Issued January 1971

SOIL SURVEY
Sullivan County, Indiana

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

Major fieldwork for this soil survey was done in the period 1958–62. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service and the Purdue University Agricultural Experiment Station. It is part of the technical assistance furnished to the Sullivan County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for agriculture, industry, and recreation.

Locating Soils

All the soils of Sullivan County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. It lists all the soils of the county in alphabetic order by map symbol and shows the capability unit and the woodland group each soil is in and the page where each soil and each capability unit is described.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the descriptions of soils and capability units.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped in tabular form according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Sullivan County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "Additional Facts about the County."

Cover picture: **A typical area of Reesville, Iona, and Alford soils in Sullivan County, showing applied conservation practices and good land use.**

U.S. GOVERNMENT PRINTING OFFICE: 1970

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Contents

	Page
How this survey was made	1
General soil map	2
1. Cincinnati-Ava-Alford association	2
2. Reesville-Iva association	2
3. Princeton-Bloomfield-Ayrshire association	3
4. Wakeland-Stendal-Genesee association	3
5. Warsaw-Elston-Fox association	3
6. Lyles-Henshaw-Patton association	4
Descriptions of the soils	4
Ade series	4
Alford series	6
Atkins series	7
Ava series	8
Ayrshire series	9
Bloomfield series	10
Carlisle series	10
Cincinnati series	11
Cory series	12
Cuba series	12
Eel series	13
Elston series	13
Fox series	14
Genesee series	15
Genesee series, sandy variant	15
Gullied land	16
Henshaw series	16
Hickory series	17
Iona series	18
Iva series	19
Kings series	20
Lyles series	20
Markland series	21
McGary series	21
Mine dumps	22
Muren series	22
Parke series	22
Patton series	23
Petrolia series	24
Princeton series	24
Ragsdale series	25
Reesville series	26
Rensselaer series	26
Riverwash	27
Rock land	27
Descriptions of the soils—Continued	
Ross series	27
Shadeland series	27
Stendal series	28
Strip mines	28
Vigo series	28
Wakeland series	30
Warsaw series	30
Westland series	31
Wilbur series	32
Zipp series	32
Use and management of the soils	33
Use of the soils for crops	33
Capability grouping	33
Estimated yields	41
Woodland	43
Woodland groups	44
Wildlife	45
Food and cover	46
Distribution of wildlife	46
Recreation	47
Engineering uses of the soils	47
Engineering classification systems	62
Engineering test data	62
Estimated properties	63
Interpretations of soil properties	63
Formation and classification of the soils	64
Factors of soil formation	64
Parent material	64
Climate	65
Plant and animal life	65
Relief	66
Time	66
Processes of soil formation	66
Classification of the soils	66
Additional facts about the county	68
Farming and natural resources	68
Climate	68
Water supply	69
Drainage	71
Industries, transportation, and markets	71
Literature cited	71
Glossary	72
Guide to mapping units Following	73

Issued January 1971

SOIL SURVEY OF SULLIVAN COUNTY, INDIANA

By LEO A. KELLY, SOIL CONSERVATION SERVICE

FIELDWORK BY LEO A. KELLY, RALPH H. STURM, HERBERT F. WILLIAMSON, AND JAMES M. SMITH, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

SULLIVAN COUNTY, in the southwestern part of Indiana (fig. 1), has an area of 292,480 acres, or 457 square miles. In 1960, the population of the county was 21,721. Sullivan, the county seat, is near the center of the county. The physiography is characterized by broad terraces and bottom lands near the Wabash River and nearly level to steep uplands in the rest of the county. Busseron Creek is the largest stream.

Sullivan County is used mainly for farming. Corn and soybeans are the main crops. Livestock is raised both for meat and for dairy products. The climate is favorable for farming.

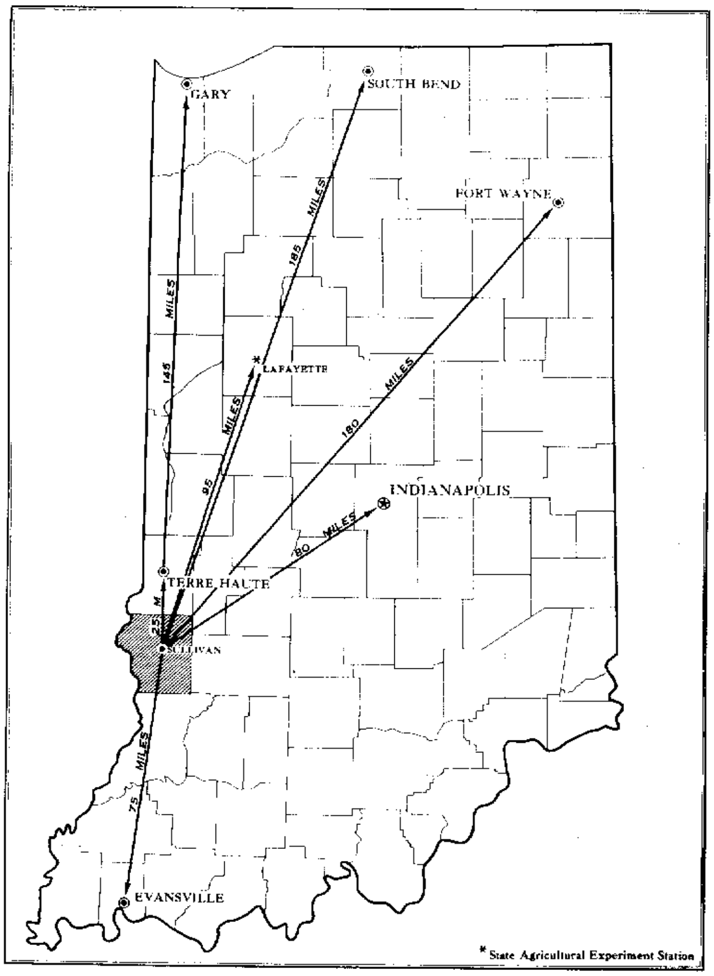

Figure 1.—Location of Sullivan County in Indiana.

How This Survey Was Made

This survey was made to learn what kinds of soils are in Sullivan County, where they are located, and how they can be used. Soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. As they traveled over the county, they observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The categories of their classification most used in a local survey are the *soil series* and the *soil phase* (*10*)[1].

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Alford and Hickory, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

[1] Italicized numbers in parentheses refer to Literature Cited, page 71.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Alford silt loam, 2 to 6 percent slopes, eroded, is one of several phases within the Alford series.

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

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gullied land is a land type in Sullivan County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this publication shows, in color, the soil associations in Sullivan County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The six soil associations in Sullivan County are described in the following pages.

1. Cincinnati-Ava-Alford association

Deep, well drained and moderately well drained, nearly level to very steep soils that have a loam to silty clay loam subsoil; on uplands

This association occurs on uplands throughout the county and takes in about 33 percent of the land area. About 27 percent of the acreage consists of Cincinnati soils, about 23 percent of Ava soils, about 15 percent of Alford soils, and the rest of less extensive soils.

Cincinnati soils are well drained and gently sloping to strongly sloping. They have a surface layer of dark grayish-brown and yellowish-brown silt loam and a subsoil that is mostly dark yellowish-brown and yellowish-brown silty clay loam. Ava soils are moderately well drained and nearly level to gently sloping. They have a surface layer of dark grayish-brown and brown silt loam and a subsoil of yellowish-brown and light yellowish-brown heavy silt loam and light silty clay loam. Both the Cincinnati and Ava soils have, at a depth of 22 to 34 inches, a slowly permeable fragipan that is firm when moist and brittle when dry. Alford soils are well drained and gently sloping to very steep. They have a surface layer of brown silt loam and a subsoil that is mostly strong-brown silty clay loam.

Among the less extensive soils in this association are Hickory, Iona, and Parke soils, which are on uplands, and Cuba and Stendal soils, which are on bottom lands along small streams. Also within this association is about 12,000 acres of Strip mines. This miscellaneous land type is in the extreme eastern part of the county.

The soils in this association are used as cropland, pasture, and woodland. Corn, soybeans, and pasture are the main crops. Orchard crops grow well on Alford soils.

A shallow root zone and limited available moisture capacity are limitations of the Ava and Cincinnati soils, which have a fragipan. Runoff and an erosion hazard are limitations of the sloping Alford, Ava, Cincinnati, Hickory, Iona, and Parke soils. The Cuba and Stendal soils are subject to flooding.

2. Reesville-Iva association

Deep, somewhat poorly drained, nearly level and gently sloping soils that have a silt loam to silty clay loam subsoil; on uplands

This association occurs on uplands throughout the county and takes in about 27 percent of the land area.

About 54 percent of the acreage consists of Reesville soils, about 32 percent of Iva soils, and the rest of less extensive soils.

Reesville soils are somewhat poorly drained and nearly level to gently sloping. They have a surface layer of dark grayish-brown silt loam and a subsoil that is mostly brown, mottled silty clay loam. Iva soils are somewhat poorly drained and nearly level to gently sloping. They have a grayish-brown silt loam surface layer and a subsoil that is mostly light brownish-gray and yellowish-brown, mottled light silty clay loam.

Among the less extensive soils in this association are Vigo, Ragsdale, and Cory soils, all of which are on uplands, and Stendal and Wakeland soils, both on bottom lands.

The soils in this association are used as cropland and pasture. Corn, soybeans, small grain, hay, and pasture are the main crops.

All the soils have a limitation of wetness, and the Stendal and Wakeland soils are subject to flooding. An erosion hazard is a limitation of the sloping Reesville, Iva, and Vigo soils.

3. Princeton-Bloomfield-Ayrshire association

Deep, somewhat excessively drained to somewhat poorly drained, nearly level to very steep soils that have a fine sand to sandy clay loam subsoil; on uplands

This association occurs on uplands near and east of the Wabash River. It takes in about 13 percent of the land area. About 33 percent of the association is made up of Princeton soils, about 30 percent of Bloomfield soils, about 24 percent of Ayrshire soils, and the rest of less extensive soils.

Princeton soils are well drained and nearly level to very steep. They have a surface layer of dark grayish-brown fine sandy loam and a subsoil that is mostly brown sandy clay loam. Bloomfield soils are somewhat excessively drained and gently sloping to very steep. They have a surface layer of dark-brown and brown loamy fine sand, a subsurface layer of light yellowish-brown loamy fine sand, and a subsoil of light yellowish-brown fine sand. The subsoil has horizontal bands of reddish-brown light sandy clay loam and sandy clay loam. Ayrshire soils are somewhat poorly drained and nearly level to gently sloping. They have a surface layer of dark grayish-brown loam or fine sandy loam and a subsoil of light brownish-gray and grayish-brown, mottled sandy clay loam.

Among the less extensive soils in this association are Ade and Lyles soils, which are on uplands, and Wakeland and Wilbur soils, which are on bottom lands along small streams.

The soils in this association are used as cropland and pasture. Corn, soybeans, melons, small grain, hay, and pasture are the main crops. Orchard crops are well suited.

Runoff and the erosion hazard are limitations of the sloping Princeton, Bloomfield, Ayrshire, and Ade soils. Droughtiness is a limitation of the Princeton, Bloomfield, and Ade soils. The Wakeland and Wilbur soils are subject to flooding, and the Wakeland, Ayrshire, and Lyles soils have a limitation of wetness.

4. Wakeland-Stendal-Genesee association

Deep, well-drained to somewhat poorly drained, nearly level soils that have a loam or silt loam subsoil; on bottom lands

This association occurs on bottom lands along the Wabash River and throughout the county. It takes in about 12 percent of the land area. About 34 percent of the acreage consists of Wakeland soils, about 18 percent of Stendal soils, about 14 percent of Genesee soils, and the rest of less extensive soils.

