or more than 12 percent. Some small areas are severely eroded.

Included with this soil in mapping are a few small areas of the well drained, moderately permeable Wellston soils on the lower part of the side slopes. These soils make up 3 to 5 percent of the unit.

Available water capacity is moderate in the Tilsit soil. Permeability is moderate above the fragipan and slow in the fragipan. The organic matter content of the surface layer is moderately low. Surface runoff is medium. The surface layer is friable and can be easily tilled. The fragipan restricts root growth. The soil has a perched water table at a depth of 1.5 to 2.5 feet from January through April.

Most areas of this soil are used as wildlife habitat or woodland. A few areas are used for hay and pasture. A few are used for cultivated crops.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major hazard. The slowly permeable fragipan is the major limitation. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures are needed to reduce the runoff rate and to prevent excessive soil loss. Examples are conservation tillage, terraces, diversions, water- and sediment-control basins, grassed waterways, and grade-stabilization structures. The soil is well suited to till-plant and no-till cropping systems. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the wetness and the slope, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness and as a site for small commercial buildings because of the slope. The slope can be modified. Installing subsurface drains around the footings and basement walls helps to lower the water table.

Because of low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the slow permeability in the fragipan and the wetness. Enlarging the absorption area, installing the absorption field in a mound of suitable filtering material, and providing subsurface drains help to ensure proper performance.

The land capability classification is IIIe. The woodland ordination symbol is 8A.

Ud—Udorthents-Aquents complex. These nearly level to steep, deep, well drained to poorly drained soils are on uplands, terraces, and bottom land. They are near or in highway interchanges, airports, abandoned airfields, building sites, large industrial complexes, borrow pits (fig. 12), and sanitary landfills. In some places, deep cuts have been made in the original land surface and the soil material has been used as fill in the lower areas. In other places the soil material has been removed and used as fill for highway grades, overpasses, exit ramps, and runways for aircraft. The Udorthents make up about 60 percent of the unit, and the Aquents make up about 40 percent. Areas are 5 to several hundred acres in size.

The soil material varies considerably. It is a mixture of material from the surface soil, subsoil, and substratum of the original soils. It is dominantly silt loam, loam, sandy loam, loamy sand, sand, silty clay loam, clay loam, and

Figure 12.—A borrow pit in an area of the Udorthents-Aquents complex. Soft shale and siltstone mined from this pit have been used in the manufacture of bricks.

sandy clay loam. In a typical area of the Aquents, the material is loamy fine sand and fine sandy loam and is compacted and thus extremely firm below the surface layer. In some areas of the Udorthents, the material is mainly sand and loamy sand. In other areas it is loam and clay loam.

Included with these soils in mapping are a few cut areas that have bedrock outcrops. Also included are a few areas of soils that have layers of silty clay or clay, a few borrow areas where shallow water stands most of the year, and some areas where highways and airport runways cover much of the surface. Included areas make up 12 to 15 percent of the unit.

Available water capacity is very low to moderate in the Udorthents and Aquents, and permeability is rapid to very slow. The organic matter content of the surface layer is low.

Some areas of these soils are used for cultivated crops. Some have a permanent cover of grasses or low-growing shrubs. A few areas are idle.

In some areas these soils are fairly well suited to row crops. A good fertility program is generally needed. Incorporating organic residue and manure into the soils greatly improves productivity. In areas where wetness is a limitation, a drainage system is needed. In the gently sloping to steep areas, measures that control erosion are needed.

In some areas these soils are well suited to trees. Onsite investigation is needed to determine the suitability of a given area. Assistance in selecting species for planting can be obtained from the Forestry Division of the Indiana Department of Natural Resources or from the Soil Conservation Service.

Onsite investigation is needed if these soils are used as building sites. The soil properties that affect the design of a structure vary from one location to another. Engineering test data should be collected. Because of the hazard of erosion, as little vegetation as possible should be removed from the building sites and a plant cover should be established as quickly as possible. A drainage system is needed in areas of the nearly level Aquents. The limitations that affect the use of these soils as sites for sanitary facilities vary. As a result, onsite investigation is needed. Attention should be given to permeability, wetness, and slope.

These soils are not assigned to a land capability classification or a woodland ordination symbol.

Wa—Wakeland silt loam, frequently flooded. This nearly level, deep, somewhat poorly drained soil is on bottom land. It is frequently flooded for brief to long periods, especially in winter and spring. Areas are narrow and elongated and are 10 to several hundred acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 9 inches thick. The substratum is mottled silt loam. The upper 8 inches is light yellowish brown, and the lower part to a depth of 60 inches is light brownish gray. In a few areas the substratum has layers of fine sand, fine sandy loam, loam, and silty clay loam.

Included with this soil in mapping are the moderately well drained Wilbur soils in the slightly higher landscape positions. Also included are the poorly drained Birds soils in old stream meanders or in the slightly lower positions. Included soils make up 6 to 9 percent of the unit.

Available water capacity is very high in the Wakeland soil, and permeability is moderate. The organic matter content of the surface layer is moderately low or moderate. Surface runoff is very slow. The surface layer is friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 1 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. Some areas are wooded. A few small areas are used for hay and pasture.

This soil is well suited to corn and soybeans. It is poorly suited to small grain. The flooding is the major hazard. The wetness is the major limitation. A drainage system is needed. Open ditches and subsurface drains help to remove excess water. Measures that keep silt from filling subsurface drains lengthen the functional life of the system. In some areas the existing natural channels should be deepened and widened so that they can be used as drainage outlets. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that incorporates crop residue into the surface layer improve or maintain tilth and the organic matter content. The soil is well suited to ridge planting if the ridges follow the natural pattern of drainage or streamflow.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include red clover, ladino clover, and lespedeza. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding and the wetness are severe limitations, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the flooding and frost action. Building up the roadbed above the normal flood stage and providing roadside drainage ditches and culverts help to prevent the damage caused by floodwater. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 5A.

WeD2—Wellston silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on side slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 30 acres in size.

In a typical profile, about 1 inch of partly decomposed leaves and roots is at the surface. The surface layer is yellowish brown silt loam about 6 inches thick. In most areas, erosion has removed nearly all of the original darkened surface layer and tillage has mixed the rest with the upper part of the subsoil. The subsoil is about 36 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is light yellowish brown, firm very channery silty clay loam. Interbedded siltstone bedrock is at a depth of about 42 inches. In places the bedrock is within a depth of 40 inches. A few areas are not eroded. A few small areas are severely eroded.

Included with this soil in mapping are small areas of the moderately well drained Tilsit soils on the upper part of the side slopes and the well drained Gilpin soils on the lower part. Gilpin soils are more loamy than the Wellston soil. Included soils make up 5 to 10 percent of the unit.

Available water capacity and permeability are moderate in the Wellston soil. The organic matter content of the surface layer is moderately low. Surface runoff is rapid. The surface layer is friable and can be easily tilled.

Most areas are wooded or are used for hay and pasture. This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. During long dry periods, yields are reduced because the available water capacity is moderate. Conservation measures are needed to reduce the runoff rate and to prevent excessive soil loss. Examples are a cropping sequence that includes grasses and legumes, terraces, diversions, grassed waterways, and grade-stabilization structures. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems.

This soil is fairly well suited to grasses and legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and ladino clover. A cover of grasses and legumes is effective in controlling erosion, unless the pasture is overgrazed. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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 erosion hazard, the equipment limitation, and plant competition are the main management concerns. Building logging roads and skid trails on the contour and constructing water bars help to control erosion. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and gridling.

Because of the slope, this soil is severely limited as a site for dwellings and septic tank absorption fields. The slope can be modified, or the buildings can be designed so that they conform to the natural slope of the land. The absorption field can be installed on the contour.

Because of the slope and the potential for frost action, this soil is severely limited as a site for local roads and streets. The slope can be modified, and the roads and streets can be built on the contour. Strengthening the base with better suited material helps to prevent the damage caused by frost action.

The land capability classification is IVe. The woodland ordination symbol is 4R.

Wh—Whitaker sandy loam, rarely flooded. This nearly level, deep, somewhat poorly drained soil is on flats on low stream terraces. It is subject to rare flooding of brief duration, especially in winter and spring. Areas are broad and irregularly shaped and are 10 to several hundred acres in size.

In a typical profile, the surface layer is dark brown sandy loam about 10 inches thick. The subsoil is about 46 inches thick. The upper part is pale brown, mottled, friable sandy loam, and the lower part is light brownish gray and dark grayish brown, mottled, friable sandy loam and coarse sandy loam. The substratum to a depth of 60 inches is pale brown sand. Some areas are not subject to flooding. A few areas are occasionally flooded. In places the substratum is gravelly coarse sand.

Included with this soil in mapping are small areas of the moderately well drained Roby Variant soils in the slightly higher landscape positions. Also included are a few areas of the poorly drained Ruark Variant soils in the slightly lower positions. Included soils make up 2 to 5 percent of the unit.

Available water capacity and permeability are moderate in the Whitaker soil. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 1 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. A few small areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. The wetness is the major limitation. A drainage system is needed. Excess water can be removed by subsurface drains with a sand guard and by open ditches. During long dry periods, yields are reduced because the available water capacity is moderate. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Cover crops, green manure crops, and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content and help to protect the surface against soil blowing. The soil is well suited to fall-chisel and till-plant tillage systems.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and lespedeza. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the wetness and the flooding are severe limitations, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of frost action. Strengthening the base with better suited material and providing roadside drainage ditches and culverts help to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 3A.

Wk—Whitaker sandy loam, frequently flooded. This nearly level, deep, somewhat poorly drained soil is on flats on low stream terraces. It is frequently flooded for brief periods, especially in winter and spring. Areas are narrow and elongated and are 5 to 400 acres in size.

In a typical profile, the surface layer is dark brown sandy loam about 9 inches thick. The subsurface layer is pale brown, mottled, friable sandy loam about 7 inches thick. The subsoil is about 34 inches of grayish brown and yellowish brown, mottled, firm and friable sandy clay loam and sandy loam. The upper 23 inches of the substratum is brown and dark grayish brown, mottled, stratified loamy coarse sand and coarse sandy loam. The lower part to a depth of about 80 inches is pale brown and light brownish gray, stratified coarse sand and loamy coarse sand. Some areas are occasionally flooded. In places the substratum is gravelly coarse sand.

Included with this soil in mapping are small areas of the moderately well drained Whitaker Variant soils in the slightly higher landscape positions. Also included are small areas of the poorly drained Driftwood and Ruark Variant soils in the slightly lower positions. Included soils make up 5 to 10 percent of the unit.

Available water capacity and permeability are moderate in the Whitaker soil. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 1 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture.

This soil is well suited to corn and soybeans. It is poorly suited to small grain. The flooding is the major hazard. The wetness is the major limitation. A drainage system is needed. Excess water can be removed by subsurface drains with a sand guard and by open ditches. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that incorporates crop residue into the surface layer improve or maintain tilth and the organic matter content.

If adequately drained, this soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include tall fescue and orchardgrass, and suitable legumes include red clover and lespedeza. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the wetness and the flooding are severe limitations, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the flooding and frost action. Building up the roadbed above the normal flood stage, providing roadside drainage ditches and culverts, and strengthening the base with better suited material help to prevent the damage caused by floodwater and frost action.

The land capability classification is IIw. The woodland ordination symbol is 3A.

Wo—Whitaker Variant loam, frequently flooded. This nearly level, deep, moderately well drained soil is on flats on low stream terraces. It is frequently flooded for brief periods, especially in winter and spring. Areas are narrow and elongated and are 5 to 200 acres in size.

In a typical profile, the surface layer is dark brown loam about 8 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable and firm loam and clay loam; the next part is yellowish brown and grayish brown, mottled, firm and friable clay loam and sandy clay loam; and the lower part is dark yellowish brown, mottled, friable, stratified sandy clay loam and coarse sandy loam. The upper 12 inches of the substratum is dark yellowish brown loamy coarse sand that has a thin layer of coarse sandy loam, and the lower part to a depth of 76 inches is brown sand. Some areas are only occasionally flooded.

Included with this soil in mapping are small areas of the somewhat poorly drained Whitaker soils in the slightly lower landscape positions. These soils make up 3 to 5 percent of the unit.

Available water capacity is high in the Whitaker Variant soil. Permeability is moderate in the subsoil and rapid in the substratum. The organic matter content of the surface layer is moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The soil has an apparent seasonal high water table at a depth of 2 to 3 feet from January through April.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture.

This soil is well suited to corn and soybeans. It is poorly suited to small grain. The flooding is a major hazard. Wetness in the early part of spring is the major limitation. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content. The soil is well suited to spring plowing, spring chiseling, and a no-till cropping system.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include red clover and ladino clover. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the wetness and the flooding are severe limitations, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the flooding and frost action. Building up the roadbed above the normal flood stage, providing roadside drainage ditches and culverts, and strengthening the base with better suited material help to prevent the damage caused by floodwater and frost action.

The land capability classification is IIw. The woodland ordination symbol is 4A.

Wr—Wilbur silt loam, frequently flooded. This nearly level, deep, moderately well drained soil is on bottom land. It is frequently flooded for brief periods, especially in late fall, winter, and spring. Areas are narrow and elongated and are 5 to 40 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 11 inches thick. The substratum to a depth of 60 inches is dark yellowish brown, mottled silt loam. In a few areas it has layers of fine sand, fine sandy loam, and loam or has strongly acid layers. A few areas are only occasionally flooded.

Included with this soil in mapping are the somewhat poorly drained Wakeland soils in swales and in the slightly lower landscape positions. Also included are a few small areas of the well drained Haymond soils in the slightly higher positions adjacent to stream channels. Included soils make up 5 to 10 percent of the unit.

Available water capacity is very high in the Wilbur soil, and permeability is moderate. The organic matter content of the surface layer is moderate or moderately low. Surface runoff is slow. The surface layer is friable and can be easily tilled. The soil has an apparent water table at a depth of 1.5 to 3.0 feet in March and April.

Most areas of this soil are used for corn or soybeans. A few areas are used for hay and pasture. A few are wooded.

This soil is well suited to corn and soybeans. It is poorly suited to small grain. The flooding is the major hazard. Wetness in early spring is a limitation. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content. The soil is well suited to spring plowing, spring chiseling, and a no-till cropping system.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. Suitable grasses include orchardgrass and tall fescue, and suitable legumes include red clover and lespedeza. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the wetness and the flooding are severe limitations, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the flooding and frost action. Building up the roadbed above the normal flood stage, providing roadside drainage ditches and culverts, and strengthening the base with better suited material help to prevent the damage caused by floodwater and frost action.

The land capability classification is IIw. The woodland ordination symbol is 8A.

Wt—Wilhite silty clay, frequently flooded. This nearly level, deep, very poorly drained soil is on bottom land. It is frequently flooded for brief to long periods, especially in late fall, winter, and spring, and is subject to ponding. Areas are broad and irregularly shaped and are 20 to 400 acres in size.

In a typical profile, the surface layer is dark brown, mottled silty clay about 10 inches thick. The subsoil is gray, mottled, firm silty clay about 30 inches thick. The substratum to a depth of 60 inches is gray, mottled silty clay. In some small areas the subsoil has less clay. In a few areas the subsoil and substratum have layers of loam, clay loam, or sandy clay loam.

Available water capacity is moderate, and permeability is very slow. The organic matter content of the surface layer is moderately low. The soil becomes very cloddy if tilled when too wet; thus, preparing a good seedbed is difficult. Surface runoff is very slow or ponded. The soil has an apparent seasonal high water table near or above the surface from December through May.

Most areas of this soil are used for cultivated crops. Some areas are wooded.

This soil is poorly suited to corn and soybeans. It is generally unsuited to small grain. The flooding and the ponding are the major hazards. The wetness is the major limitation. Shallow surface drains and subsurface drains help to remove excess water. Laterals of subsurface drains should be installed at close intervals because of the very slow permeability. During long dry periods, yields are reduced because the available water capacity is moderate. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

If adequately drained, this soil is fairly well suited to grasses for hay and pasture. It is poorly suited to shallow-rooted legumes. Suitable grasses include reed canarygrass and tall fescue, and a suitable legume is ladino clover. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant species are favored in timber stands. Prolonged seasonal wetness limits logging activities and the planting of seedlings. The equipment limitation, seedling mortality, windthrow, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Shallow surface drains, open ditches, and furrowing before planting reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because the flooding, the ponding, and the shrink-swell potential are severe limitations, this soil is generally unsuitable as a site for dwellings. It is severely limited as a site for local roads because of low strength, ponding, and flooding. Building up the roadbed above the normal flood stage helps to prevent the damage caused by ponding and flooding. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic. The soil is generally unsuitable as a site for septic tank absorption fields because the flooding, the ponding, and the very slow permeability are severe limitations.

The land capability classification is IVw. The woodland ordination symbol is 5W.

Zp—Zipp silty clay, frequently flooded. This nearly level, deep, very poorly drained soil is on low lacustrine terraces. It is frequently flooded for brief to long periods, especially in late fall, winter, and spring, and is subject to ponding. Areas are broad or narrow and irregularly shaped and are 10 to several hundred acres in size.

In a typical profile, the surface layer is dark grayish brown silty clay about 7 inches thick. The subsoil is grayish brown and gray, mottled, firm and very firm silty clay about 37 inches thick. The substratum to a depth of 60 inches is yellowish brown, mottled silty clay. In a few small areas, the surface layer is darker colored. A few small areas are only occasionally flooded. A few areas are not subject to flooding. In places the surface layer is silty clay loam.

Included with this soil in mapping are a few small areas of the somewhat poorly drained McGary soils on slight swells. These soils make up 3 to 5 percent of the unit.

Available water capacity is moderate in the Zipp soil, and permeability is slow. The organic matter content of the surface layer is moderate. The soil becomes very cloddy if tilled when too wet; thus, preparing a good seedbed is difficult. Surface runoff is very slow or ponded. The soil has an apparent water table near or above the surface from December through May.

Most areas of this soil are used for cultivated crops. A few areas are wooded.

This soil is poorly suited to corn and soybeans. It is generally unsuited to small grain. The flooding and the ponding are the major hazards. The wetness is the major limitation. Shallow surface drains and subsurface drainage help to remove excess water. Laterals of subsurface drains should be installed at close intervals because of the slow permeability. During long dry periods, yields are reduced because the available water capacity is moderate. Tilling when the soil is wet causes surface compaction, which restricts root penetration and water infiltration. Crop rotations that include meadow crops help to prevent compaction. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

If adequately drained, this soil is fairly well suited to grasses for hay and pasture. It is poorly suited to shallow-rooted legumes. Suitable grasses include reed canarygrass and tall fescue, and a suitable legume is ladino clover. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant species are favored in timber stands. Prolonged seasonal wetness hinders logging activities and the planting of seedlings. The equipment limitation, seedling mortality, windthrow, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Shallow surface drains, open ditches, and furrowing before planting reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the flooding, the ponding, and the shrink-swell potential, this soil is severely limited as a site for dwellings. It is severely limited as a site for septic tank absorption fields because of the flooding, the ponding, and the slow permeability. It is generally unsuited to these uses.

This soil is severely limited as a site for local roads and streets because of the flooding, the ponding, and low strength. Building up the roadbed above the normal flood stage helps to prevent the damage caused by flooding and ponding. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

The land capability classification is IVw. The woodland ordination symbol is 5W.

Zv—Zipp Variant clay loam, frequently flooded. This nearly level, deep, poorly drained and very poorly drained soil is on bottom land. It is frequently flooded for brief to long periods, especially in winter and spring, and is subject to ponding. Areas are narrow and elongated and are 10 to 200 acres in size.

In a typical profile, the surface layer is very dark grayish brown clay loam about 8 inches thick. The subsoil is dark gray and gray, mottled, very firm clay loam about 35 inches thick. The upper 13 inches of the substratum is gray, mottled, stratified clay loam and silty clay loam, and the lower part to a depth of 72 inches is gray, stratified loam, sandy loam, gravelly loam, and gravelly sandy loam. In a few areas the surface layer is lighter colored. In some places it is silty clay loam, loam, or silt loam. In other places the substratum is sand or gravelly sand. In some small areas the surface layer and some layers in the subsoil are muck. Some areas are only occasionally flooded.

Available water capacity is high, and permeability is slow. The organic matter content of the surface layer is moderate. The soil becomes very cloddy if tilled when too wet; thus, preparing a good seedbed is difficult. Surface runoff is very slow or ponded. The soil has an apparent seasonal high water table near or above the surface from December through May.

Most areas are used for cultivated crops. This soil is fairly well suited to corn and soybeans. It is generally unsuited to small grain. The flooding and the ponding are the major limitations. The wetness is the major limitation. A drainage system is needed. Shallow surface drains and subsurface drainage help to remove excess water. Laterals of subsurface drains should be installed at close intervals because of the slow permeability. Green manure crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and the organic matter content.

If adequately drained, this soil is well suited to grasses for hay and pasture. It is poorly suited to shallow-rooted legumes. Suitable grasses include reed canarygrass and tall fescue, and a suitable legume is ladino clover. Forage yields are reduced by prolonged periods of flooding. Grazing when the soil is wet reduces plant density and forage yields and causes surface compaction. Proper stocking rates, rotation grazing, 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. Water-tolerant species are favored in timber stands. Seasonal wetness hinders logging activities and the planting of seedlings. The equipment limitation, seedling mortality, windthrow, and plant competition are management concerns. Logging equipment should be used only during the drier periods. Shallow surface drains, open ditches, and furrowing before planting reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them too widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and if livestock are excluded from the area. Unwanted trees and shrubs can be controlled by proper site preparation and by spraying, cutting, and girdling.

Because of the flooding, the ponding, and the shrink-swell potential, this soil is severely limited as a site for dwellings. It is severely limited as a site for septic tank absorption fields because of the flooding, the ponding, and the slow permeability. It is generally unsuited to these uses.

This soil is severely limited as a site for local roads and streets because of the flooding, the ponding, and low strength. Building up the roadbed above the normal flood stage helps to prevent the damage caused by flooding and ponding. Strengthening the base with better suited material increases the capacity of the roads and streets to support vehicular traffic.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

Prime Farmland

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

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

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

About 208,705 acres in Jackson County, or nearly 63 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in associations 1 through 7, which are described under the heading "General Soil Map Units." Most of this prime farmland is used for crops, mainly corn and soybeans.

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

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

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify for prime farmland only in areas where these limitations have been overcome by such drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

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

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

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

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

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

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

Crops and Pasture

Henry T. Horstman, district conservationist, Soil Conservation Service, helped prepare this section.

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

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

In 1982, about 182,000 acres in Jackson County, or 55 percent of the total acreage, was used for crops, mainly corn, soybeans, and winter wheat, according to the Jackson County Soil and Water Conservation District. About 32,800 acres was used for hay and pasture.

The potential of the soils in Jackson County for increased production of food crops is low. A small percentage of the acreage that is currently used as woodland or pasture can be converted to cropland. In addition to the reserve productive capacity represented by this land, food production can also be increased considerably by extending the latest crop production technology to all of the cropland in the county. This soil survey can greatly facilitate the application of such technology.

The paragraphs that follow describe the main management needs on the cropland and pasture in Jackson County. These needs are measures that control water erosion and soil blowing, reduce wetness, and improve or maintain tilth and fertility.

Water erosion is the major hazard on about 45 percent of the cropland and pasture in the county. On soils that have slope of 2 percent or more, such as Cincinnati, Otwell, Stonehead, and Wellston soils, erosion is a hazard.

Erosion is damaging for several reasons. Productivity is reduced as fertilizer, herbicides, and organic matter are removed from the surface layer. The good natural tilth of some soils deteriorates as the surface layer is lost and part of the more clayey subsoil is incorporated into the plow layer.

Loss of the surface layer is especially damaging to soils that have a fragipan in the subsoil or have bedrock within a few feet of the surface. The root zone in these soils consists mainly of the part of the profile above the fragipan or bedrock. As the surface layer is lost, the thickness of the root zone and the available water capacity are reduced. Avonburg, Bedford, Cincinnati, Haubstadt, Medora, Otwell, Rossmoyne, and Tilsit soils have a fragipan. Berks, Coolville, Gilpin, Stonehead, and Wellston soils have bedrock within a few feet of the surface. The severely eroded Cincinnati, Gilpin, Otwell, and Rarden soil have a root zone that is significantly thinner than that of less eroded soils.

Erosion results in sedimentation of ditches and the pollution of lakes and streams by fertilizers and herbicides. Erosion control minimizes this sedimentation or pollution and improves water quality for fish and wildlife, for municipal use, and for recreation.

Soil conservation practices help to control erosion by reducing the rate of surface runoff, increasing the rate of water infiltration, and establishing a protective vegetative cover. A conservation tillage system that leaves protective amounts of crop residue on the surface can hold soil losses to amounts that will not reduce the productive capacity of the soils. Leaving crop residue on the surface provides a protective cover, reduces the runoff rate, and increases the infiltration rate.

In the more sloping areas on livestock farms, where part of the acreage is used for pasture and hay, including grasses and legumes in the cropping sequence helps to control erosion, unless the pasture is overgrazed (fig. 13). The grasses and legumes also provide nitrogen and improve tilth for the following crop. Rotation grazing, proper stocking rates, and restricted use during wet periods help to maintain a vigorous plant cover, to reduce runoff, and to control erosion.

Cover crops are important in controlling erosion on the more sloping soils. These crops are especially important after such crops as soybeans or corn for silage are harvested. The amount of crop residue left on the surface in the areas used for row crops is not sufficient to protect most of the more sloping soils during winter and early spring.

A proper crop rotation is important in holding soil losses to an acceptable level on most of the more sloping soils. If row crops are grown year after year on these soils, soil losses generally are high unless a conservation tillage system, such as no-till or till-plant, is applied.

No-till and till-plant cropping systems are effective in preventing excessive soil loss on the more sloping soils used for corn or soybeans (fig. 14). These conservation tillage systems can be adapted to many of the soils in the county where erosion is a hazard. If no-till is used on land that has a thick vegetative cover, soil moisture evaporates at a slower rate and the weed population is greatly reduced. Alvin, Bedford, Bloomfield, Cincinnati, Crider, Haubstadt, Medora, Otwell, Parke, and Rossmoyne are examples of soils that are suitable for no-till.

Contour farming and terraces can be used in several areas of the county. In areas where slopes are short and irregular, these practices are difficult to manage. Other types of conservation measures may be more suitable.

Terraces and diversions reduce the length of slopes and the rate of surface runoff. Water- and sediment-control basins are effective in reducing the rate of runoff in watercourses. All of these conservation practices help to control erosion. They are most effective on the deep, well drained and moderately well drained soils that have slope of 10 percent or less. Cincinnati, Crider, Haubstadt, Medora, Parke, Rossmoyne, and Stonehead soils are examples.

Grassed waterways are needed to protect the channels that drain a watershed. Subsurface drains are needed in areas where wetness is a problem in the waterways. They are generally needed in waterways in areas of the gently sloping Avonburg and Dubois soils.

Grade-stabilization structures are needed in many areas of the county where open ditches are common. These structures help to control erosion where surface water drains into an open ditch.

Information about the type and design of erosion-control practices that are best suited to each kind of soil is available at the local office of the Soil Conservation Service.

Soil blowing is a hazard on several of the soils in the county. Alvin, Bloomfield, and Bobtown soils are examples. Windblown soil particles can damage young crops in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Soil blowing can be controlled by a protective cover of vegetation or surface mulch or by tillage methods that result in a rough surface.

Wetness is the major problem on about 35 percent of the cropland and pasture in the county. On some naturally wet soils, production of the crops commonly grown in the county is generally not practical unless a drainage system is installed. The poorly drained or very poorly drained Birds, Cobbsfork, Driftwood, Lyles, Peoga, Piopolis, Wilhite, Zipp, and Zipp Variant soils make up about 51,900 acres in the county. A few areas of the very poorly drained soils are in depressions. Draining these areas is very difficult and expensive.