Wakeland soils are somewhat poorly drained soils on bottom lands along small streams. The largest area has been mapped in the western half of the county. These soils have a surface layer of dark grayish-brown silt loam and a subsoil that is mostly light brownish-gray and gray, mottled silt loam. Stendal soils are somewhat poorly drained soils on bottom lands along small streams. The largest area has been mapped in the eastern part of the county. These soils have a surface layer of grayish-brown to light brownish-gray silt loam and a subsoil that is mostly light brownish-gray, mottled silt loam. Genesee soils are well-drained soils on large bottom lands. The largest area has been mapped along the Wabash River. These soils have a surface layer of dark grayish-brown silt loam and a subsoil that is mostly brown loam.

Among the less extensive soils in this association are soils of the Atkins, Cuba, Eel, Ross, and Wilbur series, all of which are on bottom lands.

The soils in this association are used mainly as cropland and pasture. Corn, soybeans, hay, and pasture are the main crops. Flooding is a hazard to all the soils in this association. Wetness is a limitation of the Wakeland, Stendal, and Atkins soils.

5. Warsaw-Elston-Fox association

Deep, well-drained, nearly level to moderately sloping soils that have a sandy loam to clay loam subsoil; on terraces

This association occurs on gravelly terraces in the western part of the county adjacent to the Wabash River bottom lands. It takes in about 8 percent of the land area. About 70 percent of the acreage consists of Warsaw soils, about 17 percent of Elston soils, about 10 percent of Fox soils, and the rest of less extensive soils.

Warsaw soils are nearly level to moderately sloping. They have a surface layer of very dark brown and dark brown loam or sandy loam and a subsoil that is mostly dark-brown and yellowish-brown gravelly clay loam. Elston soils are nearly level to gently sloping. They have a surface layer of very dark brown loam or fine sandy loam and a subsoil that is mostly brown and dark yellowish-brown light sandy clay loam and sandy loam. Fox soils are nearly level or gently sloping. They have a surface layer of brown loam or sandy loam and a subsoil that is mostly brown and reddish-brown clay loam and gravelly clay loam.

Among the less extensive soils in this association are soils of the Rensselaer and Westland series, which are in depressions on the terraces.

The soils in this association are used mainly as cropland and meadow. Corn, grain sorghum, small grain, and hay are the main crops. Vegetable crops, such as potatoes, tomatoes, and green beans, are grown under irrigation.

A medium or low available moisture capacity is the main limitation of the Warsaw, Elston, and Fox soils. In years when rainfall is less than average or is poorly distributed, crops on these soils are subject to damage from drought. Rensselaer and Westland soils have a limitation of wetness.

6. Lyles-Henshaw-Patton association

Deep, somewhat poorly drained to very poorly drained, nearly level and gently sloping soils that have a sandy loam to silty clay loam subsoil; on terraces and uplands

This association occurs on terraces and uplands in the south-central and western parts of the county. It takes in about 7 percent of the land area. About 27 percent of the acreage consists of Lyles soils, about 21 percent of Henshaw soils, about 18 percent of Patton soils, and the rest of less extensive soils.

Lyles soils are very poorly drained. They are in depressions on uplands and terraces. They have a surface layer of very dark gray to very dark grayish-brown loam and a subsoil of dark-gray, mottled heavy loam and gray and yellowish-brown, stratified light sandy clay loam and fine sandy loam. Henshaw soils are somewhat poorly drained. They are on terraces. They have a surface layer of dark grayish-brown silt loam and a subsoil that is mostly light yellowish-brown and light brownish-gray, mottled silty clay loam. Patton soils are very poorly drained. They are in depressions on lake terraces. They have a surface layer of very dark gray silty clay loam and a subsoil that is mostly dark-gray and grayish-brown, mottled silty clay loam.

Among the less extensive soils in this association are Markland, McGary, Rensselaer, and Westland soils.

The soils in this association are used mainly as cropland and pasture. Corn, soybeans, small grain, and hay are the main crops.

Wetness is a limitation of the nearly level Lyles, Henshaw, Patton, McGary, Rensselaer, and Westland soils. The hazard of erosion is a limitation of the Markland soils.

Descriptions of the Soils

In this section the soils of Sullivan County are described in detail. The procedure is to describe first a soil series, and then the mapping units in that series. To get full information on any one mapping unit, it is necessary to read both the description of that unit and the description of the soil series to which it belongs.

The description of each soil series contains a short description of a typical soil profile and a much more detailed description of the same profile that scientists, engineers, and others can use in making highly technical interpretations. The descriptions of the mapping units give the characteristics and qualities of each soil. They also discuss briefly the use of the soils for crops and pasture and for woodland.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. At the end of the description of each mapping unit are listed the capability unit and the woodland group in which the mapping unit has been placed. The page where each of the capability groups is described and the table describing woodland groups can be found readily by referring to the "Guide to Mapping Units."

For more general information about the soils, the reader can refer to the section "General Soil Map," in which the broad patterns of soils are described. The soil map at the back of this publication shows the location and distribution of the mapping units, and the "Guide to Mapping Units" gives the page on which each is described. The approximate acreage and proportionate extent of each mapping unit are shown in table 1. Many terms used in describing the soil series and mapping units are defined in the Glossary, and some are defined in the section "How This Survey Was Made."

Ade Series

The Ade series consists of deep, somewhat excessively drained soils that have a coarse-textured surface layer and subsoil. In the subsoil are thin, horizontal bands of moderately coarse textured to moderately fine textured material. These soils are on uplands. The native vegetation was prairie grass.

A typical profile has a 19-inch surface layer of loamy fine sand, very dark gray in the upper 12 inches and very dark grayish brown to dark brown in the lower part. Below the surface layer is about 41 inches of loose, dark yellowish-brown and yellowish-brown fine sand. In the lower part of this layer are thin bands of brown sandy loam to light sandy clay loam. The underlying material is brownish-yellow to light yellowish-brown, loose fine sand.

Permeability is rapid, surface runoff is slow, and the available moisture capacity is low. The organic-matter content is high. The surface layer is medium acid unless it has been limed.

Gently sloping to moderately sloping soils of this series occur on the uplands east of the Wabash River in the southwestern part of this county.

Typical profile of Ade loamy fine sand in a cultivated field, at a point 400 feet east and 100 feet south of the northwest corner of the NE¼NW¼ sec. 2, T. 6 N., R. 10 W.

Ap—0 to 12 inches, very dark gray (10YR 3/1) loamy fine sand; weak, fine, granular structure; very friable when moist; very high organic-matter content; slightly acid; abrupt, smooth boundary.

A1—12 to 19 inches, very dark grayish-brown (10YR 3/2) to dark-brown (10YR 3/3) loamy fine sand; weak, fine, granular structure; very friable when moist; slightly acid; clear, smooth boundary.

A3—19 to 35 inches, dark yellowish-brown (10YR 4/4) fine sand; single grain; loose; medium acid; gradual, wavy boundary.

A&B—35 to 60 inches, yellowish-brown (10YR 5/4) fine sand; single grain; loose; bands of brown (7.5YR 4/4) sandy loam to light sandy clay loam; bands are about 4 inches apart and 1 to 2 inches thick; weak, medium, subangular blocky structure; friable when moist; medium acid; gradual, wavy boundary.

TABLE 1.—*Approximate acreage and proportionate extent of soils*

Soil	Acres	Percent
Ade loamy fine sand, 2 to 6 percent slopes	1, 360	0. 5
Ade loamy fine sand, 6 to 12 percent slopes	1, 605	. 5
Alford silt loam, 2 to 6 percent slopes, eroded	4, 315	1. 5
Alford silt loam, 2 to 6 percent slopes, severely eroded	995	. 3
Alford silt loam, 6 to 12 percent slopes, eroded	2, 607	. 9
Alford silt loam, 6 to 12 percent slopes, severely eroded	4, 062	1. 4
Alford silt loam, 12 to 18 percent slopes, eroded	946	. 3
Alford silt loam, 12 to 18 percent slopes, severely eroded	1, 063	. 4
Alford silt loam, 18 to 25 percent slopes	850	. 3
Alford silt loam, 25 to 50 percent slopes	335	. 1
Atkins silt loam	530	. 2
Ava silt loam, 0 to 2 percent slopes	2, 160	. 7
Ava silt loam, 2 to 6 percent slopes, eroded	15, 748	5. 4
Ava silt loam, 2 to 6 percent slopes, severely eroded	5, 175	2. 0
Ayrshire fine sandy loam, 0 to 2 percent slopes	7, 271	2. 5
Ayrshire fine sandy loam, 2 to 4 percent slopes	1, 132	. 4
Ayrshire loam, 0 to 2 percent slopes	855	. 3
Bloomfield loamy fine sand, 2 to 6 percent slopes	3, 744	1. 3
Bloomfield loamy fine sand, 6 to 12 percent slopes	3, 594	1. 2
Bloomfield loamy fine sand, 12 to 18 percent slopes	2, 915	1. 0
Bloomfield loamy fine sand, 18 to 40 percent slopes	1, 293	. 4
Carlisle muck	185	. 1
Cincinnati silt loam, 2 to 6 percent slopes, eroded	2, 907	1. 0
Cincinnati silt loam, 6 to 12 percent slopes, eroded	991	. 3
Cincinnati silt loam, 6 to 12 percent slopes, severely eroded	13, 126	4. 5
Cincinnati silt loam, 12 to 18 percent slopes, eroded	3, 609	1. 2
Cincinnati silt loam, 12 to 18 percent slopes, severely eroded	7, 122	2. 4
Cory silt loam	400	. 1
Cuba silt loam	3, 139	1. 1
Eel silt loam	5, 022	1. 7
Elston fine sandy loam, 0 to 2 percent slopes	480	. 2
Elston fine sandy loam, 2 to 6 percent slopes	295	. 1
Elston loam, 0 to 2 percent slopes	980	. 3
Elston loam, 2 to 6 percent slopes	500	. 2
Fox sandy loam, 0 to 2 percent slopes	1, 166	. 4
Fox sandy loam, 2 to 6 percent slopes	717	. 2
Fox loam, 0 to 2 percent slopes	1, 193	. 4
Genesee fine sandy loam, sandy variant	1, 744	. 6
Genesee silt loam	3, 784	1. 3
Gullied land	1, 954	. 7
Henshaw silt loam, 0 to 2 percent slopes	2, 114	. 7
Henshaw silt loam, 2 to 4 percent slopes, eroded	366	. 1
Hickory silt loam, 18 to 25 percent slopes	4, 585	1. 6
Hickory silt loam, 25 to 35 percent slopes	2, 295	. 8
Hickory silt loam, 18 to 35 percent slopes, severely eroded	4, 833	1. 7
Hickory silt loam, 35 to 50 percent slopes	897	. 3
Iona silt loam, 0 to 2 percent slopes	833	. 3
Iona silt loam, 2 to 6 percent slopes, eroded	9, 019	3. 1
Iona silt loam, 2 to 6 percent slopes, severely eroded	1, 800	. 6
Iva silt loam, 0 to 2 percent slopes	18, 634	6. 4
Iva silt loam, 2 to 4 percent slopes, eroded	4, 082	1. 4
Kings silty clay	490	. 2
Lyles loam	4, 356	1. 5
Markland silt loam, 2 to 6 percent slopes, eroded	495	. 2
Markland silt loam, 12 to 18 percent slopes, eroded	422	. 1
Markland silt loam, 18 to 25 percent slopes, eroded	476	. 2
Markland silty clay loam, 6 to 18 percent slopes, severely eroded	533	. 2
McGary silt loam	301	. 1
Mine dumps	318	. 1
Muren silt loam, 2 to 6 percent slopes, eroded	710	. 2
Parke silt loam, 6 to 12 percent slopes, severely eroded	191	. 1
Parke silt loam, 12 to 18 percent slopes, severely eroded	288	. 1
Patton silty clay loam	2, 141	. 7
Petrolia silty clay loam	958	. 3
Princeton fine sandy loam, 0 to 2 percent slopes	3, 309	1. 1
Princeton fine sandy loam, 2 to 6 percent slopes, eroded	6, 137	2. 1
Princeton fine sandy loam, 6 to 12 percent slopes, eroded	1, 251	. 4
Princeton fine sandy loam, 12 to 18 percent slopes, eroded	754	. 3
Princeton fine sandy loam, 18 to 25 percent slopes, eroded	734	. 3
Princeton fine sandy loam, 25 to 50 percent slopes	992	. 3
Ragsdale silt loam	6, 410	2. 2
Reesville silt loam, 0 to 2 percent slopes	32, 454	11. 1
Reesville silt loam, 2 to 4 percent slopes, eroded	6, 420	2. 2
Rensselaer loam	1, 255	. 4
Riverwash	80	(1)
Rock land	1, 571	. 5
Ross silt loam	2, 041	. 7
Shadeland loam	280	. 1
Stendal silt loam	5, 094	1. 7
Strip mines	11, 757	4. 0
Vigo silt loam, 0 to 2 percent slopes	6, 284	2. 1
Vigo silt loam, 2 to 4 percent slopes, eroded	1, 726	. 6
Wakeland silt loam	13, 082	4. 5
Warsaw sandy loam, 0 to 2 percent slopes	7, 938	2. 7
Warsaw sandy loam, 2 to 6 percent slopes	1, 294	. 4
Warsaw sandy loam, 6 to 12 percent slopes, eroded	415	. 1
Warsaw loam, 0 to 2 percent slopes	3, 578	1. 2
Westland silty clay loam	871	. 3
Westland silty clay loam, shallow variant	360	. 1
Wilbur silt loam	2, 514	. 9
Zipp silty clay	873	. 3
Total	292, 480	100. 0

[1] Less than 0.05 percent.