In undrained areas of the somewhat poorly drained Avonburg, Ayrshire, Bartle, Dubois, McGary, Shoals, Stendal, Stoy, Wakeland, and Whitaker soils, wetness significantly damages crops during most years. These soils make up about 62,935 acres in the county.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface and subsurface drains is needed on some soils used for intensive row cropping. Subsurface drains should be more closely spaced in slowly permeable or very slowly permeable soils than in more permeable soils. They generally are not installed in somewhat poorly drained or poorly drained soils that have a fragipan or a brittle, compact layer. Currently, experiments are being conducted to find practical ways to use subsurface drains in Avonburg, Bartle, Cobbsfork, Dubois, Peoga, and Stoy soils. Water moves slowly

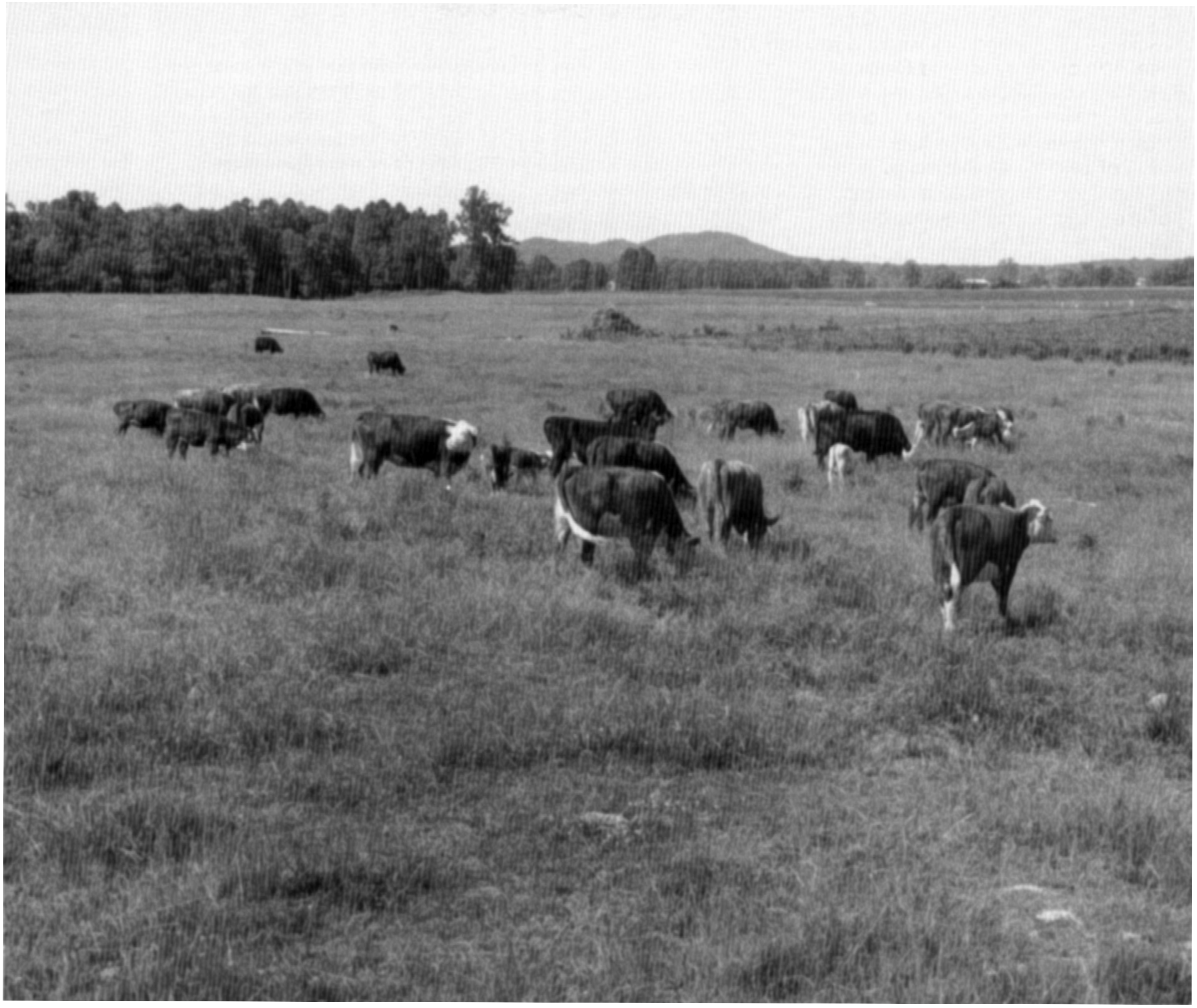


Figure 13.—A protective cover of tall fescue in a pastured area of Haubstadt silt loam, 2 to 6 percent slopes, eroded.

through the clayey subsoil of Driftwood, McGary, Wilhite, Zipp, and Zipp Variant soils; consequently, surface drains generally remove excess water more economically than subsurface drains.

Filtering material is generally needed on subsurface drains in soils that have sandy subsoil material within a depth of about 48 inches. These soils include Ayrshire, Lyles, and Whitaker soils. Subsurface drains installed on minimum grades in soils with a high silt content tend to fill with silt and thus have a shorter functional life. Examples of these soils are Birds, Piopolis, Stendal, and Wakeland soils. Finding adequate outlets for subsurface drainage systems is difficult in some areas of Birds, Driftwood, Lyles, Piopolis, Wilhite, Zipp, and Zipp Variant soils.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous.

Many of the soils used for row crops in the county have a silt loam surface layer that has a moderate or low

Figure 14.—No-till corn in an area of the gently sloping Haubstadt soils.

organic matter content. A surface crust forms during periods of intensive rainfall. It is hard when dry and thus is impervious to water. The hard crust decreases the infiltration rate, increases the runoff rate, and inhibits plant emergence. Regular additions of crop residue, manure, and other organic material improve soil structure and help to prevent crusting.

Armiesburg, Driftwood, McGary, Piopolis, and Zipp Variant soils and the severely eroded Bonnell, Markland, and Rarden soils have a moderately fine textured surface layer. Wilhite and Zipp soils have a fine textured surface layer. Tilth is a problem in all of these soils. If tilled when too wet, the surface layer becomes very cloddy when dry and cannot be easily worked. As a result, preparing a good seedbed is very difficult. Fall tillage of Armiesburg, Driftwood, McGary, Piopolis, Wilhite, Zipp, and Zipp Variant soils generally results in better tilth in the spring.

Many of the soils in the county have a silty or loamy surface layer that is easily compacted. Tilling or grazing when the soils are wet causes surface compaction, which restricts penetration by tillage equipment and plant roots and limits plant growth. Preparing a well-shattered layer that forms a good seedbed is difficult.

Fertility is affected by reaction and by the content of plant nutrients in the soil. Most of the soils on uplands and terraces in the county are naturally medium acid to very strongly acid. The soils on flood plains along the East Fork of the White River and along Sand Creek are neutral to moderately alkaline. Soils on flood plains along other streams in the county range from neutral to very strongly acid. Soils that have a pH level below about 6.0 require applications of ground limestone to raise the pH level sufficiently for cultivated crops, such as corn and soybeans, to grow well. On soils that have a pH below 6.5, limestone is needed before hay and pasture plants, such as alfalfa, can grow well. The supply of available phosphorus and potassium is generally below the level needed for good plant growth in most of the soils in the county. On all soils, additions of lime and fertilizer should be based on the results of soil tests, the needs of the crop, and the desired level of yields.

Pasture plants commonly grown in the county are mixtures of tall fescue, timothy, alfalfa, and red clover. Other pasture plants are bluegrass, orchardgrass, reed canarygrass, ladino clover, redtop, alsike, lespedeza, and sweetclover. Most of the soils in the county are well suited to grasses, such as tall fescue, Kentucky bluegrass, and orchardgrass, and to legumes, such as red clover, ladino clover, and lespedeza. Legumes grow poorly in soils that have a seasonal high water table, such as Birds, Driftwood, Lyles, and Peoga soils. The growth of most deep-rooted legumes, such as alfalfa and sweetclover, is significantly restricted in soils that have a fragipan, such as Avonburg, Cincinnati, Dubois, Haubstadt, and Otwell soils.

Poorly drained and very poorly drained soils, such as Zipp, Wilhite, Peoga, Piopolis, and Cobbsfork soils, are well suited to reed canarygrass. Deep, well drained soils, such as Alvin, Bloomfield, Bonnell, Fox, and Ockley soils, are well suited to alfalfa.

Field crops suited to the soils and climate in the county include those that are currently grown and some that are not commonly grown. Corn and soybeans are the principal row crops. Other row crops that can be grown include grain sorghum, sugar beets, potatoes, and sunflowers. Wheat is the main close-growing crop. Oats, rye, barley, and buckwheat can be successfully grown. Alsike, redtop, red clover, fescue, and bluegrass can be grown for seed.

Some *specialty crops* are grown in the county. The main crops are cantaloups and watermelons. A small acreage is used for tobacco, and a small acreage is used for vegetable crops, including tomatoes, sweet corn, and cucumbers (fig. 15). Cantaloups and watermelons are marketed locally at roadside stands and in surrounding cities. Tomatoes and cucumbers are marketed locally at roadside stands, and some are processed in canning factories.

Most of the cantaloups and watermelons are grown on the deep, well drained Alvin and Bloomfield soils. These soils and the deep, well drained Fox, Ockley, Nineveh Variant, and Parke soils are well suited to many kinds of vegetables and small fruits. These crops can generally be planted and harvested early on all these soils.

The latest information about growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the 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 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

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

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

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

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

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops,

Figure 15.—Tomatoes in an area of Bloomfield-Alvin complex, 1 to 6 percent slopes.

the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

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

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

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

Woodland Management and Productivity

Michael D. Warner, forester, Soil Conservation Service, helped prepare this section.

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

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

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

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

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

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

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

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

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

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

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

Windbreaks and Environmental Plantings

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

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

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

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

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs (fig. 16). In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

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

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

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

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

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains,

Figure 16.—Knob Lake in Jackson-Washington State Forest. The camping and picnic areas surrounding the lake are in an area of Burnside silt loam, occasionally flooded. The wooded area in the background is part of the Brownstown Hills.

and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

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

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

Wildlife Habitat

James D. McCall, biologist, Soil Conservation Service, helped prepare this section.

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

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

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

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

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

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

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, broom sedge, ragweed, pokeweed, sheep sorrel, dock, crabgrass, and dandelion.

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

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

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

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

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

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

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

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

Edge habitat consists of areas where major land uses or cover types adjoin. A good example is the border between dense woodland and a field of no-till corn. Although not rated in the table, edge habitat is of primary importance to animals from the smallest songbird to white-tailed deer. Most of the animals that inhabit openland or woodland also frequent edge habitat, and desirable edge areas are consistently used by 10 times as many wildlife as are the centers of large areas of woodland or cropland.

Engineering

Max L. Evans, state conservation engineer, Soil Conservation Service, helped prepare this section.

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

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

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

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

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

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

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

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table (fig. 17).

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made

Figure 17.—Cutbanks cave if shallow excavations are made in Bloomfield and Alvin soils.

for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

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

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

Sanitary Facilities

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

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

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

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

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

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

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

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

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

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

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

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

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

Construction Materials

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Water Management

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

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

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

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

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

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

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

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

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

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 18). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

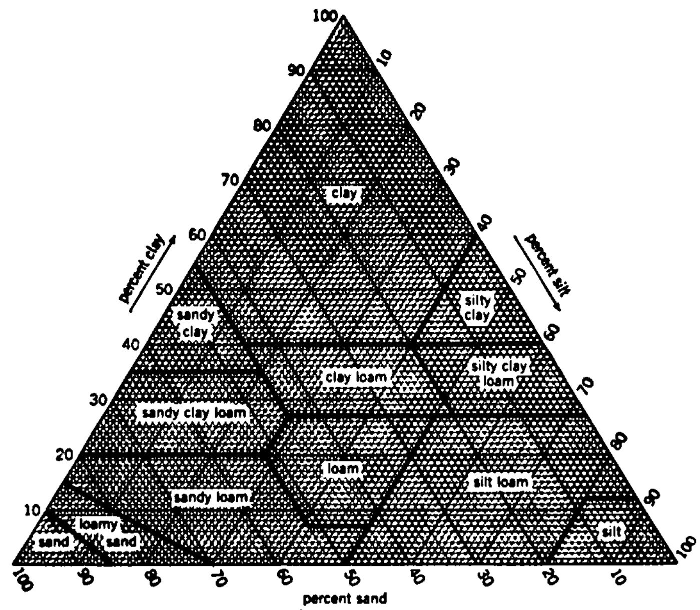


Figure 18.—Percentages of clay, silt, and sand in the USDA basic textural classes.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

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

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

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

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

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

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

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture (fig. 19). Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

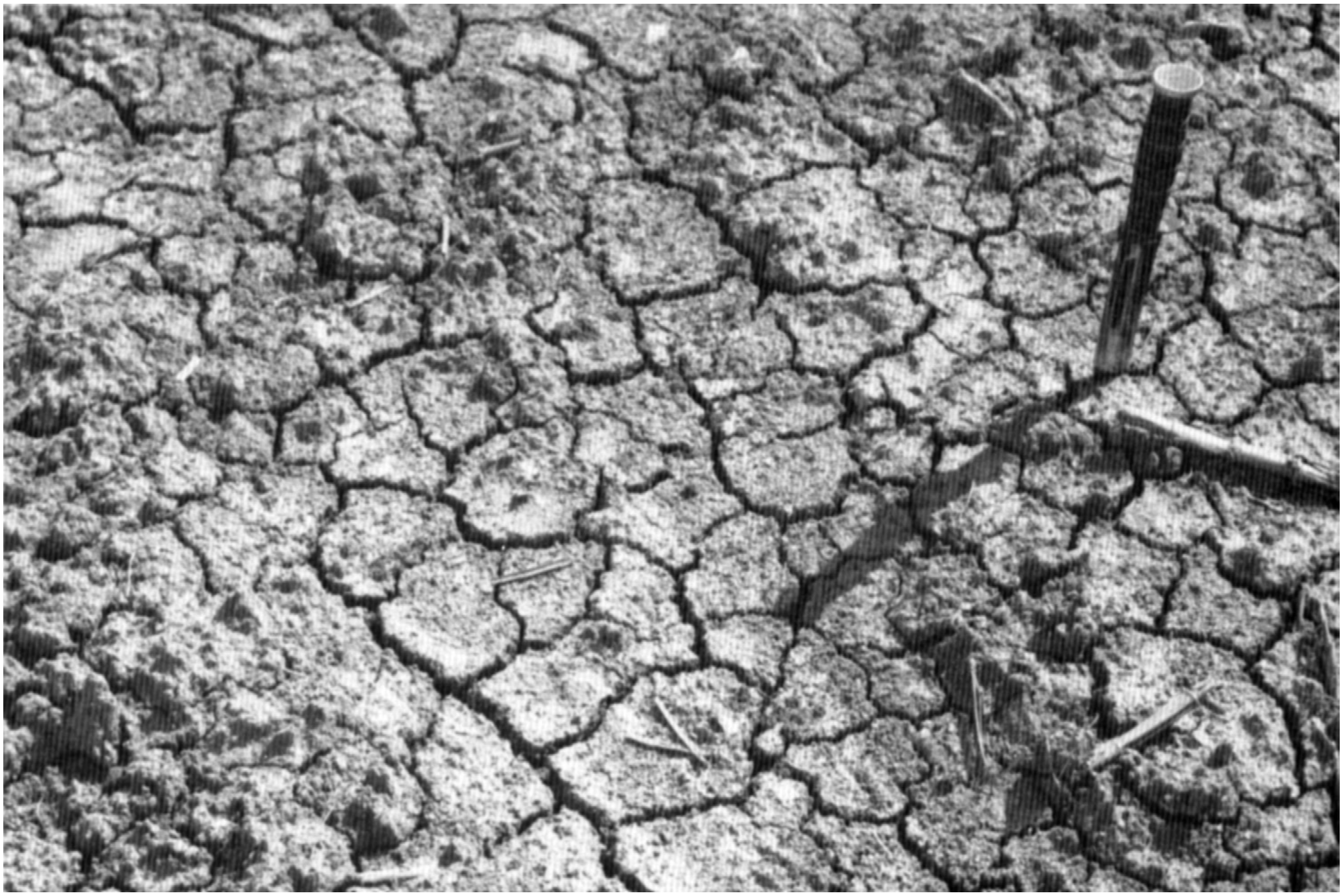


Figure 19.—Numerous large cracks at the surface of a Zipp soil, which has a high shrink-swell potential. The cracks form as the soil dries.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly

erodible. Crops can be grown if intensive measures to control 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. 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. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

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

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

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

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

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

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

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by Indiana State Highway Research and Training Center, Purdue University.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aqualf (*Aqu*, meaning water, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ochraqualfs (*Ochr*, meaning the presence of an ochric epipedon, plus *aqualf*, the suborder of the Alfisols that has an aquic moisture regime).

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

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

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*5*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alvin Series

The Alvin series consists of deep, well drained soils on terraces. These soils are moderately permeable in the subsoil and moderately rapidly permeable in the substratum. They formed in loamy outwash sediments overlying stratified sand and gravelly sand. Slopes range from 0 to 2 percent.

Alvin soils are similar to Ockley soils and are adjacent to Bloomfield, Fox, and Roby Variant soils. Bloomfield soils have less clay in the subsoil than the Alvin soils. Fox soils are less than 40 inches deep to stratified sand

and gravelly sand. Fox and Bloomfield soils are commonly in the lower landscape positions. Roby Variant soils have gray mottles in the upper part of the subsoil and are on the slightly lower flats.

Typical pedon of Alvin sandy loam, 0 to 2 percent slopes, in a cultivated field; 165 feet south and 1,060 feet east of the center of sec. 9., T. 6 N., R. 5 E.

Ap—0 to 10 inches; dark brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; common very fine roots; few fine pebbles; strongly acid; abrupt smooth boundary.

BE—10 to 15 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; common very fine roots; few fine pebbles; strongly acid; clear wavy boundary.

Bt1—15 to 32 inches; dark brown (7.5YR 3/4) sandy clay loam; weak coarse and medium subangular blocky structure; firm; few very fine roots; dark brown (7.5YR 3/4) clay bridging sand grains; about 5 percent gravel; strongly acid; gradual wavy boundary.

Bt2—32 to 41 inches; dark brown (7.5YR 3/4) sandy loam; weak coarse subangular blocky structure; friable; dark brown (7.5YR 3/4) clay bridging sand grains; about 5 percent gravel; strongly acid; gradual wavy boundary.

BC—41 to 60 inches; strong brown (7.5YR 4/6) and light yellowish brown (10YR 6/4) loamy sand; massive; very friable; few fine pebbles; strongly acid in the upper part and medium acid in the lower part; gradual irregular boundary.

2C—60 to 80 inches; pale brown (10YR 6/3) and light gray (10YR 7/2), stratified sand and gravelly coarse sand; single grain; loose; about 20 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 48 to 70 inches and generally corresponds to the depth to carbonates.

The Ap horizon has hue of 10YR or 7.5YR and chroma of 3 or 4. It is sandy loam, loamy sand, or loamy fine sand. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It generally is strongly acid or medium acid but ranges from very strongly acid to medium acid. It is fine sandy loam, sandy loam, sandy clay loam, or loam. The control section averages less than 18 percent clay. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is fine sand to gravelly coarse sand. It generally is moderately alkaline but ranges to strongly acid.

The Alvin soils in Bloomfield-Alvin complex, 1 to 6 percent slopes, and in Bloomfield-Alvin complex, 6 to 15 percent slopes, eroded, have a lower base status and a redder hue and higher chroma in the surface layer than is definitive for the Alvin series. These differences, however, do not alter the usefulness or behavior of the soils.

Armiesburg Series

The Armiesburg series consists of deep, well drained soils on flood plains. These soils are moderately permeable. They formed in silty alluvium. Slopes range from 0 to 2 percent.

Armiesburg soils are similar to Haymond soils and are adjacent to Genesee and Stonelick soils. The similar and adjacent soils have a surface layer that is lighter colored than that of the Armiesburg soils and have less clay in the control section. Genesee and Stonelick soils are in the lower positions on the flood plains.

Typical pedon of Armiesburg silty clay loam, sandy substratum, frequently flooded, in a cultivated field; 1,590 feet south and 400 feet west of the center of sec. 11, T. 6 N., R. 5 E.

Ap1—0 to 8 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; weak moderate subangular blocky structure parting to moderate medium granular; friable; many fine and medium roots; neutral; abrupt smooth boundary.

Ap2—8 to 15 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; weak medium and coarse subangular blocky structure; firm; common fine and very fine roots; neutral; clear wavy boundary.

Bw1—15 to 26 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium and fine angular blocky structure; firm; common very fine roots; many distinct dark brown (10YR 3/3) organic coatings on faces of peds; neutral; gradual wavy boundary.

Bw2—26 to 35 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak coarse prismatic structure parting to moderate medium angular blocky; firm; few very fine roots; neutral; gradual wavy boundary.

C1—35 to 48 inches; dark yellowish brown (10YR 4/6) silty clay loam; weak medium and coarse subangular blocky structure; firm; few very fine roots; neutral; gradual wavy boundary.

2C2—48 to 58 inches; yellowish brown (10YR 5/4) loam; massive; firm; neutral; clear wavy boundary.

3C3—58 to 70 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; mildly alkaline.

The solum is 30 to 50 inches thick. It is neutral or slightly acid. The mollic epipedon is 12 to 24 inches thick.

The A horizon has hue of 10YR, value of 3, and chroma of 2 or 3. It is silt loam or silty clay loam. The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 5. The C and 2C horizons have hue of 10YR, value of 4 or 5, and chroma of 4 to 6. They are silty clay loam, silt loam, loam, sandy loam, or clay loam. The 3C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is loamy sand or sand.

Avonburg Series

The Avonburg series consists of deep, somewhat poorly drained soils on uplands. These soils are very slowly permeable. They formed in loess and in the underlying loamy glacial drift. Slopes range from 0 to 6 percent.

Avonburg soils are similar to Bartle, Dubois, and Stoy soils and are adjacent to Cobbsfork and Rossmoyne soils. Bartle soils are on stream terraces. They formed in silty material of mixed origin. Dubois soils are on lacustrine plains. The lower part of their solum formed in lacustrine sediments. Stoy soils formed in loess more than 48 inches thick. Cobbsfork soils are dominantly gray between the surface layer and a depth of 30 inches and are on broad flats. Rossmoyne soils do not have gray mottles directly below the surface layer and commonly are on the lower side slopes and flats.

Typical pedon of Avonburg silt loam, 0 to 2 percent slopes, in a cultivated field; 600 feet west and 70 feet north of the southeast corner of sec. 24, T. 7 N., R. 6 E.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common very fine roots; common fine and medium black (10YR 2/1) accumulations of iron and manganese oxide; neutral; abrupt smooth boundary.

BE—9 to 18 inches; brownish yellow (10YR 6/6) silt loam; many coarse distinct light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; common very fine roots; common fine and medium black (10YR 2/1) accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt1—18 to 25 inches; light brownish gray (10YR 6/2) silt loam; many medium prominent yellowish brown (10YR 5/6) and common medium prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable; common very fine roots; pale brown (10YR 6/3) silt loam in krotovinas; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of peds; common fine and medium black (10YR 2/1) accumulations of iron and manganese oxide; extremely acid; clear wavy boundary.

Bt2—25 to 36 inches; light brownish gray (10YR 6/2) silty clay loam; many medium prominent yellowish brown (10YR 5/6) and common medium prominent strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to moderate coarse subangular blocky; firm; few very fine roots; common fine pores; pale brown (10YR 6/3) silt loam in krotovinas; thick continuous light brownish gray (10YR 6/2) clay films on faces of peds; common fine and medium black (10YR 2/1) accumulations of iron and manganese oxide; extremely acid; gradual wavy boundary.

2Btx1—36 to 61 inches; yellowish brown (10YR 5/6) silt loam; many medium prominent light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/8) mottles; moderate very coarse prismatic structure; very firm and 60 percent brittle; light brownish gray (10YR 6/2) silt loam in krotovinas; thick continuous gray (10YR 6/1) clay films and many distinct silt coatings on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; extremely acid; gradual wavy boundary.

2Btx2—61 to 77 inches; yellowish brown (10YR 5/6) silt loam; many medium prominent gray (10YR 6/1) and common medium distinct strong brown (7.5YR 5/8) mottles; weak very coarse prismatic structure; firm and 70 percent brittle; light brownish gray (10YR 6/2) silt loam in krotovinas; few discontinuous gray (10YR 6/1) clay films on faces of peds; common fine and medium black (10YR 2/1) accumulations of iron and manganese oxide; strongly acid; gradual wavy boundary.

2Bt—77 to 85 inches; light yellowish brown (10YR 6/4) silt loam; many medium distinct light brownish gray (10YR 6/2) and prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; friable; thick discontinuous gray (10YR 6/1) clay films; common fine and medium black (10YR 2/1) accumulations of iron and manganese oxide; slightly acid.

The solum is 80 or more inches thick. The loess ranges from 20 to 48 inches in thickness. Depth to the fragipan ranges from 24 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3. Some pedons have an E horizon. The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 6. Where chroma is 3 or more in this horizon, clay films on the faces of peds are continuous and have chroma of 2 or less. The Bt and 2Btx horizons range from extremely acid to strongly acid. The 2Btx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6, and it is mottled. It is silt loam or silty clay loam. The 2Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 6. It is silt loam, loam, or clay loam. It generally is strongly acid to slightly acid but ranges to moderately alkaline.

Ayrshire Series

The Ayrshire series consists of deep, somewhat poorly drained soils on uplands. These soils are moderately permeable. They formed in loamy and sandy eolian deposits. Slopes range from 0 to 2 percent.

Ayrshire soils are similar to Whitaker soils and are adjacent to Bloomfield, Bobtown, and Lyles soils.

Whitaker soils are on low terraces and have coarser sand throughout than the Ayshire soils. Bloomfield soils have a strong brown subsoil that is free of gray mottles and are on undulating ridges. Bobtown soils do not have gray mottles directly below the surface layer and are on the slightly higher ridges and flats. Lyles soils have a surface layer that is darker than that of the Ayrshire soils and are in slight depressions.

Typical pedon of Ayrshire fine sandy loam, sandy substratum, in a cultivated field; 990 feet north and 530 feet east of the southwest corner of sec. 10, T. 6 N., R. 6 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure parting to weak coarse granular; friable; common fine roots; few black (N 2/0) accumulations of iron and manganese oxide; very strongly acid; abrupt smooth boundary.

BE—9 to 17 inches; yellowish brown (10YR 5/4) fine sandy loam; many medium distinct light gray (10YR 7/2) and common fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable; common fine roots; few black (N 2/0) concretions of iron and manganese oxide; medium acid; clear wavy boundary.

Btg1—17 to 26 inches; light brownish gray (10YR 6/2) fine sandy loam; common medium prominent strong brown (7.5YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable; few fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; common black (N 2/0) concretions of iron and manganese oxide; very strongly acid; clear wavy boundary.

Btg2—26 to 42 inches; light gray (10YR 7/1) loam; common fine prominent strong brown (7.5YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable; few very fine roots; thin continuous pale brown (10YR 6/3) clay films on faces of peds; small pockets of gray (10YR 5/1) fine sandy loam; very strongly acid; gradual wavy boundary.

Cg1—42 to 70 inches; light gray (10YR 7/1) fine sandy loam stratified with sandy clay loam and loamy fine sand; common fine prominent strong brown (7.5YR 5/8) and distinct brown (10YR 5/3) mottles; massive; very friable; very strongly acid in the upper part and strongly acid in the lower part; gradual wavy boundary.

2Cg2—70 to 80 inches; light gray (10YR 7/1) fine sand; many fine prominent yellowish brown (10YR 5/6) and distinct light yellowish brown (10YR 6/4) mottles; single grain; loose; many very small black (N 2/0) crystals of iron and manganese oxide; neutral.

The solum is 40 to 60 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3. It is fine sandy loam or loamy fine sand. Some pedons have a Bt horizon. The Bt and Btg horizons have hue of 10YR, value of 5 to 7, and chroma of 1 to 6. They are loam, fine sandy loam, or sandy clay loam. They range from very strongly acid to medium acid. The Cg and 2Cg horizons have hue of 10YR, value of 5 to 7, and chroma of 1 or 2.

Bartle Series

The Bartle series consists of deep, somewhat poorly drained soils on stream terraces. These soils are very slowly permeable. They formed in silty material of mixed origin. Slopes range from 0 to 2 percent.

Bartle soils are similar to Avonburg, Dubois, and Stoy soils and are adjacent to Pekin soils. The lower part of the solum in Avonburg soils formed in glacial drift. Dubois soils are on lacustrine plains and formed in a thin layer of loess and in the underlying lacustrine sediments. Stoy soils formed in loess that is more than 48 inches thick. Pekin soils do not have gray mottles directly below the surface layer and are on the lower side slopes.

Typical pedon of Bartle silt loam, in a cultivated field; 85 feet west and 250 feet north of the southeast corner of sec. 14, T. 6 N., R. 6 E.

Ap—0 to 9 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium granular structure; friable; few fine black (10YR 2/1) accumulations of iron and manganese oxide; medium acid; abrupt smooth boundary.

E—9 to 14 inches; light gray (10YR 7/2) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium platy structure; friable; common fine roots; few fine black (10YR 2/1) accumulations of iron and manganese oxide; very strongly acid; clear smooth boundary.

BE—14 to 19 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; few fine roots; few fine black (10YR 2/1) accumulations of iron and manganese oxide; extremely acid; clear smooth boundary.

Bt—19 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct strong brown (7.5YR 5/8), common medium faint yellowish brown (10YR 5/6), and many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; thin discontinuous gray (10YR 6/1) clay films on faces of peds; few fine black (10YR 2/1) accumulations of iron and manganese oxide; extremely acid; clear wavy boundary.

Btg—24 to 35 inches; gray (10YR 6/1) silty clay loam; many medium prominent yellowish brown (10YR 5/6), common medium faint pale brown (10YR 6/3), and common fine prominent strong brown (7.5YR 5/8) mottles; moderate coarse and medium subangular blocky structure; firm; few fine roots; thin discontinuous light gray (10YR 6/1) clay films on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; extremely acid; gradual wavy boundary.

Btx1—35 to 55 inches; yellowish brown (10YR 5/6) silt loam; many medium prominent light brownish gray (10YR 6/2) mottles; weak coarse and very coarse prismatic structure; firm and brittle; common fine pores; thin continuous gray (10YR 6/1 and 5/1) clay films on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; strongly acid in the upper part and medium acid in the lower part; gradual wavy boundary.

Btx2—55 to 73 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm and slightly brittle; thin discontinuous gray (N 5/0) clay films in channels; common fine and medium black (10YR 2/1) accumulations of iron and manganese oxide; slightly acid; gradual wavy boundary.

C—73 to 80 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; common fine black (10YR 2/1) accumulations of iron and manganese oxide; neutral.

The solum ranges from 60 to 80 inches in thickness. Depth to the fragipan is 30 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It generally is very strongly acid or strongly acid but ranges from extremely acid to neutral. The Btx and C horizons are silt loam, loam, or silty clay loam. The Btx horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. It ranges from very strongly acid to slightly acid. The C horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 6.

Bedford Series

The Bedford series consists of deep, moderately well drained soils on uplands. These soils have a fragipan. They are moderately permeable above the fragipan and very slowly permeable in the fragipan. They formed in loess and in the underlying silty and clayey material weathered from limestone. Slopes range from 2 to 6 percent.

Bedford soils are similar to Medora and Tilsit soils and are adjacent to Crider, Frederick, and Stoy soils. The lower part of the solum in Medora soils formed in loamy outwash. The lower part of the solum in Tilsit soils formed in material weathered from interbedded siltstone and fine grained sandstone bedrock. Crider and Frederick soils do not have a fragipan and are on the lower side slopes. Stoy soils have gray mottles directly below the surface layer and are on the slightly higher flats.

Typical pedon of Bedford silt loam, 2 to 6 percent slopes, in a cultivated field; 250 feet west and 460 feet south of the northeast corner of sec. 26, T. 5 N., R. 2 E.

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; about 10 percent strong brown (7.5YR 5/6) material from the Bt horizon; weak medium subangular blocky structure parting to moderate medium granular; friable; many very fine roots; common very fine very dark brown (10YR 2/2) accumulations of iron and manganese oxide; slightly acid; abrupt smooth boundary.

Bt1—9 to 16 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common very fine roots; thin continuous strong brown (7.5YR 4/6) clay films on faces of peds; few distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; common very fine very dark brown (10YR 2/2) accumulations of iron and manganese oxide; very strongly acid; clear smooth boundary.

Bt2—16 to 21 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few very fine roots; thin continuous strong brown (7.5YR 5/6) clay films on faces of peds; few faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; common very fine very dark brown (10YR 2/2) accumulations of iron and manganese oxide; extremely acid; clear wavy boundary.

Bt3—21 to 25 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few very fine roots; thin continuous strong brown (7.5YR 5/6) and brown (10YR 5/3) clay films on faces of peds; many distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few very fine very dark brown (10YR 2/2) accumulations of iron and manganese oxide; extremely acid; clear wavy boundary.

Btx—25 to 37 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct strong brown (7.5YR 5/8) and grayish brown (10YR 5/2) mottles; moderate very coarse prismatic structure parting to weak coarse and medium subangular blocky; firm and brittle; medium continuous grayish brown (10YR 5/2) clay films on faces of peds; few very fine very dark brown (10YR 2/2) accumulations of iron and manganese oxide; about 2 percent chert and geode fragments; extremely acid; clear wavy boundary.

2Bt1—37 to 46 inches; strong brown (7.5YR 5/6) cherty silty clay loam; common medium distinct reddish brown (5YR 5/4) mottles; moderate medium subangular blocky structure; firm; thin discontinuous brown (10YR 5/3) clay films on faces of peds; about 30 percent chert and geode fragments; extremely acid; clear wavy boundary.

2Bt2—46 to 65 inches; dark red (2.5YR 3/6) cherty clay; many coarse prominent strong brown (7.5YR 5/6) mottles; strong medium and fine angular blocky structure; very firm; thin continuous dark red (2.5YR 3/6) clay films on faces of peds; about 20 percent chert and geode fragments; very strongly acid; gradual wavy boundary.

2Bt3—65 to 80 inches; dark red (2.5YR 3/6) clay; many coarse prominent strong brown (7.5YR 5/6) and few medium prominent light gray (10YR 7/1) mottles; strong medium and fine angular blocky structure; very firm; thin discontinuous dark red (2.5YR 3/6) clay films on faces of peds; about 5 percent chert and geode fragments; very strongly acid.

The solum ranges from 60 to more than 80 inches in thickness. The loess ranges from 20 to 40 inches in thickness. The upper part of the solum has no coarse fragments. The content of these fragments ranges from 2 to 30 percent, by volume, in the lower part of the solum. The subsoil ranges from strongly acid to extremely acid.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 6. It is silt loam or silty clay loam. Some pedons have a 2Btx horizon. The Btx and 2Btx horizons have hue of 10YR or 7.5YR, value of 5, and chroma of 6. They are silt loam or silty clay loam. The 2Bt horizon is silty clay loam, silty clay, or clay or the cherty analogs of these textures.

Berks Series

The Berks series consists of moderately deep, well drained soils on uplands. These soils are moderately permeable or moderately rapidly permeable. They formed in silty material weathered from siltstone and fine grained sandstone bedrock. The residuum has a high percentage, by volume, of coarse fragments. Slopes range from 25 to 75 percent.

Berks soils are commonly adjacent to Burnside, Gilpin, and Wellston soils. Burnside soils formed in loamy alluvium and are on bottom land. Gilpin and Wellston soils have more clay and fewer coarse fragments in the solum than the Berks soils and are commonly on the higher side slopes.

Typical pedon of Berks channery silt loam, 25 to 75 percent slopes, in a wooded area; 440 feet south and 1,550 feet west of the northeast corner of sec. 33, T. 7 N., R. 2 E.

Oi—1 inch to 0; roots and partly decomposed leaves, twigs, and roots.

A—0 to 7 inches; brown (10YR 5/3) channery silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; many fine and medium roots; about 25 percent fragments of siltstone that are less than 1 inch long; extremely acid; clear wavy boundary.

Bw—7 to 17 inches; brownish yellow (10YR 6/6) channery silt loam; weak fine subangular blocky structure; friable; common fine and medium roots; about 30 percent fragments of siltstone 1 to 6 inches long; very strongly acid; clear wavy boundary.

BC—17 to 35 inches; brownish yellow (10YR 6/6) very flaggy silt loam; weak fine subangular blocky structure; friable; common medium and fine roots; about 75 percent fragments of siltstone 6 to 15 inches long; extremely acid; clear wavy boundary.

R—35 inches; fractured siltstone and fine grained sandstone bedrock.

The thickness of the solum, or the depth to bedrock, is 20 to 40 inches. The solum generally is medium acid to extremely acid but ranges from slightly acid to extremely acid.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or channery silt loam. The Bw horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is the channery, very channery, or very flaggy analogs of silt loam or loam. The content of coarse fragments ranges from 20 to 75 percent, by volume, in individual horizons, and averages more than 35 percent in the control section.

Birds Series

The Birds series consists of deep, poorly drained soils on flood plains (fig. 20). These soils are moderately slowly permeable. They formed in silty alluvium. Slopes range from 0 to 2 percent.

Birds soils are similar to Piopolis soils and are adjacent to Wakeland soils. Piopolis soils have more clay than the Birds soils and are more acid in the control section. Wakeland soils have a horizon between the surface layer and depth of 30 inches that is not dominantly gray, have less clay in the control section than the Birds soils, and are in slightly higher areas closer to stream channels.

Typical pedon of Birds silt loam, frequently flooded, in a cultivated field; 310 feet south and 1,670 feet west of the northeast corner of sec. 23, T. 6 N., R. 6 E.

Ap—0 to 10 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; common fine distinct light brownish gray (10YR 6/2) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium granular structure; friable; common very fine roots; medium acid; abrupt smooth boundary.

Cg1—10 to 23 inches; light gray (10YR 7/1) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; few very fine roots; common fine black (10YR 3/1) accumulations of

Figure 20.—Crawfish castles indicative of the poor drainage of Birds silt loam, frequently flooded. Crawfish form krotovinas when they make burrows in this soil.

iron and manganese oxide; krotovinas, about 1.5 feet apart, filled with brown (10YR 5/3) silt loam; slightly acid; gradual wavy boundary.

Cg2—23 to 41 inches; gray (10YR 6/1) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; few very fine roots; common fine black (10YR 3/1) accumulations of iron and manganese oxide; krotovinas, about 1.5 feet apart, filled with brown (10YR 5/3) silt loam; neutral; gradual wavy boundary.

Cg3—41 to 60 inches; gray (10YR 6/1), stratified silt loam and silty clay loam; many medium distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; firm; many fine and medium black (N 2/0) accumulations of iron and manganese oxide; krotovinas, about 1.5 feet apart, filled with brown (10YR 5/3) silt loam; neutral.

The control section generally is medium acid to neutral but ranges from strongly acid to mildly alkaline. The Cg horizon has hue of 10YR, value of 6 or 7, and chroma of 1 or 2.

Bloomfield Series

The Bloomfield series consists of deep, well drained and somewhat excessively drained soils on uplands. These soils are moderately rapidly permeable or rapidly permeable. They formed in sandy eolian deposits. Slopes range from 1 to 45 percent.

Bloomfield soils are commonly adjacent to Alvin, Ayrshire, Bobtown, and Lyles soils. Alvin soils have more clay in the subsoil than the Bloomfield soils and are in the slightly higher landscape positions. Ayrshire soils have gray mottles directly below the surface layer and are on the lower flats. Bobtown soils have gray mottles in the upper part of the subsoil and commonly are on the lower ridges and flats. Lyles soils have a surface layer that is darker than that of the Bloomfield soils and are in slight depressions.

Typical pedon of Bloomfield fine sand, in a pastured area of Bloomfield-Alvin complex, 6 to 15 percent slopes, eroded; 30 feet north and 1,630 feet east of the center of sec. 32, T. 6 N., R. 6 E.

Ap—0 to 10 inches; dark brown (10YR 4/3) fine sand, pale brown (10YR 6/3) dry; single grain; loose; many fine and very fine roots; medium acid; abrupt smooth boundary.

Bt&E—10 to 39 inches; strong brown (7.5YR 4/6) lamellae of loamy fine sand (Bt); massive; very friable; yellowish brown (10YR 5/4) fine sand (E); single grain; loose; common very fine roots; lamellae are 1 to 3 inches apart, are 0.5 inch to 4.0 inches thick, and have a cumulative thickness of 17 inches; clay bridging connects sand grains in the lamellae; lamellae are discontinuous and wavy; slightly acid; gradual wavy boundary.

E&Bt—39 to 80 inches; yellowish brown (10YR 5/6) fine sand (E); single grain; loose; lamellae of strong brown (7.5YR 4/6) loamy fine sand and fine sand (Bt); lamellae are predominantly fine sand below a depth of 50 inches; massive; very friable; lamellae are 2 to 6 inches apart, are 0.25 inch to 2.0 inches thick, and have a cumulative thickness of 14 inches; clay bridging connects sand grains in the lamellae; lamellae are discontinuous and wavy; slightly acid; gradual irregular boundary.

C—80 to 90 inches; light yellowish brown (10YR 6/4) fine sand; single grain; loose; slight effervescence; mildly alkaline.

The solum ranges from 48 to more than 80 inches in thickness. It generally is medium acid to neutral but ranges from strongly acid to neutral.

The Ap horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 or 4. Pedons in uncultivated areas have an A horizon. This horizon is 2 to 6 inches thick. It has hue of 10YR, value of 3, and chroma of 2. It is sand or fine sand. The Bt part of the Bt&E and E&Bt horizons occurs as lamellae that are 1/8 inch to 5 inches thick and have a cumulative thickness of more than 15 inches within a depth of 60 inches. It has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. The bands in the upper part of the solum are mainly loamy sand or loamy fine sand, but a few are sandy loam or fine sandy loam. Those in the lower part are mainly sand or fine sand, but a few are loamy fine sand. The E part of these horizons has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is sand or fine sand. The C horizon has hue of 10YR, value of 6 or 7, and chroma of 3 to 6. It is fine sand, sand, or loamy fine sand.

Bobtown Series

The Bobtown series consists of deep, moderately well drained soils on uplands. These soils are moderately permeable. They formed in sandy and loamy eolian deposits. Slopes range from 0 to 3 percent.

Bobtown soils are similar to Roby Variant and Whitaker Variant soils and are adjacent to Ayrshire, Bloomfield, and Lyles soils. Roby Variant and Whitaker Variant soils are on low stream terraces and have coarser sand throughout than the Bobtown soils. Also, Roby Variant soils have less clay in the upper part of the subsoil. Ayrshire soils have gray mottles directly below the surface layer and are on the slightly lower flats. Bloomfield soils have a strong brown subsoil that is free of gray mottles and are on undulating ridges. Lyles soils have a surface layer that is darker than that of the Bobtown soils and are in slight depressions.

Typical pedon of Bobtown loamy fine sand, 0 to 3 percent slopes, in a cultivated field; 60 feet south and 1,120 feet west of the center of sec. 15, T. 6 N., R. 6 E.

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) loamy fine sand, pale brown (10YR 6/3) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; common fine and very fine roots; strongly acid; abrupt wavy boundary.

E—9 to 13 inches; yellowish brown (10YR 5/6) fine sandy loam; weak fine subangular blocky structure parting to weak fine granular; very friable; few very fine roots; strongly acid; clear wavy boundary.

BE—13 to 20 inches; yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable; few very fine roots; common fine dark brown (10YR 4/3) iron stains; few fine black (N 2/0) accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt1—20 to 29 inches; strong brown (7.5YR 5/8) fine sandy loam; common fine prominent light gray (10YR 7/2) mottles; moderate medium and fine subangular blocky structure; firm; few very fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; few fine black (N 2/0) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

Bt2—29 to 38 inches; yellowish brown (10YR 5/4) sandy clay loam; many medium distinct light gray (10YR 7/2), few medium distinct gray (10YR 6/1), and common medium prominent strong brown (7.5YR 5/8) mottles; weak medium and coarse subangular blocky structure; firm; few very fine roots; thin discontinuous pale brown (10YR 6/3) clay films on faces of peds; few fine black (N 2/0) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

Bt3—38 to 52 inches; pale brown (10YR 6/3) fine sandy loam; many coarse faint light gray (10YR 7/2) and many medium prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very friable; few very fine roots; clay bridging between sand grains; common fine black (N 2/0) and strong brown (7.5YR 4/6) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

BC—52 to 61 inches; pale brown (10YR 6/3) loamy sand; many medium faint light gray (10YR 7/2) mottles; massive; very friable; many fine black (N 2/0) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

C—61 to 80 inches; yellowish brown (10YR 5/4), stratified loamy sand, loamy fine sand, and fine sand; many coarse distinct light gray (10YR 7/2), common medium faint pale brown (10YR 6/3), and common medium prominent strong brown (7.5YR 5/6) mottles; massive; very friable; strongly acid.

The solum ranges from 48 to 70 inches in thickness. It generally is very strongly acid or strongly acid but ranges from very strongly acid to slightly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 3 to 8. It has mottles with chroma of 2 or less in the upper 10 inches. It is sandy clay loam, fine sandy loam, or loam. The C horizon has hue of 10YR, value of 5 to 7, and chroma of 3 to 6.

Bonnell Series

The Bonnell series consists of deep, well drained soils on uplands. These soils are slowly permeable. They formed in clayey till that has a mantle of loess as much as 18 inches thick. Slopes range from 10 to 18 percent.

Bonnell soils are similar to Markland soils and are adjacent to Cincinnati and Hickory soils. Markland soils have a solum that is thinner than that of the Bonnell soils and formed in lacustrine sediments. Cincinnati soils have a very firm and brittle fragipan and are on the higher side slopes and ridgetops. Hickory soils have less clay in the subsoil than the Bonell soils and are commonly on the lower side slopes.

Typical pedon of Bonnell silt loam, 10 to 18 percent slopes, eroded, in an idle pasture; 1,610 feet west and 240 feet north of the southeast corner of sec. 27, T. 7 N., R. 4 E.

Ap—0 to 6 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium and fine subangular blocky structure; friable; many fine roots; very strongly acid; abrupt smooth boundary.

BE—6 to 10 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; many fine and medium roots; very strongly acid; clear wavy boundary.

2Bt1—10 to 14 inches; strong brown (7.5YR 5/8) silty clay loam; moderate medium and fine subangular blocky structure; firm; common fine roots; thin discontinuous strong brown (7.5YR 5/8) clay films on faces of peds; few distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 5 percent rounded pebbles; very strongly acid; clear wavy boundary.

2Bt2—14 to 23 inches; strong brown (7.5YR 5/8) clay; moderate fine and medium blocky structure; firm; common fine roots; thin continuous strong brown (7.5YR 5/8) and yellowish red (5YR 5/6) clay films on faces of peds; many distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

2Bt3—23 to 31 inches; yellowish brown (10YR 5/8) clay; moderate medium and fine blocky structure; firm; few fine roots; thin continuous yellowish brown (10YR 5/6) clay films on faces of peds; few distinct light yellowish brown (10YR 6/4) and light gray (10YR 7/2) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

2Bt4—31 to 45 inches; yellowish brown (10YR 5/8) clay; moderate medium subangular blocky structure; firm; few fine roots; thin continuous yellowish brown (10YR 5/8) and pale brown (10YR 6/3) clay films on faces of peds; few distinct pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) silt coatings on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2BC—45 to 62 inches; yellowish brown (10YR 5/6) clay loam; weak medium and coarse subangular blocky structure; firm; common medium black (10YR 2/1) accumulations of iron and manganese oxide; few distinct light brownish gray (10YR 6/2) and light yellowish brown (2.5Y 6/4) silt coatings; very strongly acid in the upper part and neutral in the lower part; gradual wavy boundary.

2C—62 to 80 inches; yellowish brown (10YR 5/6) and light yellowish brown (10YR 6/4) clay loam; common fine prominent light olive gray (5Y 6/2) mottles; massive; firm; strong effervescence; moderately alkaline.

The solum ranges from 50 to 80 inches in thickness. The loess ranges from 3 to 18 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. Some pedons have an A horizon. This horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is less than 6 inches thick. The Ap or A horizon is silt loam or silty clay loam. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. It is silty clay loam, silty clay, or clay and ranges from very strongly acid to medium acid. The 2C horizon has hue of 10YR, value of 5, and chroma of 4 to 8. It generally is mildly alkaline or moderately alkaline but ranges from slightly acid to moderately alkaline.

Burnside Series

The Burnside series consists of deep, well drained and moderately well drained soils on flood plains. These soils are moderately permeable. They formed in silty alluvium that has a high percentage of coarse fragments. Slopes range from 0 to 2 percent.

The Burnside soils in this county are less acid than is definitive for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Burnside soils are adjacent to Berks, Haymond, and Steff soils. Berks soils formed in material weathered from interbedded siltstone and fine grained sandstone bedrock and are on side slopes in the uplands. Haymond and Steff soils generally are slightly higher on the landscape than the Burnside soils and are farther from stream channels. They have few or no coarse fragments within a depth of 40 inches. Steff soils have gray mottles within a depth of 20 inches.

Typical pedon of Burnside silt loam, occasionally flooded, in an idle field; 460 feet south and 430 feet west of the northeast corner of sec. 22, T. 7 N., R. 2 E.

Ap—0 to 5 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium and fine granular structure; friable; many fine roots; about 10 percent siltstone and sandstone fragments; strongly acid; clear smooth boundary.

Bw—5 to 24 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable; common fine and very fine roots; about 5 percent siltstone and sandstone fragments; medium acid; clear wavy boundary.

2C1—24 to 48 inches; brown (10YR 5/3) very channery silt loam; massive; very friable; few fine roots; about 70 percent siltstone and sandstone fragments; medium acid; clear wavy boundary.

2C2—48 to 54 inches; yellowish brown (10YR 5/4) channery silt loam; massive; very friable; about 38 percent siltstone and sandstone fragments; medium acid; abrupt smooth boundary.

R—54 inches; interbedded siltstone and fine grained sandstone bedrock.

The solum is 16 to 40 inches thick. The silty alluvium is 12 to 30 inches deep over the channery sediments. The content of siltstone and sandstone fragments ranges, by volume, from 0 to 15 percent in the solum and from 35 to 80 percent in the 2C horizon. The depth to interbedded siltstone, fine grained sandstone, or shale bedrock is 40 to 65 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. The Bw and C horizons have hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bw horizon is silt loam or loam. It ranges from very strongly acid to medium acid. The 2C horizon is channery or very channery loam, channery or very channery silt loam, or gravelly loam. It generally is strongly acid or medium acid but ranges from very strongly acid to medium acid.

Cincinnati Series

The Cincinnati series consists of deep, well drained soils on uplands. These soils have a fragipan. They are moderately permeable above the fragipan and moderately slowly permeable or slowly permeable in and below the fragipan. They formed in loess and in the underlying silty and loamy glacial drift. Slopes range from 2 to 12 percent.

Cincinnati soils are similar to Otwell soils and are commonly adjacent to Bonnell, Hickory, and Rossmoyne soils. The lower part of the solum in Otwell soils formed in lacustrine sediments. Bonnell and Hickory soils do not have a fragipan and are on the lower side slopes. Rossmoyne soils have gray mottles in the upper part of the subsoil and are commonly on the higher narrow flats, ridges, and side slopes.

Typical pedon of Cincinnati silt loam, 6 to 12 percent slopes, eroded, in a cultivated field; 725 feet south and 480 feet east of the northwest corner of sec. 34, T. 7 N., R. 4 E.

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; about 25 percent yellowish brown (10YR 5/6) material from the Bt horizon; moderate fine subangular blocky structure parting to moderate medium granular; friable; common very fine roots; few very fine very dark brown (10YR 2/2) accumulations of iron and manganese oxide; neutral; abrupt smooth boundary.

Bt1—8 to 16 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few very fine roots; common dark yellowish brown (10YR 4/4) organic coatings in root channels; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; few distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; common very fine very dark brown (10YR 2/2) accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt2—16 to 23 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few very fine roots; thin discontinuous brown (10YR 5/4) clay films on faces of peds; many distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; common fine very dark brown (10YR 2/2) accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

2Btx1—23 to 41 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct brownish yellow (10YR 6/8) mottles; moderate very coarse prismatic structure; very firm and brittle; few very fine roots in channels; common fine pores; yellowish brown (10YR 5/4) silty clay loam in krotovinas; medium continuous grayish brown (10YR 5/2) and brown (10YR 5/3) clay films on faces of peds; many distinct light yellowish brown (10YR 6/4) and light gray (10YR 7/2) silt coatings on faces of peds; common medium and fine very dark brown (10YR 2/2) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2Btx2—41 to 61 inches; yellowish brown (10YR 5/6) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure; very firm and brittle; few fine pores; yellowish brown (10YR 5/4) silty clay loam in krotovinas; medium continuous light brownish gray (10YR 6/2) clay films on faces of peds and brown (7.5YR 5/4) clay films in pores; many distinct light gray (10YR 7/2) silt coatings on faces of peds; common medium very dark brown (10YR 2/2) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2Bt1—61 to 70 inches; yellowish brown (10YR 5/8) silt loam; many medium distinct strong brown (7.5YR 5/8) and common medium prominent light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; medium patchy light brownish gray (10YR 6/2) clay films on faces of peds; common medium and coarse very dark brown (10YR 2/2) accumulations of iron and manganese oxide; strongly acid; gradual wavy boundary.

2Bt2—70 to 80 inches; yellowish brown (10YR 5/8) clay loam; common medium distinct brownish yellow (10YR 6/6) and strong brown (7.5YR 5/6) and prominent light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; common medium very dark brown (10YR 2/2) accumulations of iron and manganese oxide; slightly acid.

The solum ranges from 60 to 120 inches in thickness. The loess ranges from 18 to 40 inches in thickness, and depth to the fragipan ranges from 18 to 38 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR. It is silt loam or silty clay loam and is very strongly acid or strongly acid. The 2Btx horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. It is silt loam or loam. It generally is very strongly acid or strongly acid but ranges from very strongly acid to slightly acid. The 2Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. It is silt loam, loam, silty clay loam, or clay loam. It generally is strongly acid to slightly acid but ranges from very strongly acid to slightly acid.

Cobbsfork Series

The Cobbsfork series consists of deep, poorly drained soils on broad flats in the uplands. These soils are very slowly permeable. They formed in loess and other silty material and in the underlying silty and loamy glacial drift. Slopes are 0 to 1 percent.

Cobbsfork soils are similar to Peoga soils and are adjacent to Avonburg soils. The lower part of the solum in Peoga soils formed in lacustrine sediments. Avonburg soils have a horizon between the surface layer and a depth of 30 inches that is not dominantly gray and are on the lower side slopes.

Typical pedon of Cobbsfork silt loam, in a cultivated field; 660 feet west and 260 feet north of the southeast corner of sec. 35, T. 7 N., R. 6 E.

Ap1—0 to 5 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; common fine faint grayish brown (10YR 5/2) mottles; moderate fine and medium granular structure; friable; many very fine roots; strongly acid; clear smooth boundary.

Ap2—5 to 10 inches; grayish brown (10YR 5/2) silt loam; weak thick platy structure; friable; many very fine roots; many medium strong brown (7.5YR 4/6 and 5/8) stains; common fine very dark gray (N 3/0) accumulations of iron and manganese oxide; very strongly acid; clear smooth boundary.