C—60 to 70 inches +, brownish-yellow (10YR 6/6) to light yellowish-brown (10YR 6/4) fine sand; single grain; loose; calcareous.

The Ap and A1 horizons combined are 12 to 20 inches thick. The Ap horizon ranges from very dark brown to very dark gray in color. The A3 horizon is light loamy sand or fine sand. The depth to the A&B horizon ranges from 20 to 42 inches. The darker colored bands in this horizon range from heavy loamy sand to light sandy clay loam in texture. The thickness of the individual bands ranges from ¼ inch to 3 inches, and total thickness from 6 to 14 inches. The bands are 2 to 8 inches apart. The C horizon is slightly acid to mildly alkaline and in places is noncalcareous.

Ade loamy fine sand, 2 to 6 percent slopes (AdB).—This soil is on ridgetops and at the base of steeper slopes. Included in mapping were a few small areas of nearly level sandy soils on the ridgetops.

Peaches, melons, corn, soybeans, alfalfa, small grain, and hay are suitable crops. Erosion is a hazard, and low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIIs–1; woodland group 23)

Ade loamy fine sand, 6 to 12 percent slopes (AdC).—The surface layer of this soil is about 14 inches thick. Included in mapping were a few small areas of strongly sloping sandy soils.

Peaches, melons, corn, soybeans, alfalfa, small grain, and hay are suitable crops. Erosion is a hazard, and low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIIe–12; woodland group 23)

Alford Series

The Alford series consists of deep, well-drained soils that have a medium-textured surface layer and a medium-textured to moderately fine textured subsoil. These soils are on uplands. They formed in loess. The native vegetation was hardwood forest.

A typical profile has a 9-inch surface layer of silt loam, brown in the upper 7 inches and brown to yellowish brown in the lower part. The subsoil is about 44 inches thick. The uppermost 6 inches is strong-brown, friable silt loam, the next 21 inches is strong-brown, firm, light silty clay loam, and the rest is brown, friable silt loam. The underlying material is brown to yellowish-brown, friable silt loam.

Permeability is moderate, surface runoff is medium to rapid, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Gently sloping to very steep soils of this series occur on the uplands in the western and southern parts of this county.

Typical profile of Alford silt loam in a cultivated field, at a point 300 feet south and 50 feet east of the northwest corner of the SE¼NW¼ sec. 26, T. 8 N., R. 10 W.

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

A2—7 to 9 inches, brown (10YR 5/3) to yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable when moist; medium acid; clear, wavy boundary.

B1—9 to 15 inches, strong-brown (7.5YR 5/6) silt loam; moderate, fine, subangular blocky structure; friable when moist; thin, brown (7.5YR 4/4) silt and clay films and thin, pale-brown (10YR 6/3) silt coatings on some ped faces; a few stains of very dark brown (10YR 2/2); medium acid; clear, wavy boundary.

B21t—15 to 23 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate to strong, medium and coarse, subangular blocky structure; firm when moist; thin, dark reddish-brown (5YR 3/4) clay films on most ped faces; thin, pale-brown (10YR 6/3) silt coatings on a few peds and along vertical cracks; an occasional coating or splotch of very dark brown (10YR 2/2); strongly acid; gradual, wavy boundary.

B22t—23 to 36 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate to strong, coarse, subangular blocky structure; firm when moist; dark reddish-brown (5YR 3/4), thin clay films on ped faces; a few very dark brown (10YR 2/2) streaks and coatings; light brownish-gray (10YR 6/2) and light yellowish-brown (10YR 6/4) silt coatings on a few ped faces and in crack fills; strongly acid; gradual, wavy boundary.

B3t—36 to 53 inches, brown (7.5YR 4/4) silt loam; weak, coarse, subangular blocky structure; friable when moist; a few reddish-brown (5YR 4/4) clay films on ped faces; light brownish-gray (10YR 6/2) and pale-brown (10YR 6/3) streaks and silt coatings; strongly acid; gradual, wavy boundary.

C—53 to 63 inches +, brown (7.5YR 4/4) to yellowish-brown (10YR 5/6) silt loam; massive; friable when moist; a few vertical cracks filled with light brownish-gray (10YR 6/2) silt; slightly acid.

The Ap horizon ranges from grayish brown to brown in color. The B2 horizon ranges from yellowish brown to strong brown in color and from silt loam to light silty clay loam in texture. The C horizon is slightly acid to strongly acid. The loess deposit is 6 to 12 feet thick.

Alford silt loam, 2 to 6 percent slopes, eroded (AfB2).—This soil is on narrow ridges and long slopes. From 3 to 5 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and a little of the brown subsoil. Included in mapping were small areas of nearly level soils, of soils only slightly eroded, and of moderately well drained soils near the head of drainageways.

All the crops commonly grown in the county are suitable. Orchard crops also are suitable. Erosion resulting from medium surface runoff is the major hazard. (Capability unit IIe–3; woodland group 1)

Alford silt loam, 2 to 6 percent slopes, severely eroded (AfB3).—This soil is on narrow ridges and side slopes below ridgetops. From 7 inches to all of its original surface layer has been lost through erosion. The present surface layer is mostly original subsoil. Included in mapping were small areas of Gullied land.

All the crops commonly grown in the county are suitable. Orchard crops also are suitable. Erosion resulting from medium surface runoff is the major hazard. (Capability unit IIIe–3; woodland group 1)

Alford silt loam, 6 to 12 percent slopes, eroded (AfC2).—This soil is on uniform slopes and short breaks next to ridgetops. From 4 to 6 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were a few small areas of slightly eroded soils and a few of strongly sloping soils.

All the crops commonly grown in the county are suitable. Crops respond well to lime and fertilizer. Erosion resulting from medium surface runoff (fig. 2) is the major hazard. (Capability unit IIIe–3; woodland group 1)

Alford silt loam, 6 to 12 percent slopes, severely eroded (AfC3).—This soil is on side slopes below ridgetops and on short slopes next to drainageways. From 7 inches to all of its surface layer has been lost through erosion. The present surface layer is mostly original subsoil. Included in mapping were small areas of Gullied land.

Small grain, hay, pasture, and orchard crops are suitable. Crops respond well to lime and fertilizer. Erosion resulting from medium surface runoff is the major hazard. (Capability unit IVe–3; woodland group 1)

Alford silt loam, 12 to 18 percent slopes, eroded (AfD2).—This soil is on side slopes along drainageways and on short slopes next to ridgetops. From 4 to 6 inches of its original surface layer has been lost through erosion.

Figure 2.—**Rill and gully erosion on Alford silt loam, 6 to 12 percent slopes, eroded.**

The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were small areas of soils that have remained in woods or permanent pasture and so are only slightly eroded. Also included are a few areas of moderately steep soils.

Small grain, hay, pasture, and orchard crops are suitable. Crops respond well to lime and fertilizer. Erosion resulting from medium surface runoff is the major hazard. (Capability unit IVe-3; woodland group 1)

Alford silt loam, 12 to 18 percent slopes, severely eroded (AfD3).—This soil is on side slopes along drainageways and on short slopes below ridgetops. From 7 inches to all of its original surface layer has been lost through erosion. The present surface layer is mostly original subsoil. Included in mapping were small areas of Gullied land and a few areas of moderately steep soils.

Hay, pasture, and orchard crops are suitable. Crops respond well to lime and fertilizer. Erosion resulting from rapid surface runoff is the major hazard. (Capability unit VIe-1; woodland group 1)

Alford silt loam, 18 to 25 percent slopes (AfE).—This soil is on slopes along drainageways and on short breaks that have remained in woods or permanent pasture. Included in mapping were small areas of moderately eroded soils.

A cover of permanent vegetation is needed. Erosion resulting from rapid surface runoff is the major hazard. (Capability unit VIe-1; woodland group 2)

Alford silt loam, 25 to 50 percent slopes (AfF).—This soil is on side slopes along deep draws and on very narrow escarpments on uplands. Included in mapping were small areas of moderately eroded and severely eroded soils and a few areas of Gullied land.

A cover of permanent vegetation is needed. Most areas are wooded. The lesser slopes can be used as permanent pasture. Erosion resulting from rapid surface runoff is the major hazard. (Capability unit VIe-1; woodland group 2)

Atkins Series

The Atkins series consists of deep, poorly drained soils that have a medium-textured surface layer and subsoil. These soils formed in alluvium on bottom lands. The native vegetation was mixed hardwood forest.

A typical profile has a 6-inch surface layer of light brownish-gray, mottled silt loam. The subsoil is about 14 inches of gray, mottled, friable silt loam. The underlying material to a depth of about 45 inches is gray, mottled, friable silt loam, loam, and sand.

Permeability is moderate, surface runoff is very slow,

367-524—70——2

and the available moisture capacity is high. The organic-matter content is low. The surface layer is strongly acid unless it has been limed.

Nearly level soils of this series occur in depressions on bottom lands along small creeks in the eastern half of this county.

Typical profile of Atkins silt loam in a cultivated field, at a point 275 feet west and 165 feet south of the northeast corner of section 24, T. 7 N., R. 8 W.

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) silt loam; few, medium, distinct, brownish-yellow (10YR 6/8) mottles; weak, fine, granular structure; friable when moist; medium acid; abrupt, smooth boundary.

B21g—6 to 9 inches, gray (10YR 5/1) silt loam; common, medium, distinct, yellowish-red (5YR 5/6) mottles; weak, coarse, subangular blocky structure; friable when moist; few, small, black (10YR 2/1) concretions; medium acid; clear, smooth boundary.

B22g—9 to 20 inches, gray (10YR 6/1) silt loam; common, medium, distinct, light yellowish-brown (10YR 6/4) and brownish-yellow (10YR 6/8) mottles; weak, fine, subangular blocky structure; friable when moist; few, small, black (10YR 2/1) concretions; strongly acid; clear, smooth boundary.

C1g—20 to 35 inches, gray (10YR 6/1) silt loam; many, coarse, distinct, strong-brown (7.5YR 5/8) and brownish-yellow (10YR 6/6) mottles; massive; friable when moist; common, medium, black (10YR 2/1) concretions; strongly acid; clear, smooth boundary.

C2g—35 to 45 inches +, gray (10YR 6/1), stratified silt loam and loam; thin strata of sand; many, coarse, distinct, strong-brown (7.5YR 5/6) mottles; massive; friable when moist; medium acid.

In undisturbed areas of this soil, there is a gray A1 horizon 2 to 4 inches thick. The Ap horizon ranges from gray to light brownish gray in color. The reaction is slightly acid to strongly acid, depending on the amount of lime that has been applied. The soil material below a depth of 30 inches is medium acid to strongly acid. The depth to glacial till or bedrock ranges from 48 to 60 inches.

Atkins silt loam (Ak).—This soil is in depressions on creek bottoms in the eastern half of the county. The slope range is 0 to 2 percent.

Corn and soybeans can be grown if a drainage system is established and maintained. Small grain and alfalfa are less suitable, because they are damaged by flooding. Hay and pasture are well suited. Crops respond well to lime and fertilizer. Wetness and the flood hazard are limitations. (Capability unit IIIw–10; woodland group 11)

Ava Series

The Ava series consists of deep, moderately well drained soils that have a medium-textured surface layer and mainly a moderately fine textured subsoil. A fragipan begins at a depth of 22 to 34 inches. These soils are on uplands. They formed in 30 to 55 inches of loess over material weathered from till. The native vegetation was hardwood forest.

A typical profile has an 11-inch surface layer of silt loam, dark grayish brown in the upper 5 inches and brown in the lower part. The subsoil is about 44 inches thick. The upper 11 inches is yellowish-brown, friable heavy silt loam over light yellowish-brown, firm silty clay loam. The lower part is a fragipan. The upper part of the fragipan is mottled, light brownish-gray and yellowish-brown, firm silty clay loam, and the lower part is pale-brown to yellowish-brown, friable silt loam. The underlying material is brown to yellowish-brown, friable loam.

Permeability is slow, surface runoff is slow to medium, and the available moisture capacity is medium. The organic-matter content is low. The surface layer is strongly acid unless it has been limed.

Nearly level and gently sloping soils of this series occur on the uplands in the northern and eastern parts of this county.

Typical profile of Ava silt loam in an idle field next to a railroad track, at a point 250 feet east and 225 feet north of the southwest corner of the SW¼NE¼ sec. 2, T. 7 N., R. 8 W.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable when moist; neutral; clear, smooth boundary.

A2—5 to 11 inches, brown (10YR 5/3) silt loam; weak, medium, subangular blocky structure; friable when moist; medium acid; clear, smooth boundary.

B1t—11 to 17 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate, medium, subangular blocky structure; friable when moist; few, thin, discontinuous, yellowish-brown (10YR 5/6) clay films on ped faces; strongly acid; clear, smooth boundary.

B2t—17 to 22 inches, light yellowish-brown (10YR 6/4) light silty clay loam; common, medium, faint, yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; firm when moist; few light brownish-gray (10YR 6/2) silt films on some peds; few, thin, discontinuous, yellowish-brown (10YR 5/6) clay films; strongly acid; clear, smooth boundary.

Bx1—22 to 31 inches, light brownish-gray (10YR 6/2) silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, prismatic structure breaking to moderate, medium, subangular blocky; firm when moist; thin films of light-gray (10YR 7/1) silt and clay on most peds; few black (10YR 2/1) concretions of iron and manganese; strongly acid; gradual, smooth boundary.

Bx2—31 to 48 inches, yellowish-brown (10YR 5/4) silty clay loam; many, medium, distinct, light brownish-gray (10YR 6/2) mottles; strong, coarse, prismatic structure breaking to strong, coarse, subangular blocky; firm when moist; thin films of grayish-brown (10YR 5/2) clay on ped faces; light-gray (10YR 7/1) silt on vertical crack fills; common, small, black (10YR 2/1) concretions of manganese and iron; very strongly acid; gradual, smooth boundary.

IIBx3—48 to 55 inches, pale-brown (10YR 6/3) to yellowish-brown (10YR 5/4) gritty silt loam; weak, coarse, prismatic structure; friable when moist; light-gray (10YR 7/1) silt streaks ½ inch in thickness extending vertically into lower horizon; strongly acid; gradual, smooth boundary.

IIC—55 to 100 inches +, brown (10YR 5/3) to yellowish-brown (10YR 5/4) loam till; varying numbers of light brownish-gray (10YR 6/2) silt streaks; massive; friable when moist; strongly acid in upper part of horizon but becomes slightly acid with depth.

In cultivated areas the Ap horizon ranges from dark grayish brown to brown in color. The depth to the fragipan ranges from 22 to 34 inches. The fragipan is 20 to 40 inches thick and ranges from heavy silt loam to silty clay loam and light clay loam in texture. The underlying material is slightly acid to strongly acid and ranges from loam to clay loam in texture. The depth to mottling ranges from 16 to 24 inches.

Ava silt loam, 0 to 2 percent slopes (AlA).—This soil is on narrow ridgetops and at the head of drainageways. Included in mapping were small areas of nearly level, well-drained soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Alfalfa is less suitable because it is damaged by wetness, frost heave, and the restriction of root development. Crops respond well to lime and fertilizer. The slowly permeable fragipan is a limitation. Perching of water above the fragipan often results in some delay in spring farming operations. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. (Capability unit IIw-5; woodland group 9)

Ava silt loam, 2 to 6 percent slopes, eroded (AlB2).—This soil is on side slopes and ridgetops and at the head of drainageways. From 3 to 6 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the yellowish-brown subsoil. Included in mapping were small areas of slightly eroded soils and a few small areas of seepy soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Alfalfa is less suitable, because it can be damaged by wetness, frost heave, and the restriction of root development. Crops respond well to lime and fertilizer. Perching of water above the fragipan often results in some delay in spring farming operations. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. Erosion resulting from medium surface runoff is a hazard. (Capability unit IIe-7; woodland group 9)

Ava silt loam, 2 to 6 percent slopes, severely eroded (AlB3).—This soil is on side slopes along drainageways. From 6 to 8 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the yellowish-brown subsoil. Included in mapping were small areas of Gullied land and, in some places, areas of seepy soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Alfalfa and other deep-rooted crops are less suitable because they are damaged by wetness, frost heave, and the restriction of root development. Crops respond well to lime and fertilizer. Perching of water above the fragipan often results in some delay in spring farming operations. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. Erosion resulting from medium surface runoff is a hazard. (Capability unit IIIe-7; woodland group 9)

Ayrshire Series

The Ayrshire series consists of deep, somewhat poorly drained soils that have a medium-textured to moderately coarse textured surface layer and a medium-textured to moderately fine textured subsoil. These soils are on uplands. They formed in wind-deposited sand and coarse silt. The native vegetation was mixed hardwood forest.

A typical profile has a 12-inch surface layer of fine sandy loam, dark grayish brown in the upper 8 inches and light brownish gray in the lower part. The subsoil is about 34 inches thick. The uppermost 6 inches is light brownish-gray, friable loam, the next 14 inches is grayish-brown, firm sandy clay loam, and the rest is gray, firm heavy sandy loam or sandy clay loam. The underlying material is strong-brown and gray, friable, stratified silt and fine sand.

Permeability is moderate, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Nearly level and gently sloping soils of this series occur on the uplands in the western and southern parts of this county.

Typical profile of Ayrshire fine sandy loam in a cultivated field, at a point 270 feet west and 240 feet north of the southeast corner of the SW¼ sec. 17, T. 9 N., R. 10 W.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

A2—8 to 12 inches, light brownish-gray (10YR 6/2) fine sandy loam; weak, medium, platy structure; friable when moist; slightly acid; clear, smooth boundary.

B1—12 to 18 inches, light brownish-gray (10YR 6/2) loam; many, medium, distinct, dark yellowish-brown (10YR 4/4) and faint grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable when moist; few, small, very dark brown (10YR 2/2) concretions of manganese and iron; medium acid; clear, smooth boundary.

B21t—18 to 32 inches, grayish-brown (10YR 5/2) sandy clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, coarse, subangular blocky structure; firm when moist; few light-gray (10YR 6/1) clay films on ped faces; few, small, black (10YR 2/1) concretions of manganese and iron; medium acid; clear, wavy boundary.

B22t—32 to 46 inches, gray (10YR 5/1) heavy sandy loam or sandy clay loam; many, coarse, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; firm when moist; few light-gray (10YR 6/1) clay films; slightly acid; clear, irregular boundary.

C—46 to 55 inches +, strong-brown (7.5YR 5/6) and gray (10YR 5/1), stratified silt and fine sand; massive; friable when moist; calcareous.

The Ap horizon ranges from dark grayish-brown to brown in color and from loam to fine sandy loam in texture. The B21t horizon ranges from sandy clay loam to light clay loam in texture. The B22t horizon ranges from gray to dark gray in color. The depth to the C horizon ranges from 36 to 60 inches.

Ayrshire fine sandy loam, 0 to 2 percent slopes (AsA).—This soil is on broad flats.

Corn, soybeans, small grain, hay, and pasture can be grown if a drainage system is established and maintained. Vegetable crops can be grown under irrigation. Water for irrigation can be obtained in the vicinity of Rogers Ditch and Highway 58, where water-bearing sand and gravel occur below a depth of 50 inches. Crops respond well to lime and fertilizer. Wetness is the major limitation. (Capability unit IIw-2; woodland group 5)

Ayrshire fine sandy loam, 2 to 4 percent slopes (AsB).—This soil is on long slopes and short, irregular slopes at the head of drainageways. Included in mapping were small areas of moderately eroded and severely eroded soils and a few very small areas that have a surface layer of loamy fine sand.

Corn, soybeans, small grain, hay, and pasture can be grown if a drainage system is established and erosion controlled. The available moisture capacity is high. Wetness is the major limitation, and erosion is a hazard. (Capability unit IIw-2; woodland group 5)

Ayrshire loam, 0 to 2 percent slopes (AyA).—This soil occurs as small areas on broad flats.

Corn, soybeans, small grain, hay, and pasture can be grown if a drainage system is established and maintained. Vegetable crops can be grown under irrigation. Water for irrigation can be obtained in the vicinity of Rogers Ditch and Highway 58, where water-bearing sand and gravel occur below a depth of 50 inches. Crops respond well to lime and fertilizer. Wetness is the major limitation. (Capability unit IIw–2; woodland group 5)

Bloomfield Series

The Bloomfield series consists of deep, somewhat excessively drained soils that have a coarse-textured surface layer and subsoil. In the subsoil are thin, discontinuous, horizontal bands of moderately fine textured to moderately coarse textured material. These soils are on uplands. The native vegetation was mixed hardwood forest.

A typical profile has a 25-inch surface layer of loamy fine sand, dark brown in the uppermost 8 inches, brown in the middle 11 inches, and light yellowish brown in the lower part. Below this is about 45 inches of light yellowish-brown, friable fine sand with horizontal bands of light sandy clay loam and sandy loam. The underlying material is light yellowish-brown to strong-brown, very friable fine sand.

Permeability is rapid, surface runoff is slow to medium, and the available moisture capacity is low. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Gently sloping to steep soils of this series occur on the uplands, as a narrow band that roughly parallels the Wabash River.

Typical profile of Bloomfield loamy fine sand in a cultivated field, at a point 300 feet east and 50 feet north of the southwest corner of the NE¼SE¼ sec. 9, T. 9 N., R. 10 W., south-facing cut along a railroad track.

Ap—0 to 8 inches, dark-brown (10YR 3/3) loamy fine sand; weak, fine, granular structure; very friable when moist; medium acid; abrupt, smooth boundary.

A21—8 to 19 inches, brown (10YR 5/3) loamy fine sand; single grain; very friable when moist; medium acid; clear, smooth boundary.

A22—19 to 25 inches, light yellowish-brown (10YR 6/4) loamy fine sand; single grain; very friable when moist; slightly acid; abrupt, smooth boundary.

B&A—25 to 70 inches, light yellowish-brown (10YR 6/4) fine sand; wavy, discontinuous bands of reddish-brown (5YR 4/4) light sandy clay loam and sandy loam; in the upper part of the horizon the textural bands are 4 to 6 inches apart and 1 to 4 inches thick; they make up about half of the lower part of the horizon; sandy loam and sandy clay loam bands have weak, medium, subangular blocky structure, and the fine sand is single grain; friable when moist; medium acid grading with depth to neutral; clear, wavy boundary.