BEg—10 to 20 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; common very fine roots; light gray (10YR 7/2) silt loam in krotovinas; common fine very dark gray (N 3/0) accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

Btg1—20 to 28 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; friable; common very fine roots; light gray (10YR 7/2) silt loam in krotovinas; thin continuous gray (10YR 6/1) clay films on faces of peds; common fine very dark gray (N 3/0) accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

Btg2—28 to 38 inches; light brownish gray (10YR 6/2) silty clay loam; common medium prominent brownish yellow (10YR 6/6) and strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; common very fine roots; light gray (10YR 7/1) silt loam in krotovinas; medium continuous gray (10YR 6/1) clay films on faces of peds; common fine very dark gray (N 3/0) accumulations of iron and manganese oxide; very strongly acid; clear irregular boundary.

2Btxg1—38 to 65 inches; gray (10YR 6/1) silt loam; many coarse prominent yellowish brown (10YR 5/6) and common coarse prominent strong brown (7.5YR 5/8) mottles; weak very coarse prismatic structure; firm and 40 percent brittle; light gray (10YR 7/1) silt loam in krotovinas; thick continuous gray (10YR 6/1) clay films on faces of peds; common medium very dark gray (N 3/0) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2Btxg2—65 to 91 inches; light brownish gray (10YR 6/2) silt loam; many prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; weak very coarse prismatic structure; firm and 45 percent brittle; thick discontinuous gray (10YR 6/1) clay films on faces of peds; few fine very dark gray (N 3/0) accumulations of iron and manganese oxide; strongly acid; gradual wavy boundary.

3Btb—91 to 99 inches; light brownish gray (10YR 6/2) clay loam; many coarse distinct strong brown (7.5YR 5/8) and common coarse faint light yellowish brown (10YR 6/4) mottles; massive; firm; thick discontinuous gray (10YR 5/1) clay films; few medium very dark grayish brown (10YR 3/2) accumulations of iron and manganese oxide; medium acid.

The solum is more than 80 inches thick. In unlimed areas, it generally is very strongly acid to medium acid but ranges from very strongly acid to slightly acid to a depth of 50 inches or more.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Btg horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. The 2Btx horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 6. It is silt loam or silty clay loam. Less than 60 percent of the part of this horizon within a depth of 50 inches is brittle. The 3Btb horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 to 8.

Coolville Series

The Coolville series consists of deep, moderately well drained soils on uplands. These soils are moderately permeable in the upper part of the subsoil and slowly permeable in the lower part. They formed in loess and in the underlying clayey material weathered from soft bedrock of interbedded shale and siltstone (fig. 21). Slopes range from 12 to 20 percent.

Coolville soils are similar to Rarden soils and are adjacent to Gilpin, Kurtz, Rarden, and Stonehead soils. Rarden and Gilpin soils are less than 40 inches deep over bedrock. Gilpin and Kurtz soils have less clay in the subsoil than the Coolville soils and are commonly on the lower side slopes. Stonehead soils have a loess cap that is thicker than that of the Coolville soils. Also, they have a thicker solum. They are on the higher side slopes and ridgetops.

Typical pedon of Coolville silt loam, 12 to 20 percent slopes, in a wooded area; 1,980 feet east and 2,375 feet south of the northwest corner of sec. 19, T. 5 N., R. 5 E.

Oi—1 inch to 0; roots and partly decomposed leaves.

A—0 to 3 inches; grayish brown (10YR 5/2) silt loam, very pale brown (10YR 7/3) dry; moderate medium granular structure; friable; many medium and coarse roots; very strongly acid; clear wavy boundary.

E—3 to 7 inches; light yellowish brown (10YR 6/4) silt loam; weak medium subangular blocky structure parting to moderate medium granular; friable; many medium and coarse roots; very strongly acid; clear smooth boundary.

BE—7 to 12 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common medium and coarse roots; few distinct pale brown (10YR 6/3) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt1—12 to 20 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common medium roots; thin continuous yellowish red (5YR 5/6) clay films on faces of peds; few faint pale brown (10YR 6/3) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

2Bt2—20 to 27 inches; yellowish red (5YR 5/6) silty clay; common fine prominent light brownish gray (10YR 6/2) and common fine distinct light brown (7.5YR 6/4) mottles; moderate fine angular and subangular blocky structure; very firm; common fine and medium roots; thin continuous red (2.5YR 4/6) and strong brown (7.5YR 5/6) clay films on faces of peds; many distinct light brown (7.5YR 6/4) silt coatings on faces of peds; few fragments of ironstone; very strongly acid; clear wavy boundary.

2Bt3—27 to 36 inches; yellowish red (5YR 5/6) silty clay; many fine prominent light brownish gray (10YR 6/2) and common fine distinct light brown (7.5YR 6/4) mottles; moderate fine angular and subangular blocky structure; very firm; common fine and medium roots; thin continuous strong brown (7.5YR 5/6) and thin discontinuous yellowish red (2.5YR 5/6) clay films on faces of peds; many distinct light brown (7.5YR 6/4) silt coatings on faces of peds; few fine and medium roots; few fragments of ironstone; very strongly acid; clear wavy boundary.

2BC—36 to 46 inches; strong brown (7.5YR 5/6) silty clay loam; many medium prominent light brownish gray (10YR 6/2) and common fine distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky and moderate thick platy structure; firm; few fine and medium roots; few fragments of ironstone; very strongly acid; gradual wavy boundary.

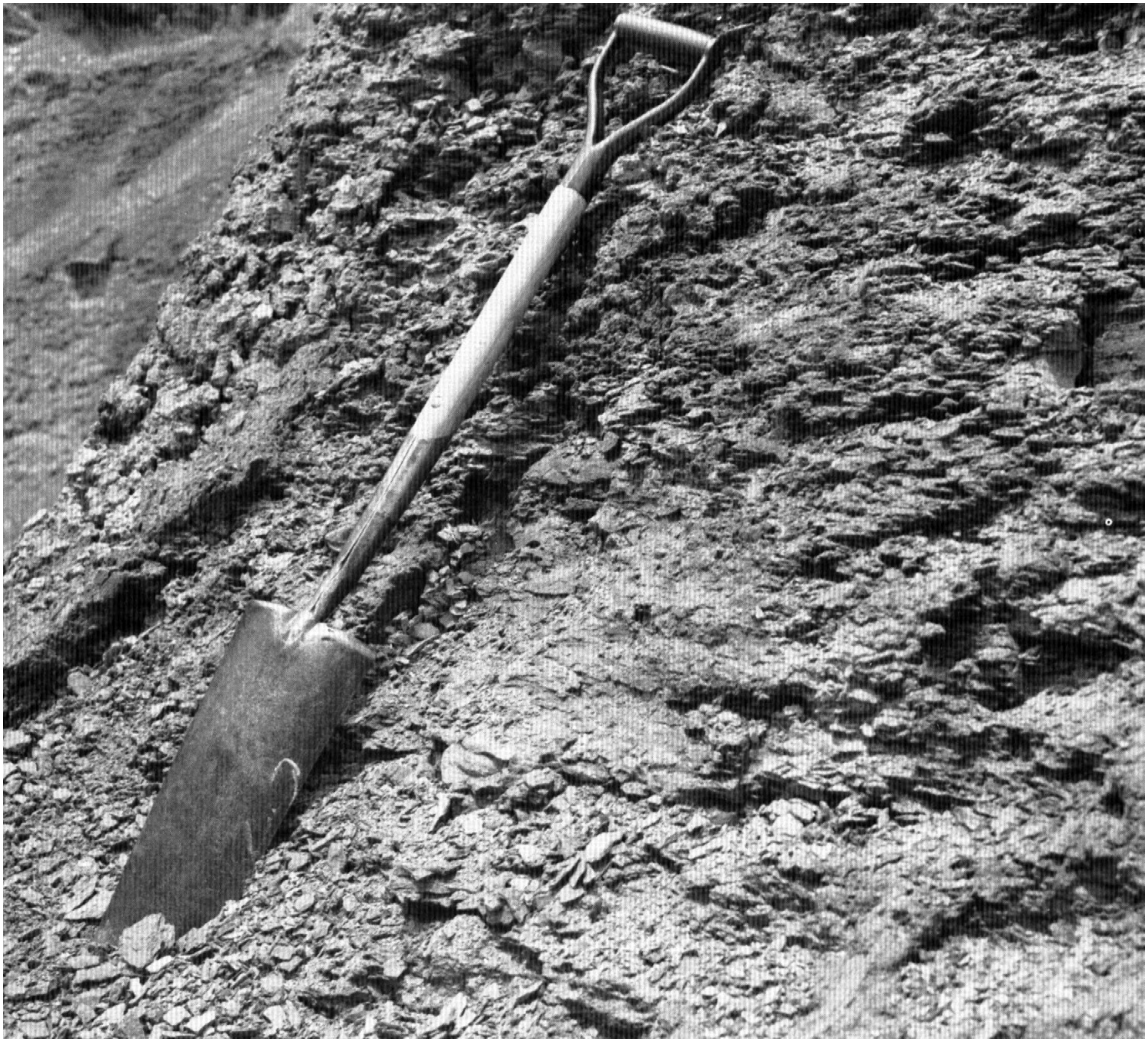


Figure 21.—Soft shale and siltstone bedrock underlying Coolville soils.

2Cr—46 to 60 inches; yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6), interbedded, soft shale and siltstone; thin light olive gray (5Y 6/2) coatings between shale and siltstone fragments; few fragments of ironstone; very strongly acid.

The solum is 36 to 60 inches thick. The depth to bedrock is 40 to 60 inches. The loess is 12 to 24 inches thick. The subsoil ranges from extremely acid to strongly acid. The content of coarse fragments, mainly shale, siltstone, and ironstone, is commonly less than 15 percent, by volume, in the 2Bt horizon and ranges to 30 percent in the 2BC horizon.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. It is 1 to 4 inches thick. Some pedons have an Ap horizon, which has hue of 10YR, value of 4 or 5, and chroma of 3. The E horizon has hue of 10YR, value of 5 or 6, and chroma of 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 6. Mottles that have chroma of 2 or less are within the upper 10 inches of this horizon. The 2Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or silty clay. The content of clay in this horizon ranges from 35 to 60 percent. The 2Cr horizon has hue of 2.5Y to 7.5YR, value of 5, and chroma of 3 to 6.

Crider Series

The Crider series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in loess and in the underlying clayey material weathered from limestone. Slopes range from 6 to 18 percent.

Crider soils are similar to Parke soils and are adjacent to Bedford, Frederick, and Gilpin soils. The lower part of the solum in Parke soils formed in loamy outwash. Bedford soils have a fragipan and are on the higher ridgetops. Frederick soils formed in less than 16 inches of loess and in the underlying limestone residuum. Gilpin soils formed in material weathered from interbedded, fine grained sandstone and siltstone and are on the lower part of side slopes and at the end of ridges.

Typical pedon of Crider silt loam, in a pastured area of Frederick-Crider-Gilpin silt loams, 6 to 18 percent slopes, eroded; 2,500 feet east and 1,385 feet south of the northwest corner of sec. 11, T. 4 N., R. 2 E.

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; about 20 percent strong brown (7.5YR 5/6) material from the Bt horizon; moderate medium granular structure; friable; common fine and very fine roots; strongly acid; abrupt smooth boundary.

Bt1—9 to 15 inches; strong brown (7.5YR 5/6) silt loam; moderate medium and fine subangular blocky structure; friable; few very fine roots; thin continuous strong brown (7.5YR 4/6) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—15 to 22 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous strong brown (7.5YR 4/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt3—22 to 31 inches; strong brown (7.5YR 5/6) silty clay loam; common medium prominent yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; many distinct light yellowish brown (10YR 6/4) and pale brown (10YR 6/3) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

2Bt4—31 to 56 inches; red (2.5YR 4/6) clay; many medium distinct strong brown (7.5YR 5/6) mottles; strong fine angular blocky structure; very firm; thin continuous dark red (2.5YR 3/6) clay films on faces of peds; thick patchy dark grayish brown (10YR 4/2) clay films; about 5 percent chert and geode fragments; very strongly acid; clear wavy boundary.

2Bt5—56 to 68 inches; red (2.5YR 4/6) clay; common medium prominent strong brown (7.5YR 5/6) mottles; moderate fine angular blocky structure; very firm; thin continuous dark red (2.5YR 3/6) clay films on faces of peds; thick patchy light gray (10YR 7/1) clay films; about 5 percent chert and geode fragments; very strongly acid; clear wavy boundary.

2Bt6—68 to 80 inches; variegated red (2.5YR 4/8) and yellowish red (5YR 5/8) silty clay; moderate fine and medium angular blocky structure; firm; thin continuous dark red (2.5YR 3/6) clay films on faces of peds; thick discontinuous light gray (10YR 7/1) clay films; about 5 percent geode and sandstone fragments; very strongly acid.

The solum ranges from 60 to more than 100 inches in thickness. The depth to bedrock ranges from 60 to more than 160 inches. The content of coarse fragments ranges from 5 to 30 percent, by volume, below the lithologic discontinuity. The loess ranges from 20 to 40 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 6 to 8. It is silt loam or silty clay loam and is very strongly acid or strongly acid. The 2Bt horizon has hue of 5YR to 10R, value of 3 to 5, and chroma of 4 to 8. It is silty clay or clay and is very strongly acid to slightly acid.

Driftwood Series

The Driftwood series consists of deep, poorly drained soils on flood plains. These soils are slowly permeable. They formed in clayey and loamy alluvium. Slopes range from 0 to 2 percent.

Driftwood soils are similar to Wilhite and Zipp soils and are adjacent to Stendal and Whitaker soils. Wilhite and Zipp soils have less sand and fewer coarse fragments than the Driftwood soils and are less acid throughout. Stendal and Whitaker soils have less clay in the control section than the Driftwood soils and have a subhorizon between the surface layer and a depth of 30 inches that is not dominantly gray. They are in the slightly higher landscape positions.

Typical pedon of Driftwood clay loam, frequently flooded, in a cultivated field; 1,540 feet south and 130 feet east of the center of sec. 5, T. 5 N., R. 4 E.

Ap—0 to 8 inches; brown (10YR 5/3) clay loam, light gray (10YR 7/2) dry; many fine faint gray (10YR 6/1) and common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse and medium subangular blocky structure; firm; about 2 percent fine gravel; strongly acid; abrupt smooth boundary.

Bg1—8 to 20 inches; light gray (10YR 7/1) sandy clay loam; many medium and coarse prominent strong brown (7.5YR 5/8) and common medium distinct light yellowish brown (10YR 6/4) mottles; moderate coarse and very coarse prismatic structure parting to moderate coarse angular blocky; firm; few faint light gray (10YR 7/1) silt coatings on faces of peds; about 4 percent fine gravel; very strongly acid; gradual wavy boundary.

Bg2—20 to 36 inches; light gray (10YR 7/1) clay; many medium and coarse prominent strong brown (7.5YR 5/8) and common medium distinct light yellowish brown (10YR 6/4) mottles; moderate coarse and very coarse prismatic structure parting to moderate coarse angular blocky; very firm; few faint light gray (10YR 7/1) silt coatings on faces of peds; about 2 percent fine gravel; strongly acid; gradual wavy boundary.

Bg3—36 to 63 inches; gray (10YR 6/1) clay; many medium prominent strong brown (7.5YR 5/6) mottles; moderate coarse and very coarse prismatic structure parting to moderate coarse angular blocky; very firm; few faint gray (10YR 6/1) silt coatings on faces of peds; common medium black (N 2/0) accumulations of iron and manganese oxide; about 4 percent fine gravel; strongly acid; gradual wavy boundary.

Cg—63 to 80 inches; gray (10YR 6/1) clay loam that has thin strata of silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; massive; firm; common medium black (N 2/0) accumulations of iron and manganese oxide; about 10 percent fine gravel; neutral.

The solum is 50 to 70 inches thick. The content of gravel is 0 to 10 percent in the solum and 5 to 15 percent in the substratum. The content of clay in the control section is 35 to 45 percent.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bg horizon has hue of 10YR, value of 6 or 7, and chroma of 1 or 2. It is sandy clay loam, clay loam, or clay. It generally is very strongly acid or strongly acid but ranges from very strongly acid to medium acid. The Cg horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 or 2. It is stratified coarse sandy loam, sandy loam, loam, sandy clay loam, clay loam, or silty clay loam. It is neutral or mildly alkaline.

Dubois Series

The Dubois series consists of deep, somewhat poorly drained soils on lacustrine terraces. These soils have a fragipan. They are moderately permeable above the fragipan and very slowly permeable in the fragipan. They formed in loess and in the underlying silty and loamy lacustrine sediments. Slopes range from 0 to 6 percent.

Dubois soils are similar to Avonburg, Bartle, and Stoy soils and are adjacent to Haubstadt and Peoga soils. The lower part of the solum in Avonburg soils formed in glacial drift. Bartle soils are on stream terraces and formed in silty material of mixed origin. Stoy soils formed in loess that is more than 48 inches thick. Haubstadt soils do not have gray mottles directly below the surface layer and are on the lower side slopes and narrow flats. Peoga soils are dominantly gray between the surface layer and a depth of 30 inches and are on broad flats.

Typical pedon of Dubois silt loam, 0 to 2 percent slopes, in a cultivated field; 1,450 feet east and 500 feet north of the southwest corner of sec. 35, T. 5 N., R. 6 E.

Ap—0 to 10 inches; brown (10YR 5/3) silt loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; common very fine and fine roots; medium acid; abrupt smooth boundary.

BE—10 to 18 inches; brownish yellow (10YR 6/6) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; weak thick and medium platy structure; friable; common very fine roots; common medium strong brown (7.5YR 5/8) iron and manganese oxide stains; very strongly acid; clear wavy boundary.

Bt—18 to 34 inches; light brownish gray (10YR 6/2) silty clay loam; many medium and coarse distinct yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common very fine roots; thin continuous light brownish gray (10YR 6/2) clay films and silt coatings on faces of peds; common medium strong brown (7.5YR 5/8) and yellowish red (5YR 5/6) iron and manganese oxide stains; extremely acid; gradual wavy boundary.

2Btx1—34 to 49 inches; yellowish brown (10YR 5/6) silt loam; many medium and coarse prominent gray (10YR 6/1) mottles; moderate very coarse prismatic structure parting to weak thick platy; very firm and brittle; few very fine roots in channels; medium discontinuous gray (10YR 5/1) clay films on faces of peds and in channels; common fine strong brown (7.5YR 5/6) and dark yellowish brown (7.5YR 4/6) iron and manganese stains; few fine black (10YR 2/1) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2Btx2—49 to 80 inches; yellowish brown (10YR 5/4) loam; many medium and coarse distinct gray (10YR 6/1) mottles; moderate very coarse prismatic structure parting to weak medium subangular blocky; very firm and brittle; few very fine roots in channels; common very fine pores; medium continuous gray (10YR 5/1) clay films on faces of peds and in channels and brown (10YR 5/3) clay films on faces of peds; common fine strong brown (7.5YR 5/6) iron and manganese stains around channels; few fine black (10YR 2/1) accumulations of iron and manganese oxide; very strongly acid in the upper part and medium acid in the lower part; gradual wavy boundary.

2C—80 to 90 inches; gray (10YR 6/1) clay loam that has very thin strata of gray (10YR 5/1) silty clay loam; many medium prominent yellowish brown (10YR 5/4) and strong brown (7.5YR 5/8) mottles; massive; firm; slightly acid.

The solum ranges from 60 to more than 80 inches in thickness. The loess ranges from 20 to 40 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Some pedons have an E horizon. The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is silt loam or silty clay loam. It generally is extremely acid or very strongly acid but ranges from extremely acid to medium acid. The 2Btx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is silt loam, loam, or clay loam. It generally is very strongly acid or strongly acid but ranges from very strongly acid to slightly acid. The 2C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 to 6. It is silt loam, loam, silty clay loam, clay loam, or sandy clay loam. It generally is very strongly acid to slightly acid but ranges from very strongly acid to neutral.

Fox Series

The Fox series consists of well drained soils on terraces. These soils are moderately permeable in the subsoil and very rapidly permeable in the substratum. They formed in loamy outwash sediments that are moderately deep over stratified, calcareous coarse sand and gravelly coarse sand. Slopes range from 0 to 2 percent.

Fox soils are adjacent to Armiesburg, Ockley, and Zipp Variant soils. Armiesburg soils formed in silty alluvium and are on bottom land. Ockley soils are more than 40 inches deep to the underlying stratified sand and gravelly sand and are in the same landscape positions as the Fox soils. Zipp Variant soils formed in clayey alluvium over loamy alluvium, are poorly and very poorly drained, and are on bottom land.

Typical pedon of Fox sandy loam, in a cultivated area of Fox-Ockley sandy loams, sandy substratums, 0 to 2 percent slopes; 1,190 feet west and 260 feet south of the center of sec. 16, T. 6 N., R. 5 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; moderate medium granular structure; very friable; many very fine roots; about 2 percent gravel; medium acid; abrupt smooth boundary.

Bt1—9 to 19 inches; dark reddish brown (5YR 3/4) gravelly sandy clay loam; moderate medium subangular blocky structure; friable; common very fine roots; dark reddish brown (5YR 3/4) clay bridging sand grains; few distinct dark yellowish brown (10YR 3/4) organic coatings lining channels; about 20 percent gravel; medium acid; gradual wavy boundary.

Bt2—19 to 27 inches; dark brown (7.5YR 3/4) gravelly sandy clay loam; weak fine subangular blocky structure; firm; few very fine roots; dark brown (7.5YR 3/4) clay bridging sand grains; about 20 percent gravel; slightly acid; abrupt irregular boundary.

2C1—27 to 33 inches; yellowish brown (10YR 5/4) coarse sand; single grain; loose; few very fine roots; about 2 percent gravel; strong effervescence; mildly alkaline; clear wavy boundary.

2C2—33 to 60 inches; pale brown (10YR 6/3), stratified gravelly coarse sand and coarse sand; single grain; loose; individual strata range from 5 to 60 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum is 24 to 40 inches and generally coincides with the depth to calcareous, stratified gravelly coarse sand and coarse sand. The content of gravel ranges from 15 to 35 percent in individual horizons in the subsoil.

The Bt horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 4. It is gravelly clay loam or gravelly sandy clay loam. It ranges from medium acid to neutral. The 2C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4.

Frederick Series

The Frederick series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in clayey limestone residuum that has a mantle of loess as much as 16 inches thick. Slopes range from 6 to 18 percent.

Frederick soils are adjacent to Bedford, Crider, and Gilpin soils. Bedford soils have a fragipan and are on the higher ridgetops and side slopes. Crider soils formed in more than 20 inches of loess and in the underlying material weathered from limestone. They are in landscape positions similar to those of the Frederick soils. Gilpin soils formed in loamy material weathered from interbedded, fine grained sandstone and siltstone and are on the lower side slopes and ridges.

Typical pedon of Frederick silt loam, in a cultivated area of Frederick-Crider-Gilpin silt loams, 6 to 18 percent slopes, eroded; 590 feet west and 860 feet south of the northeast corner of sec. 26, T. 5 N., R. 2 E.

Ap—0 to 9 inches; yellowish brown (10YR 5/4) silt loam, brownish yellow (10YR 6/6) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; common fine and very fine roots; about 3 percent chert and geode fragments; slightly acid; abrupt smooth boundary.

Bt1—9 to 16 inches; yellowish red (5YR 5/6) cherty clay; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous strong brown (7.5YR 4/6) clay films on faces of peds; many prominent very pale brown (10YR 7/4) silt coatings on faces of peds; about 25 percent chert and geode fragments; very strongly acid; clear wavy boundary.

Bt2—16 to 24 inches; strong brown (7.5YR 5/6) clay; many fine and medium red (2.5YR 4/6) mottles; strong fine and medium angular blocky structure; firm; thin continuous strong brown (7.5YR 4/6) clay films on faces of peds; few prominent very pale brown (10YR 7/4) silt coatings on faces of peds; about 5 percent chert and geode fragments; very strongly acid; clear wavy boundary.

Bt3—24 to 56 inches; variegated strong brown (7.5YR 5/8) and dark red (2.5YR 3/6) clay; strong fine and medium angular blocky structure; firm; medium continuous brown (7.5YR 5/4) and dark red (2.5YR 3/6) clay films on faces of peds; few prominent very pale brown (10YR 7/4) silt coatings on faces of peds; about 10 percent chert and geode fragments; very strongly acid; gradual wavy boundary.

Bt4—56 to 80 inches; red (2.5YR 4/6) clay; many medium distinct reddish yellow (7.5YR 6/8) mottles; moderate fine and medium angular blocky structure; firm; medium continuous dark red (2.5YR 3/6) clay films on faces of peds; thick patchy light gray (10YR 7/1) clay films; about 5 percent chert and geode fragments; very strongly acid.

The solum ranges from 60 to more than 100 inches in thickness. The content of coarse fragments is 0 to 15 percent, by volume, in the A horizon, 2 to 25 percent from the base of the A horizon to a depth of 24 inches, and 5 to 10 percent below that depth.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 6 to 8. It is cherty clay, silty clay, or clay. It generally is very strongly acid or strongly acid but ranges from very strongly acid to medium acid.

Genesee Series

The Genesee series consists of deep, well drained soils on flood plains. These soils are moderately permeable. They formed in silty alluvium. Slopes range from 0 to 2 percent.

The Genesee soils in this county have more silt and less sand in the control section than is definitive for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Genesee soils are similar to Haymond soils and are adjacent to Armiesburg and Stonelick soils. Haymond soils have less clay in the control section than the Genesee soils and do not have free carbonates within a depth of 40 inches. Armiesburg soils have a surface layer that is slightly darker than that of the Genesee soils, have more clay in the solum, and are in the slightly higher landscape positions. Stonelick soils have more sand and less clay in the control section than the Genesee soils.

Typical pedon of Genesee silt loam, frequently flooded, in a cultivated field; 2,300 feet north and 400 feet east of the southwest corner of sec. 14, T. 6 N., R. 5 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure parting to weak medium granular; friable; common very fine roots; mildly alkaline; abrupt smooth boundary.

C1—9 to 18 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium angular blocky structure; friable; common very fine roots; many faint dark brown (10YR 4/3) organic coatings on faces of peds; neutral; clear wavy boundary.

C2—18 to 29 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; few very fine roots; many faint dark brown (10YR 4/3) organic coatings on faces of peds; neutral; clear wavy boundary.

C3—29 to 46 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable; few very fine roots; few faint dark brown (10YR 4/3) organic coatings on faces of peds; very slight effervescence; mildly alkaline; gradual wavy boundary.

C4—46 to 60 inches; yellowish brown (10YR 5/4) loam that has thin strata of fine sandy loam and loamy fine sand; massive; friable; slight effervescence; moderately alkaline.

The control section generally is neutral or mildly alkaline but ranges from slightly acid to moderately alkaline. Free carbonates are within a depth of 40 inches.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 4. The part of this horizon within a depth of 40 inches is silt loam or loam and averages less than 15 percent fine sand or coarser sand. The part below a depth of 40 inches is silt loam, loam, or fine sandy loam that has thin strata of loamy fine sand or fine sand.

Gilpin Series

The Gilpin series consists of moderately deep, well drained soils on uplands. These soils are moderately permeable. They formed in silty material weathered from interbedded siltstone and fine grained sandstone bedrock. Slopes range from 10 to 55 percent.

Gilpin soils are adjacent to Berks, Frederick, Kurtz, and Wellston soils. Berks soils have less clay and a higher content of coarse fragments in the solum than the Gilpin soils. In some places they are above steep areas of the Gilpin soils, and in other places they are below the less sloping areas of the Gilpin soils. Frederick soils are on the higher side slopes. Their subsoil formed in clayey limestone residuum. Kurtz soils have a solum that is thicker than that of the Gilpin soils and have fewer coarse fragments in the solum. They are on the lower side slopes. Wellston soils commonly are on the higher side slopes. They have fewer coarse fragments in the upper part of the subsoil than the Gilpin soils. The upper part of their solum formed in loess.

Typical pedon of Gilpin silt loam, in a wooded area of Gilpin-Wellston silt loams, 10 to 25 percent slopes; 600 feet south and 130 feet east of the center of sec. 26, T. 7 N., R. 2 E.

Oi—1 inch to 0; partly decomposed leaves and roots.