C—70 to 120 inches +, banded, light yellowish-brown (10YR 6/4) to strong-brown (7.5YR 5/8) fine sand; single grain; very friable when moist; calcareous.

The Ap horizon ranges from dark brown to brown in color. The A2 horizon is loamy sand to loamy fine sand. The depth to the B&A horizon ranges from 24 to 36 inches. The bands in the B&A horizon range from 1 inch to 4 inches in thickness and are 2 to 10 inches apart.

Bloomfield loamy fine sand, 2 to 6 percent slopes (BlB).—This soil is on ridgetops and at the base of steeper slopes. Included in mapping were a few small areas of nearly level sandy soils.

Orchard fruits, melons, corn, soybeans, small grain, alfalfa, and hay are suitable crops. The low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. Erosion is a hazard. (Capability unit IIIs–1; woodland group 15)

Bloomfield loamy fine sand, 6 to 12 percent slopes (BlC).—This soil has short slopes. The topography is hummocky. Included in mapping were a few small areas of moderately eroded sandy soils.

Orchard fruits, melons, corn, soybeans, small grain, alfalfa, and hay are suitable crops. The low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. Erosion is a hazard. (Capability unit IIIe–12; woodland group 15)

Bloomfield loamy fine sand, 12 to 18 percent slopes (BlD).—This soil is on uplands next to larger areas of moderately sloping soils. Included in mapping were small areas of moderately eroded sandy soils.

Orchard fruits, melons, small grain, alfalfa, and hay are suitable crops. Crops respond well to fertilizer. Erosion resulting from medium surface runoff is a hazard, and the low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IVe–12; woodland group 15)

Bloomfield loamy fine sand, 18 to 40 percent slopes (BlF).—This soil is on escarpments or breaks along drainageways on deeply dissected uplands. Included in mapping were small areas of moderately eroded sandy soils.

This soil needs a cover of permanent vegetation. It is suitable for permanent pasture and for Christmas trees. Pasture crops respond well to lime and fertilizer. Erosion resulting from medium surface runoff is a hazard, and the low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, pasture yields are generally low. (Capability unit VIe–3; woodland group 15)

Carlisle Series

The Carlisle series consists of deep, very poorly drained organic soils in depressions. These soils are on terraces. They formed in decomposed sedges, grasses, and woody plants.

A typical profile has a 10-inch surface layer of black muck. Below this is about 12 inches of very dark brown, friable muck. Both layers contain many small fragments of wood and peat. The underlying material is dark-brown, coarse, fibrous peat that contains wood and grass fragments.

Permeability is moderate to rapid, and the available moisture capacity is high. The surface layer is slightly acid to medium acid unless it has been limed.

Soils of this series occur along the Wabash River in the vicinity of Merom Station. The areas are not extensive.

Typical profile of Carlisle muck in a cultivated field, at a point 270 feet east and 20 feet south of the northwest corner of the NW¼NE¼ sec. 28, T. 7 N., R. 10 W.

1—0 to 10 inches, black (10YR 2/1) muck; weak, medium, granular structure; friable when moist; many, small, yellowish-red (5YR 4/8) fragments of wood and peat; slightly acid; gradual, wavy boundary.

2—10 to 22 inches, very dark brown (10YR 2/2) muck; moderate, medium, granular structure; friable when moist; many, small, yellowish-red (5YR 4/8) and dark-brown (7.5YR 3/2) fragments of peat and wood; slightly acid; diffuse, wavy boundary.

3—22 to 50 inches +, dark-brown (7.5YR 3/2–4/4) peat and rotting peat; contains wood and grass fragments; coarse, fibrous; slightly acid.

The surface layer ranges from black to very dark brown in color. The number of partly decomposed fragments in the upper 22 inches ranges from few to many. The material below a depth of 22 inches is usually peat, but in some areas the muck extends to a depth of 30 to 36 inches. The reaction is slightly acid to medium acid.

Carlisle muck (Ca).—This soil is in depressions on terraces along the Wabash River. The slope range is 0 to 2 percent. Included in mapping were small areas that have thin layers of mineral soils.

All the crops commonly grown in the county can be grown if a drainage system is established and maintained. Corn and soybeans are the main crops. Crops respond well to lime and fertilizer. Wetness is a limitation, and surface ponding is a hazard. (Capability unit IIw–10; woodland group 23)

Cincinnati Series

The Cincinnati series consists of deep, well-drained soils that have a medium-textured surface layer and a medium-textured to moderately fine textured subsoil. A firm, brittle fragipan occurs at a depth of 26 to 32 inches. These soils are on uplands. They formed in 10 to 40 inches of loess over weathered loam or clay loam till. The native vegetation was hardwood forest.

A typical profile has an 11-inch surface layer of silt loam, dark grayish brown in the upper 6 inches and yellowish brown in the lower part. The subsoil extends to a depth of 130 inches. The uppermost 18 inches is dark yellowish-brown, firm silty clay loam. Below this is a 22-inch fragipan of dark yellowish-brown silt loam. Below the fragipan is a very thick layer of friable to firm, yellowish-brown loam to clay loam streaked with gray. The underlying material is friable, yellowish-brown till streaked with light gray.

Permeability is slow, surface runoff is slow to rapid, and the available moisture capacity is medium. The organic-matter content is low. The surface layer is strongly acid unless it has been limed.

Gently sloping to very steep soils of this series occur on the uplands in the northern and eastern parts of this county.

Typical profile of Cincinnati silt loam in a cultivated field, at a point 200 feet east and 150 feet south of the northwest corner of the SE¼ sec. 36, T. 8 N., R. 8 W.

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable when moist; medium acid; abrupt, smooth boundary.

A2—6 to 11 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, platy structure; friable when moist; medium acid; clear, smooth boundary.

B21t—11 to 22 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; moderate, fine and medium, subangular blocky structure; firm when moist; strongly acid; clear, smooth boundary.

B22t—22 to 29 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium and coarse, subangular blocky structure; firm when moist; thin, brown (10YR 5/3) clay films on ped faces; strongly acid; clear, smooth boundary.

IIBx—29 to 51 inches, dark yellowish-brown (10YR 4/4) gritty silt loam; many, medium, distinct, grayish-brown (10YR 5/2) mottles; weak, coarse, prismatic structure breaking to weak, coarse, subangular blocky; fragipan; firm when moist; light-gray (10YR 7/1) silt coatings on ped faces and vertical cracks; strongly acid; clear, smooth boundary.

IIB3—51 to 130 inches, yellowish-brown (10YR 5/4–5/6) loam to clay loam; gray (10YR 6/1) silt streaks and clay films; massive; friable to firm when moist; medium acid grading with depth to slightly acid; irregular, diffuse boundary.

IIC—130 to 140 inches +, yellowish-brown (10YR 5/8) loam till; light-gray (10YR 7/1) streaks; massive; friable when moist; calcareous.

The Ap horizon ranges from dark grayish brown to brown in color. The depth to the fragipan ranges from 26 to 32 inches. The fragipan ranges from 18 to 40 inches in thickness and from light silty clay loam to loam in texture. The underlying material is medium acid to mildly alkaline.

Cincinnati silt loam, 2 to 6 percent slopes, eroded (CnB2).—This soil is on ridgetops on the uplands. From 3 to 5 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the yellowish-brown subsoil. Included in mapping were a few small areas of slightly eroded soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Alfalfa is less suitable, because the fragipan restricts the development of roots and the movement of water. Crops respond well to lime and fertilizer. The available moisture capacity is medium. Nevertheless, in years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. Erosion is a hazard. (Capability unit IIe–7; woodland group 9)

Cincinnati silt loam, 6 to 12 percent slopes, eroded (CnC2).—This soil is on slopes below ridgetops and in natural draws. From 3 to 5 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the yellowish-brown subsoil. Included in mapping were small areas of slightly eroded soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Alfalfa is less suitable, because the fragipan restricts the development of roots and the movement of water. Crops respond well to lime and fertilizer. The available moisture capacity is medium. Nevertheless, in years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. Erosion resulting from medium surface runoff is the major hazard. (Capability unit IIIe–7; woodland group 9)

Cincinnati silt loam, 6 to 12 percent slopes, severely eroded (CnC3).—This soil is on uplands along drainageways and below ridgetops. From 6 inches to all of its surface layer has been lost through erosion. The present surface layer is mostly original subsoil. Included in mapping were small areas of slightly eroded soils.

Small grain, hay, and pasture are suitable crops. Alfalfa is less suitable because the fragipan restricts the development of roots and the movement of water. Corn and soybeans can be grown occasionally, but the hazard of erosion is very high. Crops respond well to lime and fertilizer. The available moisture capacity is medium. Nevertheless, in years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. Erosion resulting from rapid runoff is the major hazard. (Capability unit IVe–7; woodland group 9)

Cincinnati silt loam, 12 to 18 percent slopes, eroded (CnD2).—This soil is on uplands, mostly on slopes below ridgetops and in natural draws. From 3 to 5 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the yellowish-brown subsoil. Included in mapping were small areas of slightly eroded soils that have remained in woods or permanent pasture. There are scattered gullies.

Small grain, hay, and pasture are suitable crops. Alfalfa is less suitable, because the fragipan restricts the development of roots and the movement of water. Row crops can be grown if intensive erosion control practices are used. Crops respond well to lime and fertilizer. The available moisture capacity is medium. Nevertheless, in years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. Erosion resulting from rapid runoff is the major hazard. (Capability unit IVe–7; woodland group 9)

Cincinnati silt loam, 12 to 18 percent slopes, severely eroded (CnD3).—This soil is on uplands, on sides of natural draws, and below ridgetops. From 6 inches to all of its original surface layer has been lost through erosion. The present surface layer is mostly original subsoil. Included in mapping were small areas of moderately eroded soils. A few gullies have formed in each area.

Hay and pasture crops can be grown on this soil. Pasture crops respond well to lime and fertilizer. The available moisture capacity is medium. Erosion resulting from rapid runoff is the major hazard. (Capability unit VIe–1; woodland group 9)

Cory Series

This series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and a medium-textured to moderately fine textured subsoil. These soils are on uplands. They formed in loess. The native vegetation was prairie grass.

A typical profile has a 13-inch surface layer of silt loam, very dark grayish brown in the upper 8 inches and light brownish gray in the lower part. The subsoil is 39 inches thick and consists of three layers. The uppermost 6 inches is light brownish-gray, friable heavy silt loam. The next 23 inches is gray, firm silty clay loam. The rest is yellowish-brown, firm light silty clay loam. The underlying material is yellowish-brown, friable silt loam. All layers except the upper 8 inches of the surface layer are mottled.

Permeability and surface runoff are slow, and the available moisture capacity is high. The organic-matter content is high. The surface layer is medium acid unless it has been limed.

Nearly level soils of this series occur on the uplands in the northern part of this county, near Farmersburg.

Typical profile of Cory silt loam in a cultivated field, at a point 440 feet south and 50 feet west of the northeast corner of the SE¼NW¼ sec. 6, T. 9 N., R. 8 W.

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, medium, granular structure; friable when moist; medium acid; abrupt, smooth boundary.

A2—8 to 13 inches, light brownish-gray (10YR 6/2) silt loam; many, fine, distinct, yellowish-brown (10YR 5/6) mottles; friable when moist; weak, thick, platy structure; few old root holes and wormholes are filled with dark grayish-brown (10YR 4/2) silt loam; very strongly acid; clear, wavy boundary.

B1—13 to 19 inches, light brownish-gray (10YR 6/2) heavy silt loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable when moist; very strongly acid; clear, wavy boundary.

B21t—19 to 42 inches, gray (10YR 5/1) silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, prismatic structure breaking to moderate, medium, angular and subangular blocky; firm when moist; many, soft, black (10YR 2/1) concretions of iron and manganese; thick, gray (10YR 6/1) clay films on most ped faces and thick, light-gray (10YR 7/1) silt films on many of the prisms; medium acid; clear, wavy boundary.