A—0 to 5 inches; dark brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; weak medium granular structure; friable; many fine and medium roots; about 9 percent fragments of siltstone; slightly acid; clear wavy boundary.

BE—5 to 10 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; many medium roots; about 13 percent geode and siltstone fragments; strongly acid; clear wavy boundary.

Bt—10 to 21 inches; yellowish brown (10YR 5/6) channery silt loam; moderate fine and medium subangular blocky structure; friable; common fine and medium roots; thin discontinuous strong brown (7.5YR 5/6) clay films on faces of peds; about 20 percent geode and siltstone fragments; very strongly acid; gradual wavy boundary.

BC—21 to 31 inches; light yellowish brown (2.5Y 6/4) very channery silt loam; weak fine subangular blocky structure; friable; few fine and very fine roots; about 65 percent fragments of siltstone; very strongly acid; clear wavy boundary.

R—31 to 36 inches; interbedded siltstone bedrock.

The solum is 20 to 36 inches thick. The depth to bedrock is 20 to 40 inches. The content of coarse fragments ranges from 0 to 10 percent in the A horizon, from 10 to 30 percent in the Bt horizon, and from 40 to 70 percent in the BC horizon.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt and BC horizons generally are very strongly acid or strongly acid but range from extremely acid to strongly acid. The Bt horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 6. It is silt loam, silty clay loam, or the channery analogs of these textures. The BC horizon has hue of 10YR or 2.5Y, value of 6, and chroma of 4 to 8. It is the channery or very channery analogs of silt loam or silty clay loam.

Haubstadt Series

The Haubstadt series consists of deep, moderately well drained soils on lacustrine terraces. These soils are slowly permeable. They formed in loess and in the underlying silty and loamy lacustrine sediments. Slopes range from 0 to 6 percent.

Haubstadt soils are similar to Pekin and Rossmoyne soils and are adjacent to Dubois and Otwell soils. Pekin soils are on stream terraces and formed in silty material of mixed origin. The lower part of the solum in Rossmoyne soils formed in glacial drift. Dubois soils have gray mottles directly below the surface layer and are on the higher flats. Otwell soils do not have gray mottles in the upper part of the subsoil and are on the lower side slopes.

Typical pedon of Haubstadt silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 1,500 feet north of the center of sec. 3, T. 4 N., R. 6 E.

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; about 20 percent yellowish brown (10YR 5/6) silty clay loam from the Bt horizon; moderate medium granular structure; friable; common fine and very fine roots; very strongly acid; abrupt smooth boundary.

Bt1—7 to 10 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct strong brown (7.5YR 5/8) mottles; moderate fine and medium subangular blocky structure; friable; common very fine roots; thin continuous light yellowish brown (10YR 6/4) clay films and silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt2—10 to 17 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct strong brown (7.5YR 5/8) and few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous yellowish brown (10YR 5/4) clay films on faces of peds; many distinct pale brown (10YR 6/3) and light brownish gray (10YR 6/2) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

2Btx1—17 to 30 inches; yellowish brown (10YR 5/6) silt loam; common fine and medium distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to weak thick platy; very firm and brittle; few very fine roots in channels and on faces of peds; few fine pores in peds; thin continuous brown (10YR 5/6) clay films on faces of peds and many distinct grayish brown (10YR 5/2) and light grayish brown (10YR 6/2) silt coatings and clay films in channels; few fine black (10YR 2/1) accumulations of iron and manganese oxide; common fine strong brown (7.5YR 5/8) iron and manganese stains adjacent to channels; very strongly acid; gradual wavy boundary.

2Btx2—30 to 67 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct yellowish brown (10YR 5/8) and light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to weak thick platy and weak coarse subangular blocky; very firm and brittle; common fine and medium pores in peds; thin continuous yellowish brown (10YR 5/4) clay films on faces of peds and many distinct light brownish gray (10YR 6/2) silt coatings and clay films in channels; common fine black (10YR 2/1) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2C1—67 to 79 inches; light yellowish brown (10YR 6/4) clay loam; many medium distinct strong brown (7.5YR 5/8), light brownish gray (10YR 6/2), and gray (10YR 6/1) mottles; massive; firm; medium acid; clear wavy boundary.

2C2—79 to 88 inches; strong brown (7.5YR 5/8) clay loam; many medium prominent gray (10YR 6/1) mottles; massive; firm; slightly acid.

The solum is 60 to 90 inches thick. The thickness of the loess and depth to the fragipan range from 16 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Pedons in most forested areas have an E horizon. The Bt and 2Btx horizons are very strongly acid or strongly acid. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Btx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The 2Btx and 2C horizons are silt loam, loam, silty clay loam, or clay loam. The 2C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 8. It generally is strongly acid to neutral but ranges from very strongly acid to neutral.

Haymond Series

The Haymond series consists of deep, well drained soils on flood plains. These soils are moderately permeable. They formed in silty alluvium. Slopes range from 0 to 2 percent.

Haymond soils are similar to Armiesburg and Genesee soils and are commonly adjacent to Burnside, Steff, and Wilbur soils. Armiesburg soils have a surface layer that is darker than that of the Haymond soils and have more clay in the solum. Genesee soils have more clay in the control section than the Haymond soils and have free carbonates within a depth of 40 inches. Burnside soils have a high percentage of coarse fragments in the control section. They are generally closer to stream channels than the Haymond soils and are slightly lower on the landscape. Steff and Wilbur soils have gray mottles within 20 inches of the surface. They are farther from stream channels than the Haymond soils and are slightly lower on the landscape.

Typical pedon of Haymond silt loam, frequently flooded, in a cultivated field; 130 feet east and 1,100 feet north of the southwest corner of sec. 9, T. 6 N., R. 3 E.

Ap—0 to 12 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; weak medium granular structure; friable; common fine and very fine roots; slightly acid; abrupt smooth boundary.

C1—12 to 34 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; few fine roots; neutral; clear wavy boundary.

C2—34 to 46 inches; dark yellowish brown (10YR 4/4) loam; common fine and medium faint yellowish brown (10YR 5/4) mottles; massive; friable; few fine roots; neutral; gradual wavy boundary.

C3—46 to 60 inches; dark yellowish brown (10YR 4/4), stratified loam and fine sandy loam; massive; friable; medium acid.

The control section is medium acid to neutral. The content of clay in this section is 8 to 18 percent, by volume, and the content of fine sand or coarser sand is less than 15 percent. The Ap and C horizons have hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

Hickory Series

The Hickory series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in loamy glacial till that has a mantle of loess as much as 18 inches thick. Slopes range from 15 to 45 percent.

Hickory soils are similar to Negley soils and are adjacent to Bonnell and Cincinnati soils. Negley soils formed in loamy outwash. Bonnell and Cincinnati soils are on the higher side slopes. Bonnell soils have more clay in the subsoil than the Hickory soils. Cincinnati soils have a fragipan.

Typical pedon of Hickory loam, 15 to 45 percent slopes, in a wooded area; 825 feet east and 220 feet south of the northwest corner of sec. 19, T. 7 N., R. 5 E.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many medium and coarse roots; about 1 percent gravel; very strongly acid; clear wavy boundary.

E—4 to 10 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; common fine and medium roots; few distinct brown (10YR 4/3) organic coatings in channels and pores; about 1 percent gravel; very strongly acid; clear wavy boundary.

BE—10 to 14 inches; yellowish brown (10YR 5/6) loam; weak fine subangular blocky structure; friable; common fine and medium roots; few distinct brown (10YR 4/3) organic coatings in channels and pores; about 1 percent gravel; very strongly acid; clear wavy boundary.

Bt1—14 to 24 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous strong brown (7.5YR 5/6) clay films on faces of peds; about 3 percent gravel; very strongly acid; clear wavy boundary.

Bt2—24 to 37 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous strong brown (7.5YR 5/6) clay films on faces of peds; few distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; few medium very dark gray (10YR 3/1) accumulations of iron and manganese oxide; about 3 percent gravel; very strongly acid; clear wavy boundary.

Bt3—37 to 45 inches; yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) clay loam; weak coarse subangular blocky structure; firm; few fine roots; thin patchy strong brown (7.5YR 5/6) clay films on faces of peds; few fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; about 3 percent gravel; medium acid; clear wavy boundary.

C—45 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 3 percent gravel; strong effervescence; mildly alkaline.

The solum is 40 to more than 60 inches thick. The A horizon is 1 to 4 inches thick. It has hue of 10YR, value of 2 or 3, and chroma of 2. It is silt loam or loam. The E horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It ranges from very strongly acid to medium acid. The C horizon is loam, clay loam, or sandy loam.

Kurtz Series

The Kurtz series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in silty material weathered from soft bedrock of interbedded siltstone and shale. Slopes range from 20 to 55 percent.

Kurtz soils are similar to Wellston soils and are adjacent to Coolville, Gilpin, and Rarden soils. Wellston soils are on the less sloping side slopes. The upper part of the solum in Wellston and Coolville soils formed in loess. Coolville and Rarden soils have more clay in the subsoil than the Kurtz soils and are on the higher ridgetops and side slopes. Gilpin soils have a higher content of coarse fragments in the solum than the Kurtz soils and are on the higher side slopes.

Typical pedon of Kurtz silt loam, 20 to 55 percent slopes, in a wooded area; 500 feet east and 2,000 feet south of the northwest corner of sec. 19, T. 5 N., R. 5 E.

Oi—1 inch to 0; roots and partly decomposed leaves.

A—0 to 2 inches; grayish brown (10YR 5/2) silt loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable; many fine and medium roots; extremely acid; abrupt smooth boundary.

E—2 to 6 inches; light yellowish brown (2.5Y 6/4) silt loam; moderate medium and fine granular structure; friable; many fine and medium roots; extremely acid; clear smooth boundary.

BE—6 to 12 inches; brownish yellow (10YR 6/6) silt loam; moderate medium and fine subangular blocky structure; friable; common medium and coarse roots; few iron nodules; very strongly acid; clear wavy boundary.

Bt1—12 to 20 inches; yellowish brown (10YR 5/6) silt loam; common fine faint strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common medium and coarse roots; thin continuous light yellowish brown (10YR 6/4) clay films and silt coatings on faces of peds; few iron nodules; very strongly acid; clear wavy boundary.

Bt2—20 to 36 inches; strong brown (7.5YR 5/6) and light yellowish brown (2.5Y 6/4) silty clay loam; common fine prominent greenish gray (5GY 6/1) and yellowish red (5YR 4/6) mottles; moderate fine and medium subangular blocky structure; firm; common medium and coarse roots; thin continuous light yellowish brown (2.5Y 6/4) clay films on faces of peds; occasional iron nodules; about 10 percent weathered, soft fragments of siltstone and shale; very strongly acid; gradual wavy boundary.

BC—36 to 47 inches; light olive brown (2.5Y 5/4) very shaly silty clay loam; many medium prominent gray (5Y 6/1) and greenish gray (5GY 6/1) and common fine distinct strong brown (7.5YR 5/6) mottles; weak medium and fine subangular blocky structure and thick platy rock structure; firm; few medium and coarse roots; about 5 percent iron nodules; about 60 percent weathered, soft fragments of siltstone and shale; very strongly acid; gradual wavy boundary.

Cr—47 to 60 inches; olive (5Y 4/3), interbedded, soft siltstone and shale bedrock; very firm; light olive gray (5Y 6/2) coatings between siltstone and shale fragments; about 5 percent nodule fragments; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. It corresponds to the depth to bedrock. The content of iron nodules and weathered, soft fragments of siltstone and shale ranges from 5 to 15 percent in the Bt horizon and from 35 to 65 percent in the BC horizon.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. The E horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. The Bt horizon is extremely acid or very strongly acid. It has hue of 7.5YR, 10YR, or 2.5Y, value of 5 or 6, and chroma of 4 to 6. The gray colors in the lower part of the B horizon are derived from shale. The BC horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 3 to 6. It is very shaly silt loam or very shaly silty clay loam. The Cr horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 3 or 4. The content of iron nodules in this horizon ranges from 5 to 15 percent.

Lyles Series

The Lyles series consists of deep, very poorly drained soils in depressions on uplands. These soils are moderately permeable. They formed in loamy and sandy eolian deposits. Slopes are 0 to 1 percent.

Lyles soils are adjacent to Ayrshire, Bloomfield, and Bobtown soils. The adjacent soils have a surface layer that is lighter colored than that of the Lyles soils. Ayrshire soils are on the slightly higher flats. Bloomfield soils have a brown subsoil that is free of gray mottles and are on undulating ridges. Bobtown soils do not have gray mottles directly below the surface layer and are on the slightly higher ridges and flats.

Typical pedon of Lyles fine sandy loam, in a cultivated field; 2,240 feet north and 50 feet west of the southeast corner of sec. 9, T. 6 N., R. 6 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark gray (10YR 4/1) dry; moderate medium granular structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.

AB—8 to 18 inches; very dark gray (10YR 3/1) fine sandy loam; common fine distinct yellowish brown (10YR 5/4) and few fine prominent strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bg1—18 to 24 inches; dark gray (10YR 4/1) fine sandy loam; common fine distinct yellowish brown (10YR 5/4) and few fine prominent strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; many faint very dark gray (10YR 3/1) organic coatings; krotovinas, about 1 foot apart, filled with very dark gray (10YR 3/1) fine sandy loam; neutral; gradual wavy boundary.

Bg2—24 to 35 inches; gray (10YR 6/1) fine sandy loam; common medium prominent brownish yellow (10YR 6/6) mottles; weak coarse and medium subangular blocky structure; friable; few fine roots; few distinct very dark gray (10YR 3/1) organic coatings; krotovinas, about 1 foot apart, filled with very dark gray (10YR 3/1) fine sandy loam; neutral; gradual wavy boundary.

Bg3—35 to 46 inches; gray (10YR 6/1) sandy clay loam; many medium prominent yellowish brown (10YR 5/6) and common fine distinct light yellowish brown (2.5Y 6/4) mottles; weak coarse and medium subangular blocky structure; friable; krotovinas, about 1 foot apart, filled with very dark gray (10YR 3/1) fine sandy loam; neutral; gradual wavy boundary.

BCg—46 to 54 inches; light brownish gray (10YR 6/2) and brownish yellow (10YR 6/6) loamy sand; common fine distinct yellowish brown (10YR 5/6) mottles; massive; very friable; mildly alkaline; gradual wavy boundary.

Cg—54 to 60 inches; light brownish gray (10YR 6/2) fine sand; few fine prominent yellowish brown (10YR 5/6) mottles; single grain; loose; mildly alkaline.

The solum is 45 to 60 inches thick. It generally is slightly acid or neutral but ranges from slightly acid to mildly alkaline. The mollic epipedon is 10 to 24 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Bg horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is fine sandy loam, loam, or sandy clay loam. The Cg horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. It is fine sand or sand.

Markland Series

The Markland series consists of deep, moderately well drained and well drained soils on lacustrine terraces. These soils are slowly permeable. They formed in 0 to 20 inches of loess over clayey, calcareous, stratified lacustrine sediments. Slopes range from 1 to 12 percent.

Markland soils are similar to Bonnell soils and are adjacent to McGary soils. Bonnell soils formed in clayey glacial till and have a solum that is thicker than that of the Markland soils. McGary soils have gray mottles directly below the surface layer and are on the slightly higher flats.

Typical pedon of Markland silt loam, 1 to 5 percent slopes, eroded, in a cultivated field; 1,190 feet east and 1,060 feet north of the center of sec. 23, T. 4 N., R. 3 E.

Ap—0 to 6 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; weak coarse subangular blocky structure parting to moderate medium granular; friable; common very fine and fine roots; medium acid; abrupt smooth boundary.

Bt1—6 to 15 inches; dark yellowish brown (10YR 4/6) silty clay; moderate medium and fine angular blocky structure; firm; few very fine roots; thin continuous yellowish brown (10YR 5/6) clay films on faces of peds; few distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; common fine black (N 2/0) accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt2—15 to 27 inches; yellowish brown (10YR 5/6) silty clay; moderate coarse and medium prismatic structure parting to moderate medium and coarse angular blocky; very firm; few very fine roots; thin continuous yellowish brown (10YR 5/4) clay films on faces of peds; neutral; clear wavy boundary.

BC—27 to 32 inches; yellowish brown (10YR 5/6) silty clay; moderate medium and coarse angular blocky structure; very firm; many distinct brown (10YR 5/3) silt coatings on faces of peds; slight effervescence; mildly alkaline; abrupt wavy boundary.

C1—32 to 45 inches; light yellowish brown (10YR 6/4) silty clay; massive; very firm; many medium and fine very pale brown (10YR 8/4) accumulations of calcium carbonate; few faint pale brown (10YR 6/3) and light brownish gray (10YR 6/2) coatings of calcium carbonate on internal planes; violent effervescence; moderately alkaline; clear wavy boundary.

C2—45 to 52 inches; yellowish brown (10YR 5/6), stratified silty clay loam and clay loam; common fine distinct brownish yellow (10YR 6/8) and very pale brown (10YR 7/3) mottles; massive; friable; few fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; mildly alkaline; clear wavy boundary.

C3—52 to 60 inches; light yellowish brown (10YR 6/4), stratified silty clay loam, silt loam, and silt; massive; firm; many medium very pale brown (10YR 8/4) accumulations of calcium carbonate; few distinct light gray (10YR 7/2) coatings of calcium carbonate on internal planes; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 15 to 40 inches. The loess ranges from 0 to 20 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 4. It is silt loam or silty clay loam. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is dominantly silty clay, but in some pedons it is silty clay loam in the upper part. It ranges from strongly acid to neutral. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6.

McGary Series

The McGary series consists of deep, somewhat poorly drained soils on lacustrine terraces. These soils are slowly permeable or very slowly permeable. They formed in loess and in the underlying calcareous, silty and clayey lacustrine deposits. Slopes range from 0 to 2 percent.

McGary soils are adjacent to Markland and Zipp soils. Markland soils do not have gray mottles directly below the surface layer and are on the slightly lower side slopes and narrow flats. Zipp soils are dominantly gray in all subhorizons between the surface layer and a depth of 30 inches and are in slight depressions.

Typical pedon of McGary silty clay loam, 0 to 2 percent slopes, in a cultivated field; 1,405 feet west and 1,150 feet south of the northeast corner of sec. 24, T. 4 N., R. 3 E.

Ap—0 to 10 inches; dark brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable; common fine and medium roots; common fine very dark grayish brown (10YR 3/2) accumulations of iron and manganese oxide; neutral; abrupt smooth boundary.

BE—10 to 15 inches; yellowish brown (10YR 5/6) silty clay loam; many medium prominent light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common fine and medium roots; common fine very dark grayish brown (10YR 3/2) accumulations of iron and manganese oxide; neutral; clear wavy boundary.

Bt1—15 to 22 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate coarse and medium subangular blocky; firm; few fine roots; common fine very dark grayish brown (10YR 3/2) accumulations of iron and manganese oxide; thin discontinuous light brownish gray (10YR 6/2) and pale brown (10YR 6/3) clay films on faces of peds; neutral; clear wavy boundary.

Bt2—22 to 45 inches; yellowish brown (10YR 5/6) silty clay; many medium prominent light olive gray (5Y 6/2) mottles; weak coarse prismatic structure parting to moderate coarse and medium subangular blocky; very firm; few fine roots; common fine very dark grayish brown (10YR 3/2) accumulations of iron and manganese oxide; thin continuous light brownish gray (10YR 6/2) and pale brown (10YR 6/3) clay films on faces of peds; neutral; clear wavy boundary.

BC—45 to 54 inches; yellowish brown (10YR 5/6) silty clay; many medium prominent light brownish gray (2.5Y 6/2) mottles; weak coarse subangular blocky structure; firm; many medium white (10YR 8/2) accumulations of calcium carbonate; common fine very dark grayish brown (10YR 3/2) accumulations of iron and manganese oxide; thin patchy grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) clay films on faces of peds; strong effervescence in spots; mildly alkaline; gradual irregular boundary.

C—54 to 60 inches; yellowish brown (10YR 5/4), stratified silt loam and silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; firm; common fine white (10YR 8/2) accumulations of calcium carbonate; few distinct light brownish gray (10YR 6/2) coatings of calcium carbonate on faces of peds; strong effervescence; moderately alkaline.

The solum is 40 to 55 inches thick, and the depth to carbonates is 40 to 50 inches. The loess is 10 to 16 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3. It is silt loam or silty clay loam. The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 6. It is silty clay loam or silty clay in which the content of clay is 35 to 50 percent by volume. This horizon is slightly acid or neutral. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. It is stratified silt loam, silty clay loam, silty clay, or silt.

Medora Series

The Medora series consists of deep, moderately well drained soils on outwash ridges and eskers. These soils have a fragipan. They are moderately permeable above the fragipan and very slowly permeable in the fragipan. They formed in loess and in the underlying loamy outwash. Slopes range from 2 to 12 percent.

Medora soils are similar to Bedford and Tilsit soils and are adjacent to Negley and Parke soils. The lower part of the solum in Bedford soils formed in clayey material weathered from limestone bedrock. The lower part of the solum in Tilsit soils formed in material weathered from interbedded siltstone and fine grained sandstone bedrock. Negley and Parke soils do not have a fragipan. Negley soils are on the lower side slopes.

Typical pedon of Medora silt loam, 6 to 12 percent slopes, eroded, in a cultivated field; 1,195 feet west and 1,400 feet south of the center of sec. 5, T. 5 N., R. 6 E.

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium and coarse granular structure; friable; medium acid; abrupt smooth boundary.

Bt—8 to 21 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; thin continuous dark yellowish brown (10YR 4/6) clay films on faces of peds; few distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

2Btx1—21 to 33 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light gray (10YR 7/2) mottles; weak very coarse prismatic structure parting to weak very thick platy; very firm and brittle; common fine pores; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds and in pores; many distinct light gray (10YR 7/2) silt coatings on faces of peds; many fine and medium black (N 2/0) and common fine yellowish red (5YR 5/8) accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

2Btx2—33 to 45 inches; strong brown (7.5YR 5/6) and yellowish red (5YR 5/6) loam; weak very coarse prismatic structure parting to weak very thick platy; very firm and brittle; common fine pores; medium continuous dark brown (7.5YR 4/4) clay films on faces of peds and in pores and medium continuous light brownish gray (10YR 6/2) clay films in channels; many prominent light gray (10YR 7/2) silt coatings on faces of peds; few fine and medium black (N 2/0) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2Bt1—45 to 57 inches; yellowish red (5YR 4/6) clay loam; weak very thick platy structure parting to moderate medium angular blocky; firm and slightly brittle; common fine pores; medium continuous reddish brown (5YR 4/4) clay films on faces of peds and medium continuous light brownish gray (10YR 6/2) clay films in channels; many prominent light brown (7.5YR 6/4) silt coatings on faces of peds; very strongly acid; gradual wavy boundary.

2Bt2—57 to 70 inches; yellowish red (5YR 5/6) clay loam; moderate very thick platy structure; firm and slightly brittle; thin continuous reddish brown (5YR 4/4) clay films on faces of peds; many distinct light brown (7.5YR 6/4) silt coatings on faces of peds; very strongly acid; gradual wavy boundary.

2Bt3—70 to 80 inches; red (2.5YR 4/6) sandy clay; weak coarse subangular blocky structure; firm; thin continuous dark red (2.5YR 3/6) clay films on faces of peds; many prominent light brown (7.5YR 6/4) silt coatings on faces of peds; common medium black (N 2/0) accumulations of iron and manganese oxide; few rounded pebbles; very strongly acid.

The solum is 80 or more inches thick. The loess ranges from 18 to 40 inches in thickness. Depth to the fragipan ranges from 20 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt and 2Btx horizons are very strongly acid or strongly acid. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam. The 2Btx horizon has hue of 10YR to 5YR and value and chroma of 4 to 6. It is silt loam, loam, silty clay loam, or clay loam. The 2Bt horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 to 8. It is silty clay loam, clay loam, sandy clay loam, sandy clay, gravelly clay loam, or gravelly sandy clay loam. It ranges from extremely acid to strongly acid.

Negley Series

The Negley series consists of deep, well drained soils on outwash ridges and eskers. These soils are moderately permeable. They formed in loamy outwash sediments that have a mantle of loess as much as 18 inches thick. Slopes range from 12 to 35 percent.

Negley soils are similar to Hickory soils and are adjacent to Medora, Otwell, and Parke soils. Hickory soils formed in loamy glacial till. Medora, Otwell, and Parke soils are on the higher side slopes and ridgetops. Medora soils have a mantle of loess that is 18 to 40 inches thick, Otwell soils have one that is 12 to 36 inches thick, and Parke soils have one that is 20 to 40 inches thick. Medora and Otwell soils have a very firm, brittle fragipan.

Typical pedon of Negley silt loam, 12 to 18 percent slopes, eroded, in a cultivated field; 1,580 feet west and 495 feet north of the southeast corner of sec. 7, T. 5 N., R. 6 E.

Ap—0 to 10 inches; dark yellowish brown (10YR 4/4) silt loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; strongly acid; abrupt smooth boundary.

BE—10 to 16 inches; brown (7.5YR 5/4) loam; moderate medium subangular blocky structure; friable; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; common fine black (N 2/0) accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt1—16 to 26 inches; yellowish red (5YR 4/6) loam; moderate medium and coarse subangular blocky structure; firm; thin continuous strong brown (7.5YR 4/4) and reddish brown (5YR 4/4) clay films on faces of peds; common fine black (N 2/0) accumulations of iron and manganese oxide; about 5 percent rounded pebbles; a layer of very gravelly clay loam at a depth of 24 to 26 inches; strongly acid; gradual wavy boundary.

Bt2—26 to 39 inches; red (2.5YR 4/6) clay loam; weak coarse prismatic structure parting to moderate coarse subangular blocky; firm; thin continuous reddish brown (5YR 4/4) clay films on faces of peds and in pores; many prominent light yellowish brown (10YR 6/4) silt coatings and clean sand grains on faces of peds; common fine black (N 2/0) accumulations of iron and manganese oxide; about 5 percent rounded pebbles; strongly acid; gradual wavy boundary.

Bt3—39 to 50 inches; red (2.5YR 4/6) sandy clay loam; weak coarse prismatic structure parting to moderate coarse subangular blocky; firm; thin continuous reddish brown (5YR 4/4) clay films on faces of peds; many prominent light brown (7.5YR 6/4) silt coatings and clean sand grains on faces of peds and in pores; common fine black (N 2/0) accumulations of iron and manganese oxide; about 3 percent rounded pebbles; strongly acid; gradual wavy boundary.

Bt4—50 to 67 inches; red (2.5YR 4/6) sandy clay loam; weak coarse prismatic structure parting to moderate coarse and very coarse subangular blocky; firm; thin continuous reddish brown (5YR 4/4) clay films on faces of peds and in pores; many prominent light brown (7.5YR 6/4) silt coatings and clean sand grains on faces of peds; common fine black (N 2/0) accumulations of iron and manganese oxide; about 9 percent rounded pebbles; strongly acid; clear wavy boundary.

Bt5—67 to 80 inches; yellowish red (5YR 4/6) sandy clay loam; weak coarse and very coarse subangular blocky structure; friable; thin discontinuous red (2.5YR 4/6) clay films on faces of peds; about 14 percent rounded pebbles; strongly acid.

The solum is 80 or more inches thick. The loess ranges from 0 to 18 inches in thickness. The content of coarse fragments ranges from 0 to 25 percent, by volume, in the Bt horizon.

Some pedons have an A horizon. This horizon has hue of 10YR, value of 3, and chroma of 2. It is 2 to 5 inches thick. The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4. It is silt loam or loam. The Bt horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, clay loam, sandy clay loam, gravelly clay loam, or gravelly sandy clay loam. It generally is very strongly acid to medium acid but ranges from very strongly acid to slightly acid.

Nineveh Variant

The Nineveh Variant consists of deep, well drained soils on low terraces. These soils are moderately permeable in the subsoil and rapidly permeable in the substratum. They formed in loamy outwash sediments over stratified, sandy and loamy sediments. Slopes range from 0 to 2 percent.

Nineveh Variant soils are adjacent to Whitaker Variant soils. Whitaker Variant soils have gray mottles in the upper part of the subsoil and are on the slightly lower flats.

Typical pedon of Nineveh Variant sandy loam, occasionally flooded, 0 to 2 percent slopes, in a cultivated field; 2,160 feet east and 350 feet north of the southwest corner of sec. 25, T. 6 N., R. 4 E.

Ap—0 to 10 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; weak fine granular structure; friable; about 3 percent fine gravel; medium acid; abrupt smooth boundary.

AB—10 to 18 inches; dark brown (10YR 3/3) sandy loam; weak fine granular structure; friable; about 3

percent fine gravel; slightly acid; clear wavy boundary.
Bt1—18 to 26 inches; dark brown (10YR 4/3) sandy loam; weak medium subangular blocky structure; friable; dark brown (10YR 4/3) clay bridging between sand grains; about 3 percent fine gravel; slightly acid; clear wavy boundary.
Bt2—26 to 35 inches; dark brown (7.5YR 3/4) sandy clay loam; weak coarse and medium subangular blocky structure; firm; dark brown (7.5YR 3/4) clay bridging between sand grains; about 3 percent fine gravel; neutral; clear wavy boundary.
Bt3—35 to 41 inches; dark brown (7.5YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; dark brown (7.5YR 4/4) clay bridging between sand grains; about 3 percent fine gravel; neutral; clear wavy boundary.
Bw1—41 to 45 inches; dark brown (7.5YR 4/4) loamy sand; massive; very friable; about 5 percent gravel; neutral; clear wavy boundary.
Bw2—45 to 51 inches; dark yellowish brown (10YR 4/4) loamy sand; massive; very friable; about 14 percent fine gravel; neutral; abrupt wavy boundary.
B't—51 to 55 inches; dark yellowish brown (10YR 3/4) sandy clay loam; weak fine subangular blocky structure; friable; dark yellowish brown (10YR 3/4) clay bridging between sand grains; about 10 percent fine gravel; neutral; abrupt wavy boundary.
2C—55 to 60 inches; pale brown (10YR 6/3) sand; single grain; loose; about 10 percent fine gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches and generally coincides with the depth to free carbonates. The solum is medium acid to neutral. The content of coarse fragments ranges from 0 to 14 percent throughout the profile. The mollic epipedon ranges from 10 to 24 inches in thickness.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. The 2C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4.

Ockley Series

The Ockley series consists of deep, well drained soils on terraces. These soils are moderately permeable in the solum and very rapidly permeable in the substratum. They formed in loamy outwash sediments over calcareous, stratified coarse sand and gravelly coarse sand. Slopes range from 0 to 2 percent.

Ockley soils are adjacent to Fox and Zipp Variant soils. Fox soils have calcareous, stratified coarse sand and gravelly coarse sand at a depth of 20 to 40 inches. Zipp Variant soils formed in clayey alluvium over loamy alluvium, are poorly drained and very poorly drained, and are on bottom land.

Typical pedon of Ockley sandy loam, in a cultivated area of Fox-Ockley sandy loams, sandy substratums, 0 to 2 percent slopes; 400 feet west and 1,720 feet north of the southeast corner of sec. 36, T. 7 N., R. 5 E.

Ap—0 to 10 inches; dark yellowish brown (10YR 4/4) sandy loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; very friable; few fine pebbles; slightly acid; abrupt smooth boundary.
BE—10 to 16 inches; dark brown (7.5YR 4/4) fine sandy loam; weak medium and fine subangular blocky structure; friable; few faint dark yellowish brown (10YR 4/4) organic coatings lining root and worm channels; few fine pebbles; medium acid; clear wavy boundary.
Bt1—16 to 24 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate medium angular and subangular blocky structure; firm; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; about 8 percent gravel; medium acid; clear wavy boundary.
2Bt2—24 to 34 inches; dark brown (7.5YR 3/4) gravelly sandy clay loam; weak medium subangular blocky structure; firm; thin continuous dark reddish brown (5YR 3/4) clay films on faces of peds; about 23 percent gravel; medium acid; clear wavy boundary.
2Bt3—34 to 50 inches; dark reddish brown (5YR 3/4) gravelly sandy clay loam; weak coarse subangular blocky structure; friable; dark reddish brown (5YR 3/4) clay bridging between sand grains and pebbles; about 20 percent gravel; slightly acid; abrupt irregular boundary.
3C—50 to 60 inches; light yellowish brown (10YR 6/4), stratified coarse sand and gravelly coarse sand; single grain; loose; about 25 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. It is the same as the depth to calcareous coarse sand and gravelly coarse sand. Depth to the 2Bt horizon ranges from 12 to 26 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is medium acid or strongly acid. It is loam, fine sandy loam, sandy clay loam, or clay loam. The content of gravel in this horizon ranges from 0 to 10 percent. The 2Bt horizon has hue of 7.5YR or 5YR and value and chroma of 3 or 4. It is medium acid or slightly acid. It is the gravelly or very gravelly analogs of clay loam or sandy clay loam. The content of gravel in this horizon ranges from 20 to 60 percent. The 3C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4.

Otwell Series

The Otwell series consists of deep, well drained and moderately well drained soils on lacustrine terraces. These soils are very slowly permeable. They formed in loess and in the underlying loamy lacustrine sediments. Slopes range from 6 to 12 percent.

Otwell soils are similar to Cincinnati soils and are adjacent to Haubstadt and Negley soils. The lower part of the solum in Cincinnati soils formed in glacial drift. Haubstadt soils have gray mottles in the upper part of the subsoil and are on the higher side slopes. Negley soils do not have a fragipan and are on the lower side slopes.

Typical pedon of Otwell silt loam, 6 to 12 percent slopes, eroded, in a pastured area; 1,700 feet west and 500 feet north of the center of sec. 10, T. 4 N., R. 6 E.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; about 15 percent yellowish brown (10YR 5/6) material from the Bt horizon; moderate medium granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

Bt—7 to 20 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common fine roots; thin continuous dark yellowish brown (10YR 4/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

2Btx1—20 to 47 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/8) mottles; moderate very coarse prismatic structure; very firm and brittle; few fine roots in channels; common medium and fine pores; medium continuous yellowish brown (10YR 5/4) clay films on faces of peds and in pores and many distinct light brownish gray (10YR 6/2) silt coatings and clay films in channels; common fine black (10YR 2/1) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2Btx2—47 to 58 inches; yellowish brown (10YR 5/4) loam; many medium distinct light brownish gray (10YR 6/2) and many medium faint yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure; firm and brittle; few fine roots in channels; few fine pores; medium continuous yellowish brown (10YR 5/4) clay films on faces of peds and many distinct light brownish gray (10YR 6/2) silt coatings and clay films in channels; few fine black (10YR 2/1) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2C—58 to 80 inches; yellowish brown (10YR 5/8 and 5/4) and light brownish gray (10YR 6/2) sandy clay loam that has thin strata of sandy loam and silty clay; massive; firm; strongly acid in the upper part and medium acid in the lower part.

The solum is 50 to 80 inches thick. The loess is 12 to 36 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma generally of 3 or 4. In some severely eroded areas, it has chroma of 6. The Bt and 2Btx horizons are very strongly acid or strongly acid. The Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 6. It is dominantly silt loam or silty clay loam. In many of the severely eroded areas, however, it is loam or clay loam. The 2Btx horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. It is loam, silt loam, clay loam, or silty clay loam. The 2C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 8. It is silt loam, silty clay loam, loam, clay loam, or sandy clay loam and in some pedons has thin strata of sandy loam or silty clay. It generally is strongly acid or medium acid but ranges from strongly acid to slightly acid.

Otwell silt loam, 6 to 12 percent slopes, severely eroded, has a higher content of fine sand and coarse sand in the control section than is definitive for the Otwell series. This difference, however, does not alter the usefulness or behavior of the soil.

Parke Series

The Parke series consists of deep, well drained soils on outwash ridges and eskers. These soils are moderately permeable. They formed in loess and in the underlying loamy outwash sediments. Slopes range from 2 to 12 percent.

Parke soils are similar to Crider soils and are adjacent to Medora and Negley soils. The lower part of the solum in Crider soils formed in clayey material weathered from limestone bedrock. Medora soils have a very firm, brittle fragipan and are on the higher slopes. Negley soils have a mantle of loess that is less than 18 inches thick and are on the lower side slopes.

Typical pedon of Parke silt loam, 6 to 12 percent slopes, eroded, in a cultivated field; 330 feet east and 1,690 feet north of the southwest corner of sec. 7, T. 5 N., R. 6 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; about 15 percent yellowish brown (10YR 5/6) silty clay loam from the Bt horizon; weak medium subangular blocky structure parting to moderate medium granular; friable; neutral; abrupt smooth boundary.

Bt1—8 to 21 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; neutral; clear wavy boundary.

2Bt2—21 to 31 inches; brown (7.5YR 5/4) loam; moderate coarse subangular blocky structure; friable and very slightly brittle; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; many fine black (N 2/0) accumulations of iron and manganese oxide; neutral; gradual wavy boundary.

2Bt3—31 to 41 inches; strong brown (7.5YR 4/6) sandy clay loam; weak medium and coarse subangular blocky structure; friable; thin continuous reddish brown (2.5YR 4/4) clay films on faces of peds; many distinct brown (7.5YR 5/4) silt coatings and clay films on faces of peds; many fine black (N 2/0) accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

2Bt4—41 to 61 inches; yellowish red (5YR 4/6) sandy clay loam; moderate coarse and very coarse subangular blocky structure; firm; many prominent brown (7.5YR 5/4) silt coatings and clay films on faces of peds; many fine black (N 2/0) accumulations of iron and manganese oxide; strongly acid; gradual wavy boundary.

2Bt5—61 to 80 inches; yellowish red (5YR 5/6) sandy clay loam; weak coarse subangular blocky structure; firm; thin continuous yellowish red (5YR 4/6) clay films on faces of peds; strongly acid.

The solum is 80 or more inches thick. The loess ranges from 20 to 40 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 6. It is silt loam or silty clay loam and ranges from very strongly acid to neutral. The 2Bt horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, sandy clay loam, or clay loam. It generally is strongly acid to neutral but ranges from very strongly acid to neutral.

Pekin Series

The Pekin series consists of deep, moderately well drained soils on stream terraces. These soils have a fragipan. They are moderately permeable above the fragipan and very slowly permeable in the fragipan. They formed in silty material of mixed origin. Slopes range from 2 to 6 percent.

Pekin soils are similar to Haubstadt and Rossmoyne soils and are adjacent to Bartle soils. Haubstadt soils are on lacustrine terraces. The lower part of their solum formed in lacustrine sediments. The lower part of the solum in Rossmoyne soils formed in loamy glacial drift. Bartle soils have gray mottles directly below the surface layer and are on the slightly higher flats.

Typical pedon of Pekin silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 165 feet west and 825 feet north of the southeast corner of sec. 14, T. 6 N., R. 6 E.

Ap—0 to 8 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/4) dry; about 15 percent yellowish brown (10YR 5/6) silty clay loam from the Bt horizon; weak medium subangular blocky structure parting to moderate medium and fine granular; friable; common fine roots; strongly acid; abrupt smooth boundary.

Bt1—8 to 16 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous strong brown (7.5YR 5/6) clay films of faces of peds; few distinct light gray (10YR 7/2) and very pale brown (10YR 7/3) silt coatings; few fine black (10YR 2/1) accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

Bt2—16 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; many medium faint yellowish brown (10YR 5/6) and common fine prominent light gray (10YR 7/1) mottles; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin discontinuous brown (10YR 5/3) clay films on faces of peds; few faint light yellowish brown (10YR 6/4) silt coatings; common fine black (10YR 2/1) accumulations of iron and manganese oxide; medium acid; clear wavy boundary.

Btx1—30 to 40 inches; light yellowish brown (10YR 6/4) silt loam; common fine distinct yellowish brown (10YR 5/6), common fine faint brownish yellow (10YR 6/6), and common fine distinct light gray (10YR 7/1) mottles; moderate very coarse prismatic structure; very firm; common fine pores; thin discontinuous brown (10YR 5/3) and gray (10YR 6/1) clay films on faces of peds; few distinct light gray (10YR 7/1) silt coatings on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; medium acid; clear wavy boundary.

Btx2—40 to 58 inches; light yellowish brown (10YR 6/4) silt loam; common medium distinct light gray (10YR 7/1) and common coarse distinct yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure; very firm; common fine pores; thin discontinuous gray (10YR 6/1) clay films on faces of peds and brown (10YR 5/3) clay films on faces of peds and in pores; many distinct light gray (10YR 7/1) silt coatings on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; slightly acid; gradual wavy boundary.

C—58 to 80 inches; light yellowish brown (10YR 6/4) silty clay loam; many medium distinct light gray (10YR 7/1) and common fine prominent yellowish brown (10YR 5/8) mottles; massive; firm; common fine black (10YR 2/1) accumulations of iron and manganese oxide; neutral.

The solum is 48 to 60 inches thick. Depth to the fragipan is 24 to 36 inches.

The Ap horizon has hue of 10YR, value of 5, and chroma of 3 or 4. The Bt and Btx horizons have hue of 10YR, value of 5 or 6, and chroma of 4 to 6. They are silt loam or silty clay loam. The Bt horizon generally is very strongly acid to medium acid but ranges from very strongly acid to slightly acid. The Btx horizon generally is medium acid or slightly acid but ranges from very strongly acid to slightly acid. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 6. It is silt loam, silty clay loam, or stratified fine sandy loam and loam. It generally is medium acid to neutral but ranges from very strongly acid to neutral.

Peoga Series

The Peoga series consists of deep, poorly drained soils on lacustrine terraces. These soils are slowly permeable. They formed in loess and in the underlying loamy and silty lacustrine sediments. Slopes range from 0 to 2 percent.

Peoga soils are similar to Cobbsfork soils and are adjacent to Dubois soils. The lower part of the solum in Cobbsfork soils formed in glacial drift. Dubois soils have a horizon between the surface layer and a depth of 30 inches that is not dominantly gray. They are on the slightly higher flats.

Typical pedon of Peoga silt loam, in a cultivated field; 400 feet west and 200 feet south of the northeast corner of sec. 2, T. 4 N., R. 6 E.

Ap—0 to 11 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate fine and medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

BEg1—11 to 21 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky and weak thick platy structure; friable; common very fine roots; many medium strong brown (7.5YR 5/8) iron and manganese stains; krotovinas, about 1.5 feet apart, filled with brown (10YR 5/3) silt loam; very strongly acid; clear wavy boundary.

BEg2—21 to 28 inches; light brownish grav (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) and light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; friable; few very fine roots; few medium strong brown (7.5YR 5/8) iron and manganese oxide stains; krotovinas, about 1.5 feet apart, filled with brown (10YR 5/3) silt loam; very strongly acid; clear wavy boundary.

Btg—28 to 40 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/8) mottles; moderate medium and coarse subangular blocky structure; firm; few very fine roots; thin continuous light brownish gray (10YR 6/2) clay films on faces of peds and thick discontinuous gray (10YR 6/1) clay films in channels; few medium black (N 2/0) accumulations of iron and manganese oxide; krotovinas, about 1.5 feet apart, filled with brown (10YR 5/3) silt loam; very strongly acid; gradual wavy boundary.

Btxg1—40 to 60 inches; light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) silt loam; moderate coarse and very coarse prismatic structure; firm and about 40 percent brittle; thin continuous light brownish gray (10YR 6/2) clay films on faces of peds and thick continuous gray (10YR 6/1) clay films in channels; many medium black (N 2/0) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2Btxg2—60 to 80 inches; yellowish brown (10YR 5/4) loam and grayish brown (10YR 5/2) silt loam; moderate coarse and very coarse prismatic structure parting to weak thick platy; firm and about 50 percent brittle; medium continuous grayish brown (10YR 5/2) clay films on faces of peds and in channels; few medium black (N 2/0) accumulations of iron and manganese oxide; very strongly acid in the upper part and strongly acid in the lower part.

The solum is 80 or more inches thick. The loess ranges from 36 to 48 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Pedons in wooded areas generally have an E horizon. The Btg horizon has hue of 10YR, value of 6 or 7, and chroma of 1 or 2. It is silt loam or silty clay loam. It is 5 to 15 percent brittle, by volume. The 2Btxg horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 1 to 6. It is silt loam, loam, or silty clay loam. It is very strongly acid or strongly acid. It is 40 to 50 percent brittle, by volume. Some pedons have a 2BC horizon.

Piopolis Series

The Piopolis series consists of deep, poorly drained and very poorly drained soils on flood plains. These soils are slowly permeable. They formed in acid, silty alluvium. Slopes range from 0 to 2 percent.

Piopolis soils are similar to Birds soils and are adjacent to Stendal soils. Birds soils have less clay than the Piopolis soils and are less acid in the control section. Stendal soils have a horizon between the surface layer and a depth of 30 inches that is not dominantly gray. They are closer to stream channels than the Piopolis soils and are slightly higher on the landscape.

Typical pedon of Piopolis silty clay loam, frequently flooded, in a cultivated field; 330 feet east and 2,255 feet south of the northwest corner of sec. 12, T. 6 N., R. 4 E.

Ap—0 to 10 inches; brown (10YR 5/3) silty clay loam, very pale brown (10YR 7/3) dry; many fine distinct light brownish gray (10YR 6/2) and common fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure parting to weak medium granular; friable; common fine and very fine roots; many fine dark yellowish brown (10YR 3/4) and black (10YR 2/1) accumulations of iron and manganese oxide; neutral; clear smooth boundary.

Cg1—10 to 31 inches; light gray (10YR 7/1) silty clay loam; common medium prominent reddish yellow (7.5YR 6/8) and brownish yellow (10YR 6/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; common very fine roots; many faint light gray (10YR 7/1) silt coatings on faces of peds; many fine dark yellowish brown (10YR 3/4) and black (10YR 2/1) accumulations of iron and manganese oxide; strongly acid; gradual wavy boundary.

Cg2—31 to 60 inches; light gray (10YR 7/1) silty clay loam; many medium distinct light yellowish brown (10YR 6/4) and few medium prominent reddish yellow (7.5YR 6/8) mottles; massive; firm; few very fine roots; many fine dark yellowish brown (10YR 3/4) and black (10YR 2/1) accumulations of iron and manganese oxide; strongly acid.

The content of clay in the control section ranges from 27 to 35 percent, by volume. This section is very strongly acid or strongly acid.

The A or Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is silty clay loam or silt loam. The Cg horizon has hue of 10YR, value of 6 or 7, and chroma of 1 or 2. Some pedons have strata of silt loam, fine sandy loam, loam, or clay loam below a depth of 40 inches.

Rarden Series

The Rarden series consists of moderately deep, well drained and moderately well drained soils on uplands. These soils are slowly permeable. They formed in silty and clayey material weathered from interbedded, soft shale and siltstone. Slopes range from 6 to 20 percent.

Rarden soils are similar to Coolville soils and are adjacent to Coolville, Kurtz, and Stonehead soils. Coolville, Kurtz, and Stonehead soils are more than 40 inches deep over bedrock. The upper part of the solum in Coolville and Stonehead soils formed in loess. Kurtz soils have less clay in the subsoil than the Rarden soils and are on the lower side slopes. Stonehead soils are on the higher side slopes and ridgetops.

Typical pedon of Rarden silty clay loam, 12 to 20 percent slopes, severely eroded, in a pastured area; 650 feet east and 960 feet north of the center of sec. 31, T. 7 N., R. 4 E.

Ap—0 to 5 inches; yellowish brown (10YR 5/4) silty clay loam, very pale brown (10YR 7/4) dry; weak medium subangular blocky structure; friable; many fine roots; few faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt1—5 to 15 inches; yellowish red (5YR 5/6) silty clay; common fine prominent light brownish gray (2.5Y 6/2) mottles; moderate medium angular and subangular blocky structure; firm; few fine roots; thin continuous yellowish red (5YR 5/6) and strong brown (7.5YR 5/6) clay films on faces of peds; few prominent light yellowish brown (10YR 6/4) silt coatings on faces of peds; few fragments of ironstone; very strongly acid; clear wavy boundary.

Bt2—15 to 25 inches; strong brown (7.5YR 5/6) silty clay loam; common fine prominent light brownish gray (2.5Y 6/2) mottles; moderate medium angular and subangular blocky structure; firm; few fine roots; thin continuous strong brown (7.5YR 5/6) clay films on faces of peds; few fragments of ironstone; very strongly acid; clear wavy boundary.

BC—25 to 32 inches; yellowish brown (10YR 5/6) silty clay loam; common fine prominent light brownish gray (2.5Y 6/2) mottles; weak medium and fine subangular blocky and moderate thick platy structure; firm; few fragments of ironstone; very strongly acid; gradual wavy boundary.

Cr—32 to 60 inches; light yellowish brown (2.5Y 6/4), interbedded, soft shale and siltstone; thin gray (10YR 6/1) coatings between shale and siltstone fragments; few fragments of ironstone; very strongly acid.

The thickness of the solum ranges 20 to 40 inches. It corresponds to the depth to bedrock. The content of coarse fragments, mainly shale, siltstone, and ironstone, is commonly less than 15 percent, by volume, in the Bt horizon and ranges to 30 percent in the BC horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. The Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 6. It ranges from extremely acid to strongly acid. The Cr horizon has hue of 2.5Y to 7.5YR, value of 5 or 6, and chroma of 4 to 6.

Roby Variant

The Roby Variant consists of deep, moderately well drained soils on stream terraces. These soils are moderately rapidly permeable in the subsoil and rapidly permeable in the substratum. They formed in loamy outwash sediments over stratified, sandy sediments. Slopes range from 0 to 2 percent.

Roby Variant soils are similar to Bobtown and Whitaker Variant soils and are adjacent to Alvin and Whitaker soils. Bobtown and Whitaker Variant soils have more clay in the upper part of the subsoil than the Roby Variant soils. Also, Bobtown soils have finer sand throughout. They are on uplands. Alvin soils do not have gray mottles in the subsoil and are on the slightly higher flats. Whitaker soils have gray mottles directly below the surface layer and are on the slightly lower flats.

Typical pedon of Roby Variant sandy loam, rarely flooded, 0 to 2 percent slopes, in a cultivated field; 280 feet east and 80 feet south of the center of sec. 4, T. 6 N., R. 5 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) sandy loam, brownish yellow (10YR 6/6) dry; weak fine granular structure; very friable; many fine and very fine roots; few fine black (10YR 2/1) accumulations of iron and manganese oxide; few fine pebbles; neutral; abrupt smooth boundary.

BA—9 to 15 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; common fine and very fine roots; few faint dark brown (10YR 4/3) organic coatings in root channels; few fine black (10YR 2/1) accumulations of iron and manganese oxide; few fine pebbles; neutral; clear wavy boundary.

Bt1—15 to 23 inches; brown (7.5YR 5/4) sandy loam; few fine distinct brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; common very fine roots; brown (10YR 5/4) clay bridging between sand grains; few medium black (10YR 2/1) accumulations of iron and manganese oxide; few fine pebbles; neutral; clear wavy boundary.

Bt2—23 to 36 inches; yellowish brown (10YR 5/6) sandy loam; common medium distinct light brownish gray (10YR 6/2) and common fine distinct strong brown (7.5YR 5/8) mottles; weak coarse and medium subangular blocky structure; friable; few very fine roots; yellowish brown (10YR 5/6) clay bridging between sand grains; common medium black (10YR 2/1) accumulations of iron and manganese oxide; about 4 percent gravel; strongly acid; clear wavy boundary.

Bt3—36 to 52 inches; yellowish brown (10YR 5/4) sandy loam; common medium faint dark yellowish brown (10YR 4/4) and many medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; very friable; few very fine roots; light brownish gray (10YR 6/2) and dark yellowish brown (10YR 4/4) clay bridging between sand grains; common medium black (10YR 2/1) accumulations of iron and manganese oxide; about 4 percent gravel; strongly acid; clear wavy boundary.

BC—52 to 68 inches; dark yellowish brown (10YR 4/4) loamy sand stratified with light gray (10YR 7/2) sand; common fine distinct strong brown (7.5YR 5/6) and many medium distinct light brownish gray (10YR 6/2) mottles; massive; very friable; about 4 percent gravel; strongly acid; clear wavy boundary.

C—68 to 80 inches; pale brown (10YR 6/3) sand; single grain; loose; about 4 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 50 to 70 inches and generally corresponds to the depth to free carbonates. The content of coarse fragments ranges from 0 to 10 percent, by volume, in individual horizons in the solum and from 0 to 15 percent in individual horizons in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. It has mottles with chroma of 2 in the upper 10 inches. It is dominantly sandy loam or fine sandy loam, but in some pedons it has thin layers of sandy clay loam. It ranges from very strongly acid to neutral. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is sand or coarse sand.

Rossmoyne Series

The Rossmoyne series consists of deep, moderately well drained soils on uplands. These soils are moderately slowly permeable or slowly permeable. They formed in loess and in the underlying silty and loamy glacial drift. Slopes range from 0 to 6 percent.

Rossmoyne soils are similar to Haubstadt and Pekin soils and are adjacent to Avonburg, Cincinnati, and Stoy soils. The lower part of the solum in Haubstadt soils formed in lacustrine sediments. Pekin soils are on stream terraces and formed in silty material of mixed origin. Avonburg and Stoy soils have gray mottles directly below the surface layer and are on the slightly higher flats. Cincinnati soils do not have gray mottles in the upper part of the subsoil and are commonly on the more sloping side slopes and narrow ridges.

Typical pedon of Rossmoyne silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 990 feet west and 1,220 feet north of the southeast corner of sec. 28, T. 7 N., R. 4 E.

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; about 20 percent brownish yellow (10YR 6/6) material from the B horizon; moderate medium and fine granular structure; friable; common fine roots; common fine black (10YR 2/1) and common fine yellowish brown (10YR 5/6) accumulations of iron and manganese oxide; neutral; abrupt smooth boundary.

BE—9 to 18 inches; brownish yellow (10YR 6/6) silt loam; few fine faint yellowish brown (10YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable; few fine roots; few distinct very pale brown (10YR 7/3) silt coatings on faces of peds; common fine black (10YR 2/1) and yellowish brown (10YR 5/6) accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

Bt1—18 to 26 inches; brownish yellow (10YR 6/6) silt loam; common fine prominent light gray (10YR 7/2) and common fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable; few fine roots; thin patchy light brownish gray (10YR 6/2) and yellowish brown (10YR 5/4) clay films on faces of peds; few distinct light gray (10YR 7/2) silt coatings on faces of peds; common fine black (10YR 2/1) and common fine yellowish brown (10YR 5/6) accumulations of iron and manganese oxide; extremely acid; clear wavy boundary.

Bt2—26 to 33 inches; light yellowish brown (10YR 6/4) silt loam; common fine distinct light gray (10YR 7/2) and few fine distinct brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; friable; few fine roots; few fine pores; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of peds; few distinct light gray (10YR 7/2) silt coatings on faces of peds; common fine black (10YR 2/1) and common fine dark yellowish brown (10YR 4/6) accumulations of iron and manganese oxide; extremely acid; gradual wavy boundary.

2Btx1—33 to 50 inches; brown (7.5YR 5/4) silt loam; common fine prominent light gray (10YR 7/2) and common medium prominent brownish yellow (10YR 6/8) mottles; moderate very coarse prismatic structure; very firm and brittle; common fine pores; medium continuous gray (10YR 6/1) clay films on faces of peds; many prominent light gray (10YR 7/2) silt coatings on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; extremely acid; gradual smooth boundary.

2Btx2—50 to 65 inches; brownish yellow (10YR 6/6) silt loam; few fine prominent light gray (10YR 7/2) and common medium faint yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure; very firm and brittle; common fine pores; medium continuous gray (10YR 6/1) clay films on faces of peds; many distinct light gray (10YR 7/2) silt coatings on faces of peds; common fine strong brown (7.5YR 4/6) stains; extremely acid; gradual wavy boundary.