B22t—42 to 52 inches, yellowish-brown (10YR 5/8) light silty clay loam; many, medium, distinct, gray (10YR 6/1) mottles; weak, coarse, subangular blocky structure; firm when moist; few, soft, black (10YR 2/1) concretions of iron and manganese; medium acid; gradual, wavy boundary.

C—52 to 60 inches +, yellowish-brown (10YR 5/8) silt loam; common, medium, distinct, gray (10YR 5/1) mottles; massive; friable; some dark-gray (10YR 4/1) clay flows; slightly acid.

The Ap horizon ranges from very dark gray to very dark grayish brown in color and from 7 to 10 inches in thickness. The depth to mottling ranges from 7 to 15 inches. The C horizon is medium acid to slightly acid.

Cory silt loam (Co).—This soil occurs mainly as areas 4 to 12 acres in size, but a few areas are as much as 60 acres in size. The slope range is 0 to 2 percent. Included in mapping were a few small areas of Iva silt loam, 0 to 2 percent slopes.

Corn, soybeans, hay, and pasture can be grown if a drainage system is established and maintained. Crops respond well to lime and fertilizer. Wetness is the major limitation. (Capability unit IIw–2; woodland group 23)

Cuba Series

The Cuba series consists of deep, well-drained soils that have a medium-textured surface layer and subsoil. These soils are on bottom lands. They formed in material washed from upland areas. The native vegetation was mixed hardwood forest.

A typical profile has a 9-inch surface layer of dark grayish-brown silt loam. The subsoil is about 27 inches of dark yellowish-brown, friable silt loam. The underlying material is brown and yellowish-brown, friable silt loam.

Permeability is moderate, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is strongly acid or medium acid unless it has been limed.

Nearly level soils of this series occur on narrow creek bottoms in the eastern half of this county.

Typical profile of Cuba silt loam in a cultivated field, at a point 275 feet west and 50 feet north of the southeast corner of sec. 4, T. 7 N., R. 8 W.

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable when moist; slightly acid; clear, smooth boundary.

B2—9 to 36 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine, granular structure; friable when moist; strongly acid; gradual, smooth boundary.

C—36 to 50 inches +, brown (10YR 5/3) and yellowish-brown (10YR 5/4) silt loam; massive; friable when moist; strongly acid.

The Ap horizon ranges from dark grayish brown to brown in color, and the B horizon ranges from dark brown to dark yellowish brown. In some areas a few faint mottles occur below a depth of 30 inches. The C horizon is dominantly silt loam or loam but contains thin lenses of fine sand. It is medium acid to strongly acid.

Cuba silt loam (Cu).—This soil occurs as narrow bands along small streams and on natural levees on creek bottoms. It is likely to be flooded in winter and spring. The slope range is 0 to 2 percent. Included in mapping were small areas of soils that have a surface layer of loam. Also included were small tracts of moderately well drained soils.

Corn, soybeans, hay, and pasture are suitable crops. Small grain and alfalfa are less suitable because they are severely damaged by flooding. Crops respond well to lime and fertilizer. Flooding is the major hazard. (Capability unit I–2; woodland group 8)

Eel Series

This series consists of deep, moderately well drained soils that have a medium-textured surface layer and subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was mixed hardwood forest.

A typical profile has an 8-inch surface layer of dark grayish-brown silt loam. The subsoil is about 8 inches of dark-brown, friable silt loam. The upper 14 inches of the underlying material is dark yellowish-brown, mottled, friable silt loam stratified with thin layers of fine sandy loam. The lower part to a depth of more than 50 inches is grayish-brown, mottled, friable, stratified silt loam, loam, and sandy loam.

Permeability is moderate, surface runoff is slow to very slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer and the underlying material are slightly acid to mildly alkaline.

Nearly level soils of this series occur on bottom lands of the Wabash River.

Typical profile of Eel silt loam in a cultivated field, at a point 120 feet east and 30 feet south of the northwest corner of the SE¼NW¼ sec. 6, T. 9 N., R. 10 W.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B2—8 to 16 inches, dark-brown (10YR 4/3) silt loam; weak, coarse, granular structure; friable when moist; neutral; gradual, wavy boundary.

C1—16 to 30 inches, dark yellowish-brown (10YR 4/4) silt loam stratified with thin layers of fine sandy loam; common, medium, distinct, grayish-brown (10YR 5/2) mottles; massive; friable when moist; gradual, wavy boundary.

C2—30 to 50 inches +, grayish-brown (10YR 5/2), stratified silt loam, loam, and sandy loam; many, fine, distinct, dark-brown (10YR 4/3) mottles; massive; friable when moist; neutral.

The Ap horizon ranges from dark grayish brown to brown in color, and the C1 horizon from dark yellowish brown to yellowish brown. The depth to mottling ranges from 16 to 24 inches. The C horizon is mainly loam or light silty clay loam but contains thin strata of sandy loam. It is neutral to mildly alkaline.

Eel silt loam (Es).—This soil is in the natural drainageways on large bottom lands. It is slightly lower than the surrounding well-drained soils on bottom lands. It is likely to be flooded in winter and spring. The slope range is 0 to 2 percent. Included in mapping were small areas of somewhat poorly drained soils and a few areas of moderately well drained soils that have a surface layer of loam.

Row crops, hay, and pasture are suitable. Alfalfa and small grain are less suitable because they are damaged by flooding. Flooding between December and June is the major hazard, and wetness is a slight limitation. (Capability unit I–2; woodland group 8)

Elston Series

The Elston series consists of deep, well-drained soils that have a medium-textured to moderately coarse textured surface layer and a moderately coarse textured to moderately fine textured subsoil. These soils are on terraces. They formed in loamy material. The native vegetation was prairie grass.

A typical profile has a 14-inch surface layer of loam. The upper 8 inches is very dark brown to very dark gray, and the lower part is very dark brown. The subsoil is about 44 inches thick. The upper 23 inches is dark-brown and brown, friable to firm heavy loam and light sandy clay loam. The lower part is dark yellowish-brown, friable sandy loam. The underlying material, at a depth of 58 inches, is brown, loose sand interbedded with thin layers of gravel.

Permeability is moderate, surface runoff is slow, and the available moisture capacity is medium. The organic-matter content is high. The surface layer is medium acid unless it has been limed.

Nearly level to gently sloping soils of this series occur on terraces east of the Wabash River, in the southwestern part of this county.

Typical profile of Elston loam in a cultivated field, at a point 175 feet south and 135 feet east of the northwest corner of the NW¼SE¼ sec. 34, T. 7 N., R. 10 W.

Ap—0 to 8 inches, very dark brown (10YR 2/2) to very dark gray (10YR 3/1) loam; weak, medium, granular structure; friable when moist; medium acid; abrupt, smooth boundary.

A1—8 to 14 inches, very dark brown (10YR 2/2) loam; moderate, coarse, granular structure; friable when moist; medium acid; clear, smooth boundary.

B21t—14 to 25 inches, dark-brown (10YR 3/3) heavy loam; crushes to brown (10YR 4/3); weak to moderate, fine, subangular blocky structure; friable when moist; thin clay films on most ped faces; medium acid; clear, smooth boundary.

B22t—25 to 37 inches, brown (10YR 5/3) light sandy clay loam; moderate, medium, subangular blocky structure; firm when moist; thin clay films on ped faces; medium to strongly acid; clear, smooth boundary.

B3—37 to 58 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, coarse, subangular blocky structure; friable when moist; scattered small pebbles; strongly acid; clear, smooth boundary.

IIC—58 to 64 inches +, brown (10YR 5/3) stratified sand; interbedded with thin layers of gravelly sand and fine gravel; loose; slightly acid.

The Ap horizon ranges from black to very dark grayish brown in color and from 12 to 16 inches in thickness. The colors of the B horizon include brown, dark brown, and dark yellowish brown. The texture of the B21t and B22t horizons is loam, light sandy clay loam, or light clay loam. The depth to the IIC horizon ranges from 36 to 60 inches. This horizon is medium acid to slightly acid in the upper part and becomes mildly alkaline with depth.

Elston fine sandy loam, 0 to 2 percent slopes (EtA).—This soil is on broad terraces along the Wabash River. Included in mapping were small areas of gently sloping, sandy soils.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Surface runoff is very slow. The medium available moisture capacity and slight droughtiness are limitations. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIIs–2; woodland group 23)

Elston fine sandy loam, 2 to 6 percent slopes (EtB).—This soil is on short breaks on broad terraces along the Wabash River. Included in mapping were small areas of moderately eroded sandy soils. Also included were a few areas of moderately sloping sandy soils.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Erosion resulting from slow surface runoff is a hazard. The medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIIe–13; woodland group 23)

Elston loam, 0 to 2 percent slopes (EuA).—This soil is on broad terraces along the Wabash River. It is the most extensive of the Elston soils. Included in mapping were a few small areas of soils that have a surface layer of silt loam.

Corn, soybeans, grain sorghum, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Surface runoff is slow. The medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. (Capability unit IIs–2; woodland group 23)

Elston loam, 2 to 6 percent slopes (EuB).—This soil is on breaks below nearly level terraces along the Wabash River. Included in mapping were small areas of moderately eroded sandy soils.

Corn, soybeans, grain sorghum, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Crops respond well to fertilizer. Erosion is a hazard. The medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. Because of the short and irregular slopes, erosion control practices are limited to minimum tillage, contour farming, and the use of winter cover crops. (Capability unit IIe–8; woodland group 23)

Fox Series

The Fox series consists of deep, well-drained soils that have a medium-textured to moderately coarse textured surface layer and a moderately fine textured subsoil. These soils are on terraces. They formed in 24 to 42 inches of outwash over gravel and sand. The native vegetation was mixed hardwood forest.

A typical profile has an 8-inch surface layer of brown loam. The subsoil is about 33 inches thick. The upper 11 inches is brown to reddish-brown, firm clay loam. The lower part is reddish-brown, firm gravelly clay loam. The underlying material is brown, stratified, loose gravel and sand.

Permeability is moderate, surface runoff is slow, and the available moisture capacity is medium to low. The organic-matter content is low.

Nearly level to gently sloping soils of this series occur on gravelly terraces in the southwestern part of this county.

Typical profile of Fox loam in a cultivated field (now a gravel pit), at a point 150 feet north and 125 feet east of the southwest corner of the NE¼ sec. 7, T. 9 N., R. 10 W.

Ap—0 to 8 inches, brown (10YR 5/3) loam; weak, fine, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

B1t—8 to 12 inches, brown (7.5YR 4/4) light clay loam; moderate, medium, angular and subangular blocky structure; firm when moist; medium acid; clear, smooth boundary.

B21t—12 to 19 inches, reddish-brown (5YR 4/4) clay loam; some gravel in lower part; moderate, medium and coarse, angular and subangular blocky structure; firm when moist; thin, dark-brown (7.5YR 3/2) and dark reddish-brown (5YR 3/4) clay films on ped faces; medium acid; clear, wavy boundary.

B22t—19 to 41 inches, reddish-brown (5YR 4/3) gravelly clay loam; moderate, medium and coarse, subangular blocky structure; firm when moist; thin, dark-brown (7.5YR 3/2) clay films on ped faces; medium acid; abrupt, irregular boundary; tongues 6 to 12 inches thick extend into the underlying material.

IIC—41 to 60 inches +, brown (10YR 5/3) stratified gravel and sand; loose; calcareous.

The Ap horizon ranges from dark grayish brown to brown in color and from loam to sandy loam in texture. In some places where the Ap horizon is sandy loam, the B2 horizon is sandy clay loam. The tongues of B2 material that extend into the IIC horizon vary in thickness and number. The depth to the IIC horizon ranges from 24 to 42 inches.

Fox sandy loam, 0 to 2 percent slopes (FsA).—This soil is on broad terraces along the Wabash River.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Permeability is moderate, and surface runoff is slow. The low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to very severe damage from drought. (Capability unit IIIs–2; woodland group 2)

Fox sandy loam, 2 to 6 percent slopes (FsB).—This soil is on breaks on broad terraces along the Wabash River.