2BC1—65 to 75 inches; brownish yellow (10YR 6/6) clay loam; few fine prominent gray (10YR 6/1) and common medium distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; medium patchy gray (10YR 6/1) clay films on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; medium acid; clear wavy boundary.

2BC2—75 to 80 inches; strong brown (7.5YR 5/8) loam; weak coarse subangular blocky structure; friable; many medium black (10YR 2/1) accumulations of iron and manganese oxide; slightly acid.

The solum ranges from 60 to 120 inches in thickness. The loess ranges from 18 to 40 inches in thickness. Depth to the fragipan ranges from 18 to 38 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt and 2Btx horizons are extremely acid to strongly acid. The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. It has mottles with chroma of 2 or less in the upper 10 inches. It is silt loam or silty clay loam. The 2Btx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is silt loam or loam. The 2BC horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 6 to 8. It is silt loam, loam, silty clay loam, or clay loam. It generally is medium acid to slightly acid but ranges from medium acid to moderately alkaline.

Ruark Variant

The Ruark Variant consists of deep, poorly drained soils on low stream terraces. These soils are moderately permeable in the subsoil and rapidly permeable in the substratum. They formed in loamy sediments over sandy sediments. Slopes range from 0 to 2 percent.

Ruark Variant soils are adjacent to Whitaker soils. Whitaker soils have a horizon that is not dominantly gray between the surface layer and a depth of 30 inches. They are on the slightly higher flats.

Typical pedon of Ruark Variant sandy loam, occasionally flooded, in a cultivated field; 1,950 feet east and 90 feet north of the center of sec. 26, T. 6 N., R. 4 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure parting to weak medium granular; friable; many fine and very fine roots; few fine black (10YR 2/1) accumulations of iron and manganese oxide; about 5 percent gravel; slightly acid; abrupt smooth boundary.

Btg1—9 to 16 inches; dark gray (10YR 4/1) sandy clay loam; common fine prominent yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; few very fine roots; few faint dark grayish brown (10YR 4/2) organic coatings in root channels; dark grayish brown (10YR 4/2) sandy loam in krotovinas; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; about 5 percent gravel; slightly acid; clear wavy boundary.

Btg2—16 to 29 inches; gray (10YR 5/1) sandy clay loam; few fine prominent strong brown (7.5YR 5/8) and common fine prominent yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to weak coarse subangular blocky; firm; few very fine roots; dark grayish brown (10YR 4/2) sandy loam in krotovinas; medium continuous dark gray (10YR 4/1) clay films on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; about 5 percent gravel; slightly acid; gradual wavy boundary.

Btg3—29 to 43 inches; gray (10YR 4/1) sandy clay loam; few fine prominent strong brown (7.5YR 5/8) and common fine prominent yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to weak coarse subangular blocky; firm; few very fine roots; dark grayish brown (10YR 4/2) sandy loam in krotovinas; medium continuous gray (10YR 5/1) clay films on faces of peds; common medium black (10YR 2/1) accumulations of iron and manganese oxide; about 8 percent gravel; slightly acid; clear wavy boundary.

Btg4—43 to 49 inches; gray (10YR 5/1) sandy clay loam; many medium prominent yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; dark grayish brown (10YR 4/2) sandy loam in krotovinas; medium discontinuous gray (10YR 5/1) clay films on faces of peds; few medium black (10YR 2/1) accumulations of iron and manganese oxide; about 8 percent gravel; slightly acid; clear wavy boundary.

BCg—49 to 64 inches; gray (10YR 5/1) sandy clay loam; many medium prominent yellowish brown (10YR 5/6) and common medium prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; friable; about 5 percent gravel; slightly acid; gradual wavy boundary.

Cg1—64 to 70 inches; gray (10YR 5/1) sandy loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; very friable; about 5 percent gravel; very slight effervescence; mildly alkaline; clear wavy boundary.

2Cg2—70 to 80 inches; light brownish gray (10YR 6/2) sand; single grain; loose; strong effervescence; mildly alkaline.

The solum ranges from 60 to 80 inches in thickness. The content of coarse fragments ranges from 0 to 10 percent, by volume, in the solum and from 0 to 15 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Btg horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is sandy loam, sandy clay loam, or clay loam. It is slightly acid or neutral. The control section ranges from 20 to 32 percent clay, by volume. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is neutral or mildly alkaline. The upper part of this horizon is sand, loamy sand, or sandy loam. The lower part is sand or coarse sand.

Shoals Series

The Shoals series consists of deep, somewhat poorly drained soils on flood plains. These soils are moderately permeable. They formed in loamy alluvium. Slopes range from 0 to 2 percent.

Shoals soils are commonly adjacent to Zipp Variant soils. Zipp Variant soils have a surface layer that is darker than that of the Shoals soils, are dominantly gray between the surface layer and a depth of 30 inches, contain more clay in the control section than the Shoals soils, and are in slight depressions.

Typical pedon of Shoals loam, frequently flooded, in a cultivated field; 975 feet west and 125 feet north of the center of sec. 20, T. 6 N., R. 5 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) loam, light yellowish brown (10YR 6/4) dry; weak coarse subangular blocky structure parting to moderate medium granular; friable; common fine and very fine roots; slightly acid; abrupt smooth boundary.

C—8 to 13 inches; yellowish brown (10YR 5/4) loam; many medium distinct grayish brown (10YR 5/2) and common fine distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; common fine and very fine roots; few faint dark brown (10YR 4/3) organic coatings in root channels; common fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; slightly acid; clear wavy boundary.

Cg1—13 to 37 inches; dark gray (10YR 4/1) clay loam; common fine distinct yellowish brown (10YR 5/4) mottles; moderate coarse subangular blocky structure; firm; few very fine roots; common fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; slightly acid; gradual wavy boundary.

Cg2—37 to 52 inches; gray (10YR 5/1) clay loam that has strata of silty clay loam; many medium prominent yellowish brown (10YR 5/6) and common fine prominent reddish yellow (7.5YR 6/8) mottles; massive; firm; few very fine roots; common medium very dark gray (10YR 3/1) accumulations of iron and manganese oxide; dark gray (10YR 4/1) clay loam in krotovinas; slightly acid; gradual wavy boundary.

Cg3—52 to 60 inches; reddish yellow (7.5YR 6/6), stratified silt loam and loam; many coarse prominent gray (10YR 6/1) mottles; massive; friable; common medium very dark gray (10YR 3/1) accumulations of iron and manganese oxide; neutral.

The control section generally is slightly acid or neutral but ranges from slightly acid to mildly alkaline. The Ap horizon is loam or silt loam. It has hue of 10YR, value dominantly of 4, and chroma of 2 or 3. Some pedons have a thin Ap horizon that has value of 3. 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, sandy loam, silty clay loam, or clay loam.

Steff Series

The Steff series consists of deep, moderately well drained soils on flood plains. These soils are moderately permeable. They formed in acid, silty alluvium. Slopes range from 0 to 2 percent.

The Steff soils in this county are taxadjuncts because they do not have a cambic horizon and have less clay in the control section than is definitive for the series. These differences, however, do not alter the usefulness or behavior of the soils.

Steff soils are similar to Wilbur soils and are adjacent to Burnside, Haymond, and Stendal soils. Wilbur soils are less acid in the control section than the Steff soils. Burnside soils have a high percentage of coarse fragments in the control section and are in the slightly lower areas adjacent to stream channels. Haymond soils have a dark yellowish brown subsoil that is free of gray mottles. They are closer to stream channels than the Steff soils and are slightly higher on the landscape. Stendal soils have a dominantly gray subhorizon within a depth of 20 inches. They are farther from stream channels than the Steff soils and are slightly lower on the landscape.

Typical pedon of Steff silt loam, frequently flooded, in a cultivated field; 450 feet west and 1,075 feet north of the center of sec. 23, T. 7 N., R. 2 E.

Ap—0 to 7 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/4) dry; weak medium subangular blocky and moderate medium granular structure; friable; many very fine roots; strongly acid; abrupt smooth boundary.

C1—7 to 17 inches; light olive brown (2.5Y 5/4) silt loam; common fine distinct light brownish gray (2.5Y 6/2) mottles; weak medium and coarse subangular blocky structure; friable; few fine roots; very strongly acid; clear smooth boundary.

C2—17 to 30 inches; light yellowish brown (2.5Y 6/4) silt loam; common fine prominent reddish yellow (5YR 6/8) and many medium distinct light gray (10YR 7/2) mottles; weak coarse and medium subangular blocky; friable; few fine roots; very strongly acid; gradual wavy boundary.

C3—30 to 60 inches; yellowish brown (10YR 5/6) silt loam; many medium prominent light brownish gray (2.5Y 6/2) mottles; massive; friable; few fine roots; common fine strong brown (7.5YR 5/6) stains; strongly acid.

The control section is strongly acid or very strongly acid. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 4. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 6. It is dominantly silt loam, but in some pedons it has strata of fine sandy loam or loam below a depth of 40 inches.

Stendal Series

The Stendal series consists of deep, somewhat poorly drained soils on flood plains. These soils are moderately permeable. They formed in acid, silty alluvium. Slopes range from 0 to 2 percent.

Stendal soils are similar to Wakeland soils and are commonly adjacent to Driftwood, Piopolis, and Steff soils. Wakeland soils are less acid in the control section than the Stendal soils. Driftwood and Piopolis soils have more clay in the control section than the Stendal soils, are dominantly gray between the surface layer and a depth of 30 inches, and are in the slightly lower landscape positions. Steff soils do not have a dominantly gray subhorizon within a depth of 20 inches. They are closer to stream channels than the Stendal soils and are slightly higher on the landscape.

Typical pedon of Stendal silt loam, rarely flooded, in a cultivated field; 620 feet east and 690 feet south of the northwest corner of sec. 7, T. 5 N., R. 4 E.

Ap—0 to 12 inches; dark brown (10YR 4/3) silt loam, brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine and very fine roots; slightly acid; abrupt smooth boundary.

C1—12 to 19 inches; brownish yellow (10YR 6/6) silt loam; many medium prominent light gray (10YR 7/2) and common medium distinct yellowish brown (10YR 5/8) and very pale brown (10YR 7/4) mottles; weak medium and fine subangular blocky structure; friable; common very fine roots; strongly acid; clear smooth boundary.

C2—19 to 30 inches; light gray (10YR 7/2) silt loam; many medium prominent yellowish brown (10YR 5/8) and common fine distinct brownish yellow (10YR 6/6) mottles; weak coarse and very coarse prismatic structure; friable; few very fine roots; few distinct light yellowish brown (10YR 6/4) silt coatings in pores; common fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

C3—30 to 60 inches; light gray (10YR 7/2) silt loam; many medium prominent yellowish brown (10YR 5/8) and brownish yellow (10YR 6/6) mottles; massive; friable; few distinct light yellowish brown (10YR 6/4) silt coatings in pores; common fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; very strongly acid in the upper part and strongly acid on the lower part.

The control section is strongly acid or very strongly acid. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The C horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 6. It is dominantly silt loam, but in some pedons it has strata of fine sandy loam, loam, or silty clay loam below a depth of 40 inches.

Stonehead Series

The Stonehead series consists of deep, moderately well drained soils on uplands. These soils are moderately permeable in the upper part of the solum and slowly permeable in the lower part. They formed in loess and clayey and silty material weathered from interbedded, soft shale and siltstone. Slopes range from 4 to 12 percent.

Stonehead soils are adjacent to Coolville and Rarden soils. The adjacent soils are on the lower side slopes. They have more clay in the upper part of the subsoil than the Stonehead soils. Also, the upper part of the solum in Coolville soils formed in thinner loess. Rarden soils are less than 40 inches deep over bedrock.

Typical pedon of Stonehead silt loam, 4 to 12 percent slopes, eroded, in a pastured area; 230 feet south and 1,020 feet east of the center of sec. 23, T. 5 N., R. 4 E.

Ap—0 to 5 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate fine granular structure; friable; slightly acid; abrupt smooth boundary.

Bt1—5 to 11 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine and medium subangular blocky structure; firm; thin discontinuous strong brown (7.5YR 5/6) clay films on faces of peds; many worm casts lined with yellowish brown (10YR 5/4) silt loam; strongly acid; clear wavy boundary.

Bt2—11 to 19 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; thin discontinuous dark yellowish brown (10YR 4/6) clay films on faces of peds; few distinct very pale brown (10YR 7/3) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt3—19 to 24 inches; dark brown (7.5YR 4/4) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; many prominent very pale brown (10YR 7/3) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt4—24 to 30 inches; dark yellowish brown (10YR 4/6) silty clay loam; common fine prominent light brownish gray (10YR 6/2) and common fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few distinct pale brown (10YR 6/3) clay films and silt coatings on faces of peds; very strongly acid; clear wavy boundary.

2Bt5—30 to 39 inches; red (2.5YR 4/6) silty clay; many fine prominent light olive gray (5Y 6/2) mottles; moderate fine and medium angular and subangular blocky structure; very firm; thin continuous light olive gray (5Y 6/2) clay films on faces of peds and gray (10YR 5/1) clay films in channels; few fragments of ironstone; very strongly acid; gradual wavy boundary.

2Bt6—39 to 46 inches; yellowish red (5YR 5/6) silty clay; many fine prominent light olive gray (5Y 6/2) and common fine faint yellowish red (5YR 4/6) mottles; weak thick platy structure parting to moderate fine angular blocky; very firm; thin continuous light olive gray (5Y 6/2) clay films on faces of peds and light brownish gray (10YR 6/2) clay films in channels; few fragments of ironstone; strongly acid; gradual wavy boundary.

2BC1—46 to 55 inches; light yellowish brown (2.5Y 6/4) and yellowish brown (10YR 5/4) silty clay loam; many fine distinct light olive gray (5Y 6/2) and greenish gray (5GY 6/1) and common fine prominent strong brown (7.5YR 5/6) mottles; weak thick platy and moderate fine angular blocky structure; very firm; about 20 percent shale and siltstone fragments; few fragments of ironstone; strongly acid; gradual wavy boundary.

2BC2—55 to 65 inches; light olive brown (2.5Y 5/4) extremely shaly silty clay loam; many fine prominent greenish gray (5G 6/1) mottles; moderate thick platy and moderate fine subangular blocky structure; very firm; about 60 percent shale and siltstone fragments up to 6 inches long; about 10 percent fragments of ironstone; strongly acid; gradual wavy boundary.

2Cr—65 to 71 inches; olive (5Y 5/4) interbedded, soft shale and siltstone; slightly acid.

The thickness of the solum ranges from 40 to 70 inches and corresponds to the depth to bedrock. The loess ranges from 25 to 40 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Pedons in undisturbed areas have an A horizon. This horizon is 1 to 4 inches thick. It has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam and is very strongly acid or strongly acid. The 2Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. It ranges from very strongly acid to medium acid. The 2Cr horizon has hue of 2.5Y to 10YR, value of 4 or 5, and chroma of 3 or 4.

Stonelick Series

The Stonelick series consists of deep, well drained soils on flood plains. These soils are moderately rapidly permeable. They formed in calcareous, stratified, loamy and sandy alluvium. Slopes range from 0 to 2 percent.

The Stonelick soils in this county have more sand in the control section than is definitive for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Stonelick soils are adjacent to Armiesburg and Genesee soils. The adjacent soils have more silt and clay in the control section than the Stonelick soils and are slightly higher on the landscape. Also, Armiesburg soils have a slightly darker surface layer.

Typical pedon of Stonelick fine sandy loam, frequently flooded, in a cultivated field; 530 feet south and 2,180 feet west of the northeast corner of sec. 14, T. 6 N., R. 5 E.

Ap—0 to 11 inches; dark brown (10YR 4/3) fine sandy loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure parting to weak medium granular; friable; common fine and medium roots; about 1 percent fine gravel; strong effervescence; moderately alkaline; abrupt smooth boundary.

C1—11 to 19 inches; yellowish brown (10YR 5/4) fine sand that has thin strata of loamy fine sand; single grain; loose; few fine and very fine roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

C2—19 to 32 inches; dark yellowish brown (10YR 4/4) very fine sandy loam; massive; very friable; few fine roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

C3—32 to 50 inches; light gray (10YR 7/2) and pale brown (10YR 6/3) sand; single grain; loose; about 2 percent fine gravel; strong effervescence; moderately alkaline; abrupt smooth boundary.

C4—50 to 54 inches; brown (10YR 5/3) loam; massive; friable; patchy strong brown (7.5YR 4/6) streaks in pore spaces; strong effervescence; moderately alkaline; abrupt smooth boundary.

C5—54 to 60 inches; light gray (10YR 7/2) and pale brown (10YR 6/3) sand; single grain; loose; about 2 percent fine gravel; strong effervescence; moderately alkaline.

The control section is mildly alkaline or moderately alkaline. The content of gravel throughout the control section ranges from 0 to 20 percent, by weighted average.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is loam, silt loam, sandy loam, or fine sandy loam. The C horizon has hue of 10YR, value of 4 to 7, and chroma of 2 to 4. It is stratified fine sand, sand, coarse sand, loamy sand, loamy fine sand, sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam.

Stoy Series

The Stoy series consists of deep, somewhat poorly drained soils on uplands. These soils are slowly permeable. They formed in loess. Slopes range from 0 to 2 percent.

Stoy soils are similar to Avonburg, Bartle, and Dubois soils and are adjacent to Bedford and Rossmoyne soils. Avonburg soils formed in a thin layer of loess and in the underlying glacial drift. Bartle soils are on stream terraces. They formed in silty material of mixed origin. Dubois soils are on lacustrine terraces and formed in a thin layer of loess and in the underlying lacustrine sediments. Bedford and Rossmoyne soils are on the lower side slopes. They do not have gray mottles directly below the surface layer. The lower part of the solum in Bedford soils formed in clayey material weathered from limestone. The lower part of the solum in Rossmoyne soils formed in loamy glacial drift.

Typical pedon of Stoy silt loam, 0 to 2 percent slopes, in a cultivated field; 1,120 feet west and 910 feet north of the center of sec. 29, T. 6 N., R. 3 E.

Ap—0 to 10 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; common very fine roots; common fine very dark brown (10YR 2/2) accumulations of iron and manganese oxide; neutral; abrupt smooth boundary.

BE—10 to 14 inches; light brownish gray (10YR 6/2) silt loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common very fine roots; common medium very dark brown (10YR 2/2) accumulations of iron and manganese oxide; slightly acid; clear wavy boundary.

Bt1—14 to 20 inches; yellowish brown (10YR 5/4) silt loam; common medium faint yellowish brown (10YR 5/6) and many medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; few very fine roots; thin patchy pale brown (10YR 6/3) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—20 to 28 inches; yellowish brown (10YR 5/4) silt loam; few medium faint yellowish brown (10YR 5/6) and many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few very fine roots; thin continuous pale brown (10YR 6/3) clay films on faces of peds; many faint light brownish gray (10YR 6/2) silt coatings on faces of peds; common fine very dark brown (10YR 2/2) accumulations of iron and manganese oxide; extremely acid; clear wavy boundary.

Bt3—28 to 39 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct strong brown (7.5YR 5/8) mottles; moderate coarse subangular blocky structure; firm; few very fine roots; thin continuous brown (10YR 5/3) and light brownish gray (10YR 6/2) clay films on faces of peds; extremely acid; gradual wavy boundary.

Btx1—39 to 60 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/4) and many coarse prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm and about 40 percent brittle; medium discontinuous grayish brown (10YR 5/2) clay films on faces of peds; few medium very dark brown (10YR 2/2) accumulations of iron and manganese oxide; extremely acid; gradual wavy boundary.

Btx2—60 to 80 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct yellowish brown (10YR 5/8) and many coarse distinct light brownish gray (10YR 6/2) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; very firm and about 60 percent brittle; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of peds; extremely acid in the upper part and strongly acid in the lower part.

The solum ranges from 60 to more than 80 inches in thickness. Depth to the Btx horizon ranges from 30 to 40 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3. The Bt and Btx horizons have hue of 10YR, value of 5 or 6, and chroma of 2 to 8. They range from extremely acid to strongly acid.

Tilsit Series

The Tilsit series consists of deep, moderately well drained soils on uplands. These soils have a fragipan. They are moderately permeable above the fragipan and slowly permeable in the fragipan. They formed in loess and in the underlying silty material weathered from interbedded siltstone, fine grained sandstone, and shale bedrock. Slopes range from 2 to 12 percent.

Tilsit soils are similar to Bedford and Medora soils and are adjacent to Wellston soils. The lower part of the solum in Bedford soils formed in clayey material weathered from limestone bedrock. The lower part of the solum in Medora soils formed in loamy outwash sediments. Wellston soils do not have a fragipan and are on the lower side slopes.

Typical pedon of Tilsit silt loam, 6 to 12 percent slopes, eroded, in a wooded area; 1,190 feet east and 1,320 feet south of the center of sec. 28, T. 7 N., R. 2 E.

Ap—0 to 5 inches; yellowish brown (10YR 5/6) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; many fine and medium roots; very strongly acid; clear smooth boundary.

Bt1—5 to 21 inches; brown (7.5YR 5/4) silty clay loam; weak medium subangular blocky structure; friable; common medium and fine roots; thin discontinuous brown (7.5YR 5/4) clay films on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

Bt2—21 to 31 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common fine and medium roots; thin discontinuous strong brown (7.5YR 5/6) clay films on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; few prominent pale yellow (2.5Y 7/4) silt coatings between depths of 21 and 28 inches and many distinct light gray (10YR 7/1) silt coatings between depths of 28 and 31 inches; very strongly acid; clear wavy boundary.

2Btx—31 to 49 inches; yellowish brown (10YR 5/6) silt loam; moderate very coarse prismatic structure; very firm and brittle; few fine roots in channels; common fine pores; medium continuous gray (10YR 6/1) clay films and few faint strong brown (7.5YR 5/6) silt coatings on faces of peds; few fine black (10YR 2/1) accumulations of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2BCx—49 to 58 inches; brownish yellow (10YR 6/6) silt loam; weak medium and coarse subangular blocky structure; firm; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; few prominent light gray (2.5Y 7/2) silt coatings on faces of peds; very strongly acid; gradual wavy boundary.

2C—58 to 64 inches; brownish yellow (10YR 6/6) channery silt loam; common medium prominent light gray (2.5Y 7/2) mottles; massive; friable; about 20 percent weathered fragments of siltstone; extremely acid; clear wavy boundary.

2R—64 inches; siltstone bedrock.

The solum is 40 to 60 inches thick. The depth to bedrock is 40 to 80 inches. The loess is 20 to 36 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The Bt and 2Btx horizons generally are very strongly acid or strongly acid but range from extremely acid to strongly acid. The Bt horizon has hue of 7.5YR or 10YR, value of 5, and chroma of 4 to 8. It is silt loam or silty clay loam. The 2Btx horizon has hue of 10YR, value of 5 or 6, and chroma of 6 to 8. It is silt loam, loam, or silty clay loam.

Wakeland Series

The Wakeland series consists of deep, somewhat poorly drained soils on flood plains. These soils are moderately permeable. They formed in silty alluvium. Slopes range from 0 to 2 percent.

Wakeland soils are similar to Stendal soils and are commonly adjacent to Birds and Wilbur soils. Stendal soils are more acid in the control section than the Wakeland soils. Birds soils are dominantly gray between the surface layer and a depth of 30 inches. They are farther from stream channels than the Wakeland soils and are slightly lower on the landscape. Wilbur soils do not have a dominantly gray subhorizon within a depth of 20 inches. They are nearer stream channels than the Wakeland soils and are slightly higher on the landscape.

Typical pedon of Wakeland silt loam, frequently flooded, in a cultivated field; 125 feet west and 950 feet south of the northeast corner of sec. 19, T. 4 N., R. 6 E.

Ap—0 to 9 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium granular structure; friable; many fine roots; common fine black (10YR 2/1) accumulations of iron and manganese oxide; slightly acid; abrupt smooth boundary.

C1—9 to 17 inches; light yellowish brown (10YR 6/4) silt loam; many medium distinct light gray (10YR 7/2) and common medium distinct dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; friable; common fine roots; common fine black (10YR 2/1) accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

C2—17 to 30 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct light yellowish brown (10YR 6/4) and prominent strong brown (7.5YR 5/8) mottles; massive; friable; few fine roots; common fine black (10YR 2/1) accumulations of iron and manganese oxide; strongly acid; gradual wavy boundary.

C3—30 to 60 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent yellowish brown (10YR 5/8) and common distinct light yellowish brown (10YR 6/4) mottles; massive; friable; common fine black (10YR 2/1) accumulations of iron and manganese oxide; common fine strong brown (7.5YR 5/6) iron stains; medium acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4. It is dominantly silt loam, but in some pedons it has thin strata of loam or fine sandy loam below a depth of 40 inches.

Wellston Series

The Wellston series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in loess and in the underlying silty material weathered from interbedded siltstone, fine grained sandstone, and shale bedrock. Slopes range from 10 to 18 percent.

The Wellston soils in this county have a lower base status and a thicker solum than is definitive for the series. These differences, however, do not alter the usefulness or behavior of the soils.

Wellston soils are similar to Kurtz soils and are adjacent to Berks, Gilpin, and Tilsit soils. Kurtz soils are on the steeper slopes and formed in material weathered from soft bedrock of interbedded siltstone and shale. Berks and Gilpin soils are less than 40 inches deep over bedrock. Berks soils are commonly on the lower side slopes. Tilsit soils have a very firm, brittle fragipan and are on the higher side slopes and ridgetops.

Typical pedon of Wellston silt loam, in a wooded area of Gilpin-Wellston silt loams, 10 to 25 percent slopes; 840 feet south and 290 feet east of the center of sec. 26, T. 7 N., R. 2 E.

Oi—1 inch to 0; partly decomposed leaves and roots.

A—0 to 6 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak fine subangular blocky structure; friable; many medium and coarse roots; strongly acid; clear wavy boundary.

BE—6 to 15 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common medium and coarse roots; very strongly acid; clear wavy boundary.

Bt1—15 to 23 inches; brown (7.5YR 5/4) silty clay loam; weak medium subangular and angular blocky structure; firm; common medium roots; thin discontinuous strong brown (7.5YR 5/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—23 to 32 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium angular and subangular blocky structure; firm; common fine roots; thin discontinuous strong brown (7.5YR 5/6) clay films on faces of peds; very strongly acid; gradual wavy boundary.

2Bt3—32 to 56 inches; strong brown (7.5YR 5/8) silty clay loam; few medium prominent light gray (10YR 7/2) and few fine faint yellowish red (5YR 5/8) mottles; moderate fine and medium angular blocky structure; firm; thin discontinuous strong brown (7.5YR 5/6) clay films on faces of peds; few distinct brownish yellow (10YR 6/6) silt coatings on faces of peds; stone line of geodes between depths of 36 and 39 inches; few fragments of siltstone; very strongly acid; gradual wavy boundary.

2BC—56 to 66 inches; strong brown (7.5YR 5/6) channery silty clay loam; common medium prominent light gray (10YR 7/2) and few fine distinct yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure and moderate thick platy rock structure; firm; about 20 percent fragments of siltstone; very strongly acid; gradual wavy boundary.

2R—66 to 70 inches; interbedded siltstone bedrock.

The solum is 40 to 70 inches thick. The depth to bedrock is 40 inches or more. The loess is 12 to 40 inches thick.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt and 2Bt horizons generally are very strongly acid or strongly acid but range from very strongly acid to medium acid. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam. The 2Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 5 or 6, and chroma of 4 to 8. It is silt loam, silty clay loam, or the channery analogs of these textures. The content of coarse fragments in this horizon ranges from 2 to 20 percent.

Whitaker Series

The Whitaker series consists of deep, somewhat poorly drained soils on low stream terraces. These soils are moderately permeable. They formed in loamy sediments over stratified coarse sand and coarse sandy loam. Slopes range from 0 to 2 percent.