Included in mapping were small areas of gently sloping and moderately sloping soils that are moderately eroded.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Erosion is a hazard, and the low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIIe–13; woodland group 2)

Fox loam, 0 to 2 percent slopes (FxA).—This soil is on broad terraces east of the Wabash River. Included in mapping were a few small tracts that have a surface layer of silt loam.

Corn, soybeans, grain sorghum, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Permeability is moderate, and surface runoff is slow. The medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. (Capability unit IIs–1; woodland group 1)

Genesee Series

The Genesee series consists of deep, well-drained soils that have a medium-textured surface layer and subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was mixed hardwood forest.

A typical profile has a 9-inch surface layer of dark grayish-brown silt loam. The subsoil is about 21 inches of brown, friable loam. The underlying material is dark yellowish-brown to yellowish-brown, friable, stratified loam, fine sandy loam, and silt loam.

Permeability is moderate, surface runoff is slow to very slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer and the underlying material are slightly acid to mildly alkaline.

Nearly level soils of this series occur on bottom lands of the Wabash River.

Typical profile of Genesee silt loam in a cultivated field, at a point 700 feet north and 250 feet west of the southeast corner of the NE¼NE¼ sec. 1, T. 9 N., R. 11 W.

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B2—9 to 30 inches, brown (10YR 4/3) loam; massive to very weak, coarse, granular structure; friable when moist; neutral; clear, smooth boundary.

C—30 to 50 inches +, dark yellowish-brown (10YR 4/4) to yellowish-brown (10YR 5/4), stratified loam, fine sandy loam, and silt loam; weak, coarse, granular structure; friable when moist; neutral.

The Ap horizon ranges from dark grayish brown to brown in color, and the B horizon from brown to dark yellowish brown. The texture of the C horizon ranges from loam, fine sandy loam, and silt loam to light silty clay loam that contains lenses of sand. The reaction of the C horizon is neutral to mildly alkaline.

Genesee silt loam (Gs).—This soil is on broad bottom lands along the Wabash River. The slope range is 0 to 2 percent. Most areas are protected by levees (fig. 3), but flooding resulting from seepage and surface runoff occurs in some areas. Included in mapping were small areas of moderately well drained soils on drainageways. Also included were a few small areas of soils that have a surface layer of loam.

All the crops commonly grown in the county are suitable, but alfalfa and small grain are likely to be severely damaged by prolonged floods. Flooding between the months of December and June is the major hazard. (Capability unit I–2; woodland group 8)

Genesee Series, Sandy Variant

The Genesee series, sandy variant, consists of deep, well-drained soils that have a moderately coarse textured surface layer and a medium-textured to moderately coarse textured subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was mixed hardwood forest.

A typical profile has an 8-inch surface layer of dark grayish-brown fine sandy loam. The upper 4 inches of the subsoil is brown, very friable fine sandy loam, and the lower 4 inches is dark-brown, friable loam. The underlying material is yellowish-brown, very friable fine sandy loam over stratified loam, fine sandy loam, and loamy fine sand.

Permeability is moderately rapid, surface runoff is slow, and the available moisture capacity is medium. The organic-matter content is low. The surface layer is slightly acid to mildly alkaline.

Nearly level soils of this series occur on bottom lands near old channels and oxbows of the Wabash River.

Typical profile of Genesee fine sandy loam, sandy variant, in a cultivated field, at a point 450 feet south and 150 feet west of the northeast corner of the NW¼ sec. 9, T. 8 N., R. 11 W.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable when moist; neutral; abrupt, smooth boundary.

B21—8 to 12 inches, brown (10YR 5/3) fine sandy loam; weak, fine, granular structure; very friable when moist; neutral; clear, smooth boundary.

B22—12 to 16 inches, dark-brown (10YR 3/3) loam; weak, fine, granular structure; friable when moist; neutral; clear, smooth boundary.

C1—16 to 24 inches, yellowish-brown (10YR 5/4) fine sandy loam; massive; very friable when moist; neutral; gradual, wavy boundary.

C2—24 to 48 inches, yellowish-brown (10YR 5/4) stratified loam, fine sandy loam, and loamy fine sand (the layers of loamy fine sand are 2 to 4 inches thick); very friable when moist; calcareous.

The Ap horizon ranges from dark grayish brown to brown in color. It is slightly acid to mildly alkaline. The B horizon commonly consists of 1-inch to 10-inch layers of loam and fine sandy loam. Thin strata of fine sand and minor amounts of gravel are in the C2 horizon in some areas. The C horizon is neutral to mildly alkaline.

Genesee fine sandy loam, sandy variant (Gn).—This soil is on natural levees near stream channels and oxbows. It is likely to be flooded in winter and spring. The slope range is 0 to 2 percent. Included in mapping were areas of soils that have a surface layer of loamy fine sand.

Corn, soybeans, grain sorghum, hay, and pasture are suitable crops. Alfalfa and small grain are less suitable, because they are subject to damage from overflow in some areas. Crops respond well to fertilizer. Flooding between the months of December and June is the major hazard. In years when rainfall is less than normal or is poorly

Figure 3.—Levee (background) on Genesee silt loam. Pumping plant and structure at right discharge surface water through the levee into the Wabash River.

distributed, crops are subject to damage from drought. (Capability unit I–2; woodland group 8)

Gullied Land

Gullied land (Gu) (fig. 4) occurs on uplands throughout the county. It has moderate to strong slopes. The areas are 3 to 20 acres in size and are associated with areas of Alford, Cincinnati, Hickory, and Princeton soils. Most of the areas of Gullied land are underlain by till, but a few are underlain by sandstone and shale.

This land type needs a cover of permanent vegetation. It is suited to trees, grass, and shrubs. Some areas are well suited to Christmas trees. Most areas have been abandoned. Weeds, grass, and a few trees are starting to grow. Some areas have been planted to trees. Runoff and erosion are the major hazards. A cover of permanent vegetation would help to stabilize the soil material and control runoff and would provide cover for wildlife. (Capability unit VIIe–4; woodland group 3)

Henshaw Series

The Henshaw series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are on terraces. They formed in lakebed deposits. The native vegetation was mixed hardwood forest.

A typical profile has a 12-inch surface layer of silt loam, dark grayish brown in the upper 8 inches and pale brown in the lower part. The subsoil is about 30 inches of firm silty clay loam, pale brown in the uppermost 4 inches, light yellowish brown in the next 8 inches, light brownish gray in the next 9 inches, and light yellowish brown below that. The subsoil is mottled throughout. The underlying material is gray, mottled, friable, stratified silty clay loam and silt loam.

Permeability and surface runoff are slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Nearly level to gently sloping soils of this series occur on terraces in the south-central and northwestern parts of this county.

Typical profile of Henshaw silt loam in a cultivated field, at a point 300 feet north and 100 feet west of the southeast corner of the NE¼SE¼ sec. 29, T. 7 N., R. 9 W.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; friable when moist; neutral; clear, smooth boundary.

A2—8 to 12 inches, pale-brown (10YR 6/3) silt loam; few, medium, distinct, yellowish-brown (10YR 5/4) mottles;

Figure 4.—Gullied land.

weak, medium, granular structure; friable when moist; neutral; clear, smooth boundary.

B21t—12 to 16 inches, pale-brown (10YR 6/3) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/4–5/8) mottles; moderate, medium, subangular blocky structure; firm when moist; thin, discontinuous, gray (10YR 5/1) clay films on ped faces; strongly acid; gradual, smooth boundary.

B22t—16 to 24 inches, light yellowish-brown (10YR 6/4) silty clay loam; many, medium, faint, gray (10YR 6/1) mottles; moderate, medium, subangular blocky structure; firm when moist; thin, discontinuous, gray (10YR 5/1) clay films on ped faces; strongly acid; clear, smooth boundary.

B23t—24 to 33 inches, light brownish-gray (10YR 6/2) silty clay loam; many, medium, prominent, yellowish-brown (10YR 5/4–5/6) mottles; weak, medium, prismatic structure breaking to moderate, medium, angular blocky; firm when moist; thin, gray (10YR 5/1) clay films on ped faces; fine, common, black (10YR 2/1) concretions of iron and manganese; strongly acid; gradual, smooth boundary.

IIB3—33 to 42 inches, light yellowish-brown (10YR 6/4) heavy silty clay loam; many, medium, faint, yellowish-brown (10YR 5/4) mottles; weak, coarse, prismatic structure breaking to weak, coarse, subangular blocky; firm when moist; thin, gray (10YR 5/1) clay films on ped faces; common, medium, black (10YR 2/1) concretions of iron and manganese; slightly acid; gradual, smooth boundary.

IIC—42 to 60 inches +, gray (10YR 6/1), stratified silty clay loam and silt loam; many, coarse, prominent, yellowish-brown (10YR 5/8) mottles; massive; friable when moist; calcareous (soft concretions of carbonate).

The Ap horizon ranges from dark grayish brown to brown in color and from 8 to 12 inches in thickness. The depth to mottling ranges from 6 to 12 inches. The B2 horizon ranges from silty clay loam to light silty clay in texture. The depth to the C horizon ranges from 34 to 50 inches.

Henshaw silt loam, 0 to 2 percent slopes (HeA).—This soil is in broad lakebeds on terraces. Included in mapping were small areas of moderately eroded soils at the head of drainageways.

Corn, soybeans, small grain, hay, and pasture can be grown if a drainage system is established and maintained. Wetness is the major limitation. (Capability unit IIw–2; woodland group 5)

Henshaw silt loam, 2 to 4 percent slopes, eroded (HeB2).—This soil occurs as small, narrow areas at the base of more steeply sloping soils and at the head of small drainageways. From 3 to 5 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were small areas of slightly eroded soils.

Corn, soybeans, small grain, hay, and pasture can be grown if a drainage system is established and maintained. Wetness is the major limitation, and erosion is a hazard. (Capability unit IIw–2; woodland group 5)

Hickory Series

The Hickory series consists of deep, well-drained soils that have a medium-textured surface layer and mainly a moderately fine textured subsoil. These soils are on uplands. They formed in a deposit of no more than 20 inches of loess and the underlying material weathered from till. The native vegetation was mixed hardwood forest.

A typical profile has a 7-inch surface layer of silt loam. The upper 2 inches is very dark gray, and the lower part is pale brown. The subsoil is about 43 inches thick. The uppermost 4 inches is light yellowish-brown, friable silt loam. Below this is 8 inches of yellowish-brown, firm silty clay loam, over 22 inches of strong-brown, firm clay loam. The lowermost 9 inches of the subsoil is yellowish-brown, firm clay loam. The underlying material is grayish-brown, friable loam.

Permeability is moderate, surface runoff is rapid, and the available moisture capacity is high. The organic-matter content is low.

Moderately steep to very steep soils of this series occur on the uplands in the eastern and northern parts of this county.

Typical profile of Hickory silt loam in a wooded area, at a point 450 feet south and 400 feet west of the northeast corner of sec. 23, T. 8 N., R. 8 W.

O2—½ inch to 0, partly decomposed leaf litter; very strongly acid.

A1—0 to 2 inches, very dark gray (10YR 3/1) silt loam; moderate, fine, granular structure; friable when moist; very strongly acid; abrupt, wavy boundary.

A2—2 to 7 inches, pale-brown (10YR 6/3) silt loam; moderate, thick, platy structure; friable when moist; abundant roots; some wormhole fillings of A1 material; very strongly acid; clear, smooth boundary.

B1—7 to 11 inches, light yellowish-brown (10YR 6/4) silt loam; weak, medium, subangular blocky structure; friable when moist; strongly acid; clear, smooth boundary.

IIB21t—11 to 19 inches, yellowish-brown (10YR 5/6), gritty silty clay loam; moderate, medium, subangular blocky structure; firm when moist; strongly acid; clear, wavy boundary.

IIB22t—19 to 41 inches, strong-brown (7.5YR 5/6) clay loam; moderate, medium, subangular blocky structure; firm when moist; few clay films and concretions of manganese; medium acid; gradual, smooth boundary.