Whitaker soils are similar to Ayrshire soils and are adjacent to Driftwood, Roby Variant, Ruark Variant, and Whitaker Variant soils. Ayrshire soils are on uplands and have finer sand throughout than the Whitaker soils. Driftwood and Ruark Variant soils are dominantly gray between the surface layer and a depth of 30 inches and are on the slightly lower flats. Roby Variant and Whitaker Variant soils do not have gray mottles directly below the surface layer and are on the slightly higher flats. Also, Roby Variant soils have less clay in the upper part of the subsoil than the Whitaker soils.

Typical pedon of Whitaker sandy loam, frequently flooded, in a cultivated field; 540 feet south and 1,200 feet east of the northwest corner of sec. 30, T. 6 N., R. 5 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) sandy loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; many fine and very fine roots; few fine black (10YR 2/1) accumulations of iron and manganese oxide; about 5 percent fine gravel; medium acid; abrupt smooth boundary.

E—9 to 16 inches; pale brown (10YR 6/3) sandy loam; many medium faint light brownish gray (10YR 6/2) and common fine distinct dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; friable; common very fine roots; few faint dark brown (10YR 4/3) organic films in root channels; grayish brown (10YR 5/2) sandy loam in krotovinas; common fine black (10YR 2/1) accumulations of iron and manganese oxide; about 5 percent fine gravel; slightly acid; clear wavy boundary.

Bt1—16 to 24 inches; grayish brown (10YR 5/2) sandy clay loam; common fine distinct dark yellowish brown (10YR 4/4) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common very fine roots; grayish brown (10YR 5/2) sandy loam in krotovinas; medium continuous dark gray (10YR 4/1) clay films on faces of peds; common fine black (10YR 2/1) accumulations of iron and manganese oxide; about 5 percent fine gravel; slightly acid; gradual wavy boundary.

Bt2—24 to 42 inches; yellowish brown (10YR 5/6) sandy clay loam; many fine distinct grayish brown (10YR 5/2) and common fine strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few very fine roots; grayish brown (10YR 5/2) sandy loam in krotovinas; medium discontinuous dark gray (10YR 4/1) clay films on faces of peds; common medium black (10YR 2/1) accumulations of iron and manganese oxide; about 5 percent fine gravel; slightly acid; gradual wavy boundary.

Bt3—42 to 50 inches; grayish brown (10YR 5/2) sandy loam; many medium prominent strong brown (7.5YR 5/8) and common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few very fine roots; medium discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; few medium black (10YR 2/1) accumulations of iron and manganese oxide; about 5 percent fine gravel; slightly acid; clear wavy boundary.

C1—50 to 60 inches; brown (10YR 5/3), stratified loamy coarse sand and coarse sandy loam; many medium distinct dark grayish brown (10YR 4/2) and few fine distinct dark brown (7.5YR 4/4) mottles; massive; very friable; about 5 percent fine gravel; slightly acid; gradual wavy boundary.

C2—60 to 73 inches; dark grayish brown (10YR 4/2), stratified loamy coarse sand and coarse sandy loam; common fine distinct dark yellowish brown (10YR 4/4) and few fine prominent strong brown (7.5YR 5/6) mottles; massive; very friable; about 5 percent fine gravel; neutral; gradual wavy boundary.

C3—73 to 80 inches; pale brown (10YR 6/3) and light brownish gray (10YR 6/2), stratified coarse sand and loamy coarse sand; single grain; loose; about 12 percent fine gravel; strong effervescence; mildly alkaline.

The solum is 45 to 60 inches thick. The content of coarse fragments is 0 to 5 percent, by volume, in the solum and 0 to 12 percent in the substratum.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam or sandy loam. The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 6. It is sandy loam, clay loam, or sandy clay loam. It ranges from strongly acid to neutral. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. It is stratified loamy sand, loamy coarse sand, sandy loam, coarse sandy loam, coarse sand, or sand.

Whitaker sandy loam, rarely flooded, has less clay in the argillic horizon than is definitive for the Whitaker series. This difference, however, does not alter the usefulness or behavior of the soil.

Whitaker Variant

The Whitaker Variant consists of deep, moderately well drained soils on low stream terraces. These soils are moderately permeable in the subsoil and rapidly permeable in the substratum. They formed in loamy sediments over stratified sand and loamy coarse sand. Slopes range from 0 to 2 percent.

Whitaker Variant soils are similar to Bobtown and Roby Variant soils and are adjacent to Nineveh Variant and Whitaker soils. Bobtown soils are on uplands and have finer sand throughout than the Whitaker Variant soils. Roby Variant soils have less clay in the upper part of the subsoil than the Whitaker Variant soils. Nineveh Variant soils do not have gray mottles in the subsoil and are on the slightly higher flats. Whitaker soils have gray mottles directly below the surface layer and are on the slightly lower flats.

Typical pedon of Whitaker Variant loam, frequently flooded, in a cultivated field; 1,180 feet south and 250 feet west of the northeast corner of sec. 18, T. 5 N., R. 4 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; many fine and very fine roots; few fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; slightly acid; abrupt smooth boundary.

BE—8 to 18 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; few very fine roots; many distinct dark brown (10YR 4/3) organic coatings in root channels; common fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt1—18 to 27 inches; yellowish brown (10YR 5/4) clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; common medium and fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

Bt2—27 to 38 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct grayish brown (10YR 5/2) and many fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few very fine roots; medium continuous yellowish brown (10YR 5/4) clay films on faces of peds; common medium and fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

Bt3—38 to 47 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) sandy clay loam; weak medium and coarse subangular blocky structure; friable; few very fine roots; grayish brown (10YR 5/2) clay bridging sand grains; common medium and fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

BC—47 to 56 inches; dark yellowish brown (10YR 4/4), stratified sandy clay loam and coarse sandy loam; common fine distinct yellowish brown (10YR 5/8) and common medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; few fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; strongly acid; gradual wavy boundary.

2C1—56 to 68 inches; dark yellowish brown (10YR 4/4) loamy coarse sand that has a few strata of coarse sandy loam; massive; very friable; many fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; medium acid; clear wavy boundary.

2C2—68 to 76 inches; brown (10YR 5/3) sand; single grain; loose; strong effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is loam or sandy loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 8. It has mottles with chroma of 2 or less in the upper 10 inches. It is loam, clay loam, or sandy clay loam and ranges from very strongly acid to slightly acid. The 2C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. The upper part of this horizon is stratified loamy coarse sand, loamy sand, sandy loam, or coarse sandy loam. The lower part is dominantly stratified sand or coarse sand, but in some pedons it has thin strata of coarse sandy loam, loamy coarse sand, or gravelly coarse sand.

Wilbur Series

The Wilbur series consists of deep, moderately well drained soils on flood plains. These soils are moderately permeable. They formed in silty alluvium. Slopes range from 0 to 2 percent.

Wilbur soils are similar to Steff soils and are commonly adjacent to Haymond and Wakeland soils. Steff soils are more acid in the control section than the Wilbur soils. Haymond soils have a dark yellowish brown substratum that is free of gray mottles. They are closer to stream channels than the Wilbur soils and are slightly higher on the landscape. Wakeland soils have a dominantly gray subhorizon within a depth of 20 inches. They are farther from stream channels than the Wilbur soils and are slightly lower on the landscape.

Typical pedon of Wilbur silt loam, frequently flooded, in a cultivated field; 20 feet east and 2,320 feet south of the center of sec. 32, T. 5 N., R. 6 E.

Ap—0 to 11 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

C1—11 to 29 inches; dark yellowish brown (10YR 4/4) silt loam; many medium distinct pale brown (10YR 6/3) and common fine and medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; few fine roots; neutral; clear smooth boundary.

C2—29 to 51 inches; dark yellowish brown (10YR 4/4) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; common fine black (10YR 2/1) iron and manganese accumulations; slightly acid; gradual smooth boundary.

C3—51 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; common fine black (10YR 2/1) iron and manganese accumulations; medium acid.

Reaction ranges from medium acid to neutral throughout the profile. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. In some pedons it has strata of loam or fine sandy loam below a depth of 40 inches.

Wilhite Series

The Wilhite series consists of deep, very poorly drained soils on flood plains. These soils are very slowly permeable. They formed in clayey alluvium. Slopes range from 0 to 2 percent.

Wilhite soils are similar to Driftwood and Zipp soils. Driftwood soils have more sand in the solum than the Wilhite soils and are less acid in the control section. Zipp soils have a cambic horizon, have free carbonates in the substratum, and are on low terraces.

Typical pedon of Wilhite silty clay, frequently flooded, in a cultivated field; 1,700 feet north and 100 feet west of the southeast corner of sec. 20, T. 4 N., R. 5 E.

Ap1—0 to 4 inches; dark brown (10YR 4/3) silty clay, pale brown (10YR 6/3) dry; weak medium and coarse granular structure; friable; common very fine roots; medium acid; abrupt smooth boundary.

Ap2—4 to 10 inches; dark brown (10YR 4/3) silty clay; common medium distinct gray (10YR 6/1) and common medium prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; firm; common very fine roots; medium acid; abrupt smooth boundary.

Bg1—10 to 16 inches; gray (10YR 6/1) silty clay; common medium distinct brown (10YR 5/3) and many medium prominent strong brown (7.5YR 5/8) and reddish yellow (7.5YR 6/8) mottles; weak coarse and medium subangular blocky structure; firm; few very fine roots; medium acid; clear smooth boundary.

Bg2—16 to 28 inches; gray (10YR 6/1) silty clay; many medium distinct pale brown (10YR 6/3) and few medium prominent reddish yellow (7.5YR 6/8) and strong brown (7.5YR 5/8) mottles; moderate medium and coarse subangular blocky structure; firm; few very fine roots; few fine very dark gray (N 3/0) accumulations of iron and manganese oxide; medium acid; gradual wavy boundary.

BCg—28 to 40 inches; gray (10YR 6/1) silty clay; common medium prominent yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; firm; few very fine roots; few fine very dark gray (N 3/0) accumulations of iron and manganese oxide; slightly acid; gradual wavy boundary.

Cg—40 to 60 inches; gray (10YR 6/1) silty clay; many medium prominent yellowish brown (10YR 5/8) mottles; massive; firm; neutral.

The solum ranges from 30 to 40 inches in thickness. The content of clay in the control section ranges from 35 to 45 percent, by volume. The soils are silty clay or silty clay loam throughout.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bg horizon has hue of 10YR, value of 5 or 6, and chroma of 0 or 1. It ranges from strongly acid to slightly acid. The Cg horizon ranges from strongly acid to neutral.

Zipp Series

The Zipp series consists of deep, very poorly drained soils on low terraces. These soils are slowly permeable. They formed in clayey lacustrine and slack-water sediments. Slopes range from 0 to 1 percent.

The Zipp soils in this county have higher chroma in the upper 30 inches of the solum than is definitive for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Zipp soils are similar to Driftwood and Wilhite soils and are adjacent to McGary soils. Driftwood and Wilhite soils do not have a cambic horizon and are on flood plains. Also, Driftwood soils have more sand than the Zipp soils and are more acid, and Wilhite soils do not have free carbonates in the substratum. McGary soils have a subhorizon that is not dominantly gray between the surface layer and a depth of 30 inches and are on the slightly higher flats.

Typical pedon of Zipp silty clay, frequently flooded, in a cultivated field; 2,475 feet east and 825 feet south of the northwest corner of sec. 23, T. 4 N., R. 4 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay, light brownish gray (10YR 6/2) dry; weak coarse subangular blocky and weak medium granular structure; firm; common fine roots; cracks 1.5 inches wide and, on average, 3 feet apart; mildly alkaline; abrupt smooth boundary.
Bg1—7 to 15 inches; grayish brown (10YR 5/2) silty clay; many medium faint yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to moderate coarse and medium blocky; very firm; few fine roots; cracks 1 inch wide and, on average, 3 feet apart; neutral; clear wavy boundary.
Bg2—15 to 28 inches; gray (10YR 5/1) silty clay; few fine prominent yellowish brown (10YR 5/8) and common medium distinct yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to moderate coarse and medium blocky; very firm; few fine roots; cracks 0.25 to 0.5 inch wide and, on average, 3 feet apart; mildly alkaline; clear wavy boundary.
BCg—28 to 44 inches; gray (10YR 6/1) silty clay; many medium and fine distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; common fine and medium white (10YR 8/2) concretions of calcium carbonate; slight effervescence; moderately alkaline; gradual wavy boundary.
C—44 to 60 inches; yellowish brown (10YR 5/6) silty clay; many medium distinct light brownish gray (10YR 6/2) mottles; massive; firm; common fine white (10YR 8/2) accumulations of calcium carbonate; few fine and medium white (10YR 8/2) concretions of calcium carbonate; strong effervescence; moderately alkaline.

The solum ranges from 30 to 48 inches in thickness. It generally is slightly acid to moderately alkaline but ranges from medium acid to moderately alkaline. In some years the soils have cracks, which are 1.0 to 1.5 inches wide, 3 feet apart, and about 2 feet deep.

The Bg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 6. It is silty clay that in some pedons has strata of silty clay loam.

Zipp Variant

The Zipp Variant consists of deep, poorly drained and very poorly drained soils on flood plains. These soils are slowly permeable. They formed in clayey and loamy slack-water sediments. Slopes range from 0 to 2 percent.

Zipp Variant soils are commonly adjacent to Fox, Ockley, and Shoals soils. Fox and Ockley soils are on the higher stream terraces and have a dark brown subsoil that is free of gray mottles. Shoals soils have a surface layer that is lighter colored than that of the Zipp Variant soils, have less clay in the control section, and have a subhorizon between the surface layer and a depth of 30 inches that is not dominantly gray. They are in the slightly higher landscape positions.

Typical pedon of Zipp Variant clay loam, frequently flooded, in a cultivated field; 2,080 feet west and 50 feet north of the center of sec. 20, T. 6 N., R. 5 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; weak coarse angular blocky structure; firm; common very fine roots; few fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; grayish brown (10YR 5/2) clay loam in krotovinas; few fine pebbles; slightly acid; abrupt smooth boundary.
Bg1—8 to 19 inches; dark gray (10YR 4/1) clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium angular blocky; very firm; few very fine roots; few distinct very dark grayish brown (10YR 3/2) organic coatings in root channels; common fine very dark gray (10YR 3/1) accumulations of iron and manganese oxide; grayish brown (10YR 5/2) clay loam in krotovinas; about 5 percent gravel; slightly acid; clear wavy boundary.
Bg2—19 to 33 inches; gray (10YR 5/1) clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium angular blocky; very firm; few very fine roots; common medium very dark gray (10YR 3/1) accumulations of iron and manganese oxide; grayish brown (10YR 5/2) clay loam in krotovinas; about 5 percent gravel; neutral; gradual wavy boundary.
Bg3—33 to 43 inches; gray (10YR 5/1) clay loam; many medium prominent yellowish brown (10YR 5/8) and few medium prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very firm; common medium very dark gray (10YR 3/1) accumulations of iron and manganese oxide; grayish brown (10YR 5/2) clay loam in krotovinas; about 2 percent gravel; neutral; gradual wavy boundary.
Cg1—43 to 56 inches; gray (10YR 6/1), stratified clay loam and silty clay loam; many coarse prominent reddish yellow (7.5YR 6/8) mottles; massive; firm; grayish brown (10YR 5/2) silty clay loam in krotovinas; about 2 percent gravel; neutral; gradual wavy boundary.
2Cg2—56 to 62 inches; gray (10YR 6/1), stratified loam and sandy loam that has thin strata of clay loam; many medium prominent strong brown (7.5YR 5/8) and yellowish brown (10YR 5/8) mottles; massive;

firm; about 2 percent gravel; neutral; clear wavy boundary.

2Cg3—62 to 72 inches; gray (10YR 6/1), stratified gravelly loam and gravelly sandy loam; massive; friable; about 20 percent gravel; strong effervescence; mildly alkaline.

The solum is 30 to 48 inches thick. The content of clay in the control section is 35 to 45 percent, by volume.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3. The Bg horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam, clay loam, silty clay, or clay. It is slightly acid or neutral. The Cg and 2Cg horizons have hue of 10YR, value of 4 to 6, and chroma of 1 or 2. The Cg horizon is stratified clay loam, sandy clay loam, or silty clay loam. The 2Cg horizon is dominantly stratified loam, gravelly loam, sandy loam, or gravelly sandy loam, but in some pedons it has thin strata of clay loam.

Formation of the Soils

In this section the effects of the major factors of soil formation on the soils in Jackson County are described. The processes of soil formation also are described.

Factors of Soil Formation

Soil forms through processes acting on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by 1) the physical and mineralogical composition of the parent material; 2) the climate under which the soil formed; 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 that the forces of soil formation have acted on the soil material.

Parent material greatly affects the kind of soil profile that forms. 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. Relief conditions the effects of climate and plant and animal life. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of the parent material into a soil. Some time is always required for the differentiation of soil 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.

Plant and Animal Life

Plants have been the principal organism influencing the soils in Jackson County; however, bacteria, fungi, earthworms, and human activities also have been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material in and on the soil depends on the kind of native plants that grew on the soil. The remains of these plants accumulated in the surface layer, decayed, and eventually became humus. The roots of the plants provided channels for the downward movement of water and air through the soil, and they added organic matter as they decayed. Bacteria in the soil help to break down the organic matter into plant nutrients.

The native vegetation in Jackson County was mainly deciduous, mixed hardwoods. Differences in natural soil drainage and minor variations in the parent material affected the composition of the forest species. Common trees on well drained soils, such as Bonnell and Alvin soils, were yellow-poplar, oak, hickory, elm, and sugar maple. Wet soils, such as Birds and Peoga soils, supported primarily sweetgum, pin oak, and soft maple. Depressional soils that are subject to ponding, such as Lyles and Zipp Variant soils, supported swamp grasses, sedges, mosses, and some water-tolerant trees, such as willow. The soils in Jackson County that formed dominantly under forest vegetation generally have a lower content of organic matter than the soils that formed dominantly under grasses.

Climate

Climate largely determines the kind of plant and animal life on and in the soil. It also determines the amount of water available for the weathering of minerals and the translocation of soil material. Temperature determines the rate of chemical reactions in the soil. These effects tend to be uniform in relatively small areas, such as those the size of a county.

The climate in Jackson County is generally cool and moist in winter and hot and humid in summer. It is presumably similar to the one that prevailed when the soils formed. The climate is nearly uniform throughout the county, and differences among the soils in the county are not the result of varied climatic conditions. More detailed information about the climate is available under the heading "General Nature of the County."

Relief

Relief has markedly affected the soils in Jackson County through its effect on natural drainage, erosion, runoff, plant cover, and soil temperature. Some soils formed in the same kind of parent material but differ mainly in drainage characteristics because of relief. Examples are Alvin and Lyles soils.

Runoff is most rapid on the steepest slopes. Low, depressional areas are often temporarily ponded. The greater the runoff rate, the greater the hazard of erosion.

Through its effect on aeration in the soil, drainage determines the major color of a soil. Water and air move freely through most well drained soils and slowly through very poorly drained soils. In Alvin and other soils that are well aerated, the iron and aluminum compounds that give most soils their color are reddish or brownish and are oxidized. Peoga and other poorly aerated soils that are saturated for long periods commonly are dull gray and mottled because the compounds are in a reduced state or have been removed from the soil.

Soils on west- and south-facing slopes generally have a warmer soil temperature than soils on north- and east-facing slopes.

Time

Usually, a long time is needed for the development of distinct soil horizons. The length of time that parent material has been in place commonly reflects the degree of profile development.

The soils in Jackson County range from immature to mature. Whitaker, Cincinnati, and other soils that formed in glacial drift and Crider, Tilsit, and other soils formed in loess over material weathered from bedrock have been exposed to the soil-forming factors long enough for the development of distinct horizons. Haymond, Stonelick, and other soils that formed in recent alluvium, however, have not been in place long enough for this kind of development. Some steep soils, such as Berks soils, have been exposed to the soil-forming factors for a long time but do not have distinct horizons. Most of the precipitation that has fallen on these soils has run off the surface and thus has not moved through the profile; consequently, very little weathering of minerals or tranlocation of soil material has occurred.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of chemical and mineralogical composition of the soil. The soils in Jackson County formed in many different kinds of parent material. The origin of some of this material is uncertain. As more information is gained through investigations, some of the parent material will likely be redefined. The parent materials are currently defined as follows: glacial drift, glacial till, glaciofluvial deposits, and glaciolacustrine deposits; eolian deposits of Wisconsinan age; material weathered from siltstone, fine grained sandstone, shale, and limestone bedrock; and alluvium along streams. Loess covers much of the glacial material and some of the material weathered from bedrock. It ranges from a few inches to about 48 inches in thickness.

Many soils in the survey area formed entirely or partly in material weathered from bedrock. The bedrock at or near the surface in Jackson County consists of sedimentary rocks. The rocks dip 20 to 25 feet per mile to the west-southwest. They are fine grained sandstone, siltstone, shale, and limestone. They are almost entirely of Mississippian age. In a few small areas in the eastern part of the county, however, Devonian shale crops out.

Several formations make up the Mississippian System. Each formation varies in type and composition of bedrock. Berks soils formed in material weathered from predominantly interbedded siltstone and fine grained sandstone (fig. 22). Coolville soils formed in loess-covered material weathered from predominantly interbedded, soft shale and siltstone. Frederick soils formed in material weathered from limestone.

Several continental glaciers covered a large part of the county. Drift from the Illinoian and Wisconsinan glaciers was deposited in the county. Although Wisconsinan glacial ice never entered the county, meltwater from it deposited glaciofluvial and glaciolacustrine material in the valley of the East Fork of the White River.

Glacial till is unsorted mineral material that was transported and deposited as thick glacial ice moved across the land. The material consists of mixed particles of sand, silt, and clay and a small percentage of rocks of various sizes. It ranges from a few feet to more than 20 feet in thickness. It is not leached below a depth of 3 feet or more and is calcareous loam or clay loam. It has some small pockets or strata of outwash. Bonnell soils formed in loess-covered glacial till, and Hickory soils formed entirely in till.

Glacial drift includes sorted, unsorted, and reworked glacial deposits. Avonburg and Cincinnati are some of the soils that formed in loess-covered glacial drift. The upper part of the drift is loamy and has dominantly silt-size particles. The lower part has more sand, clay, and pebbles.

Glaciofluvial deposits, or outwash, consist of sorted material deposited by running water from melting glacial ice. The size of the particles varies, depending on the velocity of the meltwater. Meltwater with a high velocity deposited the coarser particles, namely gravel and sand. The water moving at slower velocities deposited the finer particles, namely silt and clay. Parke soils formed in loess-covered outwash, and Negley soils formed entirely in Illinoian outwash on eskers and ridges. The outwash is mainly sand that has lesser amounts of silt, clay, and gravel. It is unleached and calcareous below a depth of 10 to 15 feet.

Fox and Whitaker are examples of soils that formed in loamy Wisconsinan outwash on terraces along the East Fork of the White River. These soils are underlain mainly by sand or gravelly sand. The gravel in these soils is dominantly less than 5 millimeters in size. Fox soils have and are underlain by moderate amounts of gravel, and Whitaker soils are underlain mainly by sand.

The glaciolacustrine deposits in this county are considered to be of Illinoian and Wisconsinan age. The Illinoian deposits are mainly in the southeastern quarter of the county, but they also are in smaller areas throughout the rest of the county. As the Illinoian glacial ice receded, meltwater deposited sorted soil material into temporarily formed lakes. In Jackson County most of the Illinoian lacustrine material consists of stratified deposits

Figure 22.—Interbedded siltstone and fine grained sandstone bedrock of Mississippi age exposed in a road cut. Berks soils formed in the material weathered from this bedrock.

that are loamy in the upper part and sandy in the lower part. In some areas the lacustrine deposits consist mainly of silt. Dubois and Haubstadt soils formed in loess and in the underlying Illinoian lacustrine deposits.

The Wisconsinan lacustrine deposits are mainly in the area of the convergence of the East Fork of the White River and the Muscatatuck River. Clay, silt, and some fine sand were deposited in the Wisconsinan lakes. Markland and McGary soils formed in loess and in the underlying lacustrine deposits of Wisconsinan age.

Loess is silty material that was deposited by the wind. During the late Wisconsinan age, silt particles were deposited throughout most of the survey area. The mantle of loess ranges from a few inches to about 9 feet in thickness. Most of the loess remains on the less sloping soils. Stoy soils formed in 5 or more feet of loess. Many other soils, including Bedford and Cincinnati soils, formed in a few feet of loess and in the underlying parent material.

Eolian material was carried from the valley of the East Fork of the White River during the period when the Wisconsinan glacial ice melted. Periods of flooding alternated with periods of drying; consequently, no vegetation protected the material against soil blowing. The prevailing westerly winds transported fine sand and sand and some silt onto terraces and uplands. These eolian deposits range from about 6 to more than 75 feet in thickness. Most of the deposits are south and east of the valley of the East Fork of the White River. Bloomfield and Ayrshire are examples of soils that formed in these windblown deposits.

Alluvium was recently deposited by floodwater along present streams. The texture of this material varies, depending on the speed of the water from which it was deposited and the source of the alluvium. The alluvium along Sand Creek and the East Fork of the White River is loamy and sandy. It washed from areas of Wisconsinan glacial drift and is neutral or calcareous. Armiesburg, Genesee, Shoals, and Stonelick soils formed in this alluvium.

The alluvium along White Creek, the Muscatatuck River, and Salt Creek is predominantly silty and is neutral to very strongly acid. Birds, Wilbur, and Stendal are examples of soils that formed in this alluvium. Birds, Driftwood, Haymond, Piopolis, Wakeland, and Wilbur soils formed in alluvium washed from areas of loess-covered glacial drift. Steff and Stendal soils formed in alluvium washed from areas of siltstone residuum. Burnside soils formed in loamy alluvium over channery alluvium washed from areas of material weathered from interbedded siltstone, fine grained sandstone, and shale bedrock. This alluvium was deposited in the narrow valleys draining the steep adjacent soils that formed in bedrock residuum.

Processes of Soil Formation

Several processes have been involved in the formation of the soils in Jackson County. These processes are the accumulation of organic matter; the dissolution, transfer, and removal of calcium carbonates and bases; the liberation and translocation of silicate clay minerals; and the reduction and transfer of iron. In most of the soils more than one of these processes have helped to differentiate soil horizons.

Some organic matter has accumulated in the surface layer of all the soils in the county. The organic matter content of some soils is low, but that of others is high. Generally, the soils that have the most organic matter, such as Lyles soils, have a thick, dark surface layer.

Carbonates and bases have been leached from the upper horizons of most of the soils in the county. Leaching probably preceded the translocation of silicate clay minerals. Almost all of the carbonates and some of the bases have been leached from the A and B horizons of the well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by an acid soil reaction. Leaching of wet soils is slow because of a seasonal high water table or the slow movement of water through the profile.

Clay accumulates in pores and other voids and forms films on the surfaces along which water moves. The leaching of bases and the translocation of silicate clays are among the more important processes affecting horizon differentiation in the soils. Dubois soils are an example of soils in which translocated silicate clays in the form of clay films have accumulated in the Bt horizon.

Gleying, or the reduction and transfer of iron, has occurred in all of the very poorly drained to somewhat poorly drained soils in the county. In these naturally wet soils, this process has had a significant effect on horizon differentiation. A gray color in the subsoil indicates the reduction of iron oxides. This reduction is commonly accompanied by some transfer of the iron from the upper horizons to the lower ones, or completely out of the profile. Mottles, which are in some horizons, indicate the segregation of iron.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

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

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

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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

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

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

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

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

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

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

Coarse textured soil. Sand or loamy sand.

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

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

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

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

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

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

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

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

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

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

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

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

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

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, subsurface. Removal of excess ground water through buried drains installed within the soil profile.

The drains collect the water and convey it to a gravity or pump outlet.

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

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

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

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

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

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

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

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

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

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

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

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

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

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

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

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

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

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

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

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

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

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

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

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

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

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

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

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

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

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

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

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

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

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

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

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

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

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

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

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

Sandstone. Sedimentary rock containing dominantly sand-size particles.

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

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

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

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

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

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

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

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

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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

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

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

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

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

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

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

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

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

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

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

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

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

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

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

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

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

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

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

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

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

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.