IIB3t—41 to 50 inches, yellowish-brown (10YR 5/6) clay loam; weak, coarse, subangular blocky structure; firm when moist; few concretions of manganese; medium acid; gradual, smooth boundary.

IIC—50 to 60 inches +, grayish-brown (10YR 5/2) loam till; massive; friable when moist; calcareous.

In areas used as pasture, the surface layer is dark grayish brown. The B horizon is predominantly clay loam in texture, but it ranges from loam to silty clay loam. It ranges from 24 to 50 inches in thickness and is medium acid to strongly acid in the lower part. The IIC horizon ranges from loam to clay loam in texture.

Hickory silt loam, 18 to 25 percent slopes (HkE).—This soil is on slopes below ridgetops. Included in mapping were small areas of moderately eroded soils.

This soil is suitable for use as permanent pasture and woodland. Runoff and erosion are the major hazards. (Capability unit VIe–1; woodland group 2)

Hickory silt loam, 25 to 35 percent slopes (HkF).—This soil is on the side slopes of natural draws below ridgetops. Included in mapping were small areas of moderately eroded soils. Also included were small areas of soils that have a reddish-brown, rapidly permeable lower subsoil and underlying material.

This soil is suitable for use as permanent pasture and woodland. Runoff and erosion are the major hazards. (Capability unit VIe–1; woodland group 2)

Hickory silt loam, 18 to 35 percent slopes, severely eroded (HkF3).—This soil is on the side slopes of drainageways and in areas below ridgetops. From 5 to 7 inches of its original surface layer has been lost through erosion. The present surface layer is mostly original subsoil. There are a few gullies in some areas. Included in mapping were small areas of moderately eroded soils. Also included were small areas of soils that have a reddish-brown, rapidly permeable subsoil and underlying material. Small tracts of very steep soils occur in some areas.

This soil is suitable for use as woodland. Runoff and erosion are the major hazards. (Capability unit VIe–1; woodland group 2)

Hickory silt loam, 35 to 50 percent slopes (HkG).—This soil is on escarpments and on the side slopes of deep valleys. Included in mapping were small areas of moderately eroded soils.

This soil is suitable for use as woodland. Runoff and erosion are the major hazards. A permanent cover of vegetation helps to control runoff and erosion. (Capability unit VIIe–1; woodland group 4)

Iona Series

The Iona series consists of deep, moderately well drained soils that have a medium-textured surface layer and a moderately fine textured to medium textured subsoil. These soils are on uplands. They formed in silty loess. The native vegetation was mixed hardwood forest.

A typical profile has a 7-inch surface layer of dark grayish-brown silt loam. The subsoil is about 43 inches thick. The uppermost 5 inches is brown, friable light silty clay loam. The middle 22 inches is yellowish-brown, mottled, firm silty clay loam. The rest is light yellowish-brown to brownish-yellow, friable silt loam. The underlying material is light yellowish-brown, friable silt.

Permeability is moderately slow, surface runoff is slow to medium, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Nearly level to gently sloping soils of this series occur on the uplands in the western half of this county.

Typical profile of Iona silt loam in a cultivated field, at a point 300 feet north of the junction of U.S. Highway 41 and State Highway 58, SW¼ sec. 10, T. 6 N., R. 9 W. (distance measured from center of Highway 58).

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B1t—7 to 12 inches, brown (10YR 5/3) light silty clay loam; moderate, fine, subangular blocky structure; friable when moist; few light brownish-gray (10YR 6/2) silt coatings in cracks and on ped faces; medium acid; clear, smooth boundary.

B21t—12 to 20 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, faint, pale-brown (10YR 6/3) mottles; moderate, medium, angular and subangular blocky structure; firm when moist; few, thin, brown (10YR 4/3) clay films on ped faces; medium acid; clear, wavy boundary.

B22t—20 to 34 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, distinct, brownish-yellow (10YR 6/6) and grayish-brown (10YR 5/2) mottles; moderate, medium and coarse, subangular blocky structure; firm when moist; few, thin, brown (10YR 4/3) clay films on ped faces; light brownish-gray (10YR 6/2) silt streaks along vertical cracks; few very dark brown (10YR 2/2) concretions of iron and manganese; strongly acid, grading to slightly acid to neutral in lower part; clear, wavy boundary.

B3—34 to 50 inches, light yellowish-brown (10YR 6/4) to brownish-yellow (10YR 6/6) silt loam; weak, coarse, subangular blocky structure; friable when moist; thin grayish-brown (10YR 5/2) clay films on some ped faces; neutral; clear, wavy boundary.

C—50 to 60 inches +, light yellowish-brown (10YR 6/4) silt; massive; friable when moist; calcareous.

The Ap horizon ranges from dark grayish brown to brown in color. The depth to mottling ranges from 12 to 24 inches. The depth to calcareous material ranges from 36 to 60 inches.

Iona silt loam, 0 to 2 percent slopes (IoA).—This soil is on short, narrow ridges in the southern and western parts of the county. Included in mapping were small areas of somewhat poorly drained soils and small areas of gently sloping soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Crops respond well to lime and fertilizer. Surface runoff is slow. This soil has no serious limitations. (Capability unit I–2; woodland group 1)

Iona silt loam, 0 to 2 percent slopes, eroded (IoB2).—This soil is on narrow ridges and side slopes next to drainageways. From 2 to 4 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were small areas of slightly eroded soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Orchard crops are also suitable. Crops respond well to lime and fertilizer. Erosion resulting from medium surface runoff is the main hazard. (Capability unit IIe–3; woodland group 1)

Iona silt loam, 2 to 6 percent slopes, severely eroded (IoB3).—This soil is at the head of draws and on side slopes below ridgetops. From 5 inches to all of its original surface layer has been lost through erosion. The present surface layer is mostly original subsoil. Included in mapping were a few gullied areas and a few small areas of moderately eroded soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Erosion resulting from medium surface runoff is the main hazard. (Capability unit IIIe–3; woodland group 1)

Iva Series

The Iva series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and mainly a moderately fine textured subsoil. These soils are on uplands. They formed in silty loess. The native vegetation was mixed hardwood forest.

A typical profile has a 12-inch surface layer of silt loam, grayish brown in the upper 9 inches and light brownish gray in the lower part. The subsoil is about 28 inches thick. The uppermost 5 inches is light brownish-gray, mottled, friable silt loam. The middle 13 inches is yellowish-brown and light brownish-gray, firm silty clay loam. The rest is gray to light brownish-gray, mottled, firm light silty clay loam. The underlying material is light yellowish-brown, friable silt loam with yellowish-brown mottles and gray streaks. The reaction of the underlying material is slightly acid.

Permeability is slow, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Nearly level to gently sloping soils of this series occur on the uplands in the eastern half of this county.

Typical profile of Iva silt loam in a cultivated field, at a point 175 feet east and 150 feet south of the northwest corner of the SE¼ sec. 10, T. 8 N., R. 9 W.

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam; moderate, fine to medium, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

A2—9 to 12 inches, light brownish-gray (10YR 6/2) silt loam; few, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak to moderate, thick, platy structure; friable when moist; medium acid; clear, wavy boundary.

B1—12 to 17 inches, light brownish-gray (10YR 6/2) silt loam; common, medium, distinct, dark grayish-brown (10YR 4/2) and yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; friable when moist; few, small, firm, dark-brown (10YR 3/3) concretions of iron and manganese; strongly acid; clear, smooth boundary.

B21t—17 to 30 inches, yellowish-brown (10YR 5/4) and light brownish-gray (10YR 6/2) silty clay loam; moderate, medium, subangular blocky structure; firm when moist; thin gray (10YR 5/1) clay films on peds and as fillings in root channels; few, small, firm, dark-brown (10YR 3/3) concretions of iron and manganese; medium acid; gradual, irregular boundary.

B22tg—30 to 40 inches, gray (10YR 6/1) to light brownish-gray (10YR 6/2) light silty clay loam; many, coarse, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; weak, medium to coarse, subangular blocky structure; firm when moist; many, small, dark-brown (10YR 3/3) concretions of iron and manganese; thin light-gray (10YR 7/2) silt coatings on some ped faces and in crack fills; medium acid in upper part but becomes slightly acid in lower part; gradual, smooth boundary.

C—40 to 50 inches +, light yellowish-brown (10YR 6/4) silt loam; many, medium, distinct, yellowish-brown (10YR 5/4–5/6) mottles and gray (10YR 6/1) streaks; massive; friable when moist; slightly acid.

The Ap horizon ranges from dark grayish brown to grayish brown in color. The depth to mottling ranges from 6 to 15 inches, and the depth to the C horizon ranges from 36 to 50 inches. The C horizon is medium acid to slightly acid.

Iva silt loam, 0 to 2 percent slopes (IvA).—This soil is on broad flats in the uplands. Included in mapping were small areas of gently sloping soils around small natural draws.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Wetness is the major limitation. (Capability unit IIw–2; woodland group 5)

Iva silt loam, 2 to 4 percent slopes, eroded (IvB2).—This soil is on ridges and slopes along drainageways. From 5 to 7 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brownish-gray subsoil. Included in mapping were small areas of severely eroded soils.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Wetness is the major limitation. Erosion is a hazard. (Capability unit IIw–2; woodland group 5)

Kings Series

The Kings series consists of deep, very poorly drained soils that have a fine-textured surface layer and subsoil. These soils are in depressions on lake terraces. They formed in fine-textured, water-deposited sediments. The native vegetation consisted of swamp forest and marsh grass.

A typical profile has a 16-inch surface layer of black silty clay. The lower 10 inches is mottled. The subsoil is about 32 inches thick. The upper 21 inches is dark-gray, mottled, very firm silty clay, and the lower part is gray, mottled, firm silty clay. Vertical cracks in the subsoil are filled with black surface soil. The underlying material is gray, mottled, firm silty clay.

Permeability is very slow, and surface runoff is very slow or ponded. The available moisture capacity is high. The organic-matter content is high. The surface layer is neutral or slightly acid.

Soils of this series occur along the Wabash River.

Typical profile of Kings silty clay in a cultivated field, at a point 50 feet west and 150 feet north of the southeast corner of sec. 4, T. 6 N., R. 10 W.

- Ap—0 to 6 inches, black (10YR 2/1) silty clay; weak, fine, granular structure; firm when moist; neutral; abrupt, smooth boundary.
- A1—6 to 16 inches, black (10YR 2/1) silty clay; few, fine, distinct, brown (10YR 4/4) mottles; weak, fine, angular blocky structure; firm when moist; a few slickensides on ped faces; fresh Ap material in cracks; neutral; gradual, smooth boundary.
- B21g—16 to 26 inches, dark-gray (N 4/0) heavy silty clay; common, fine, distinct, strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/6) mottles; moderate, medium to coarse, angular blocky structure; very firm when moist; black (10YR 2/1) Ap material in cracks; noticeable slickenside faces; neutral; gradual, smooth boundary.
- B22g—26 to 37 inches, dark-gray (N 4/0) silty clay; many, medium, distinct, reddish-brown (5YR 4/3) mottles; very firm when moist; weak, medium, prismatic structure breaking to strong, coarse, angular blocky; very firm when moist; black (10YR 2/1) Ap material in cracks; distinct slickensides; neutral; gradual, wavy boundary.
- B3g—37 to 48 inches, gray (N 5/0) silty clay; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, prismatic structure breaking to moderate, medium, angular blocky; firm when moist; few dark-gray (N 4/0) tubular tongues extend downward; neutral; gradual, wavy boundary.
- Cg—48 to 60 inches +, gray (N 5/0) silty clay; common, medium, distinct, yellowish-brown (10YR 5/8) mottles and few, fine, distinct, dark-brown (7.5YR 4/4) mottles; weak, coarse, angular blocky structure; firm when moist; few light-gray (N 7/0) concretions of lime; calcareous.

The total thickness of the A horizon ranges from 15 to 22 inches. The dark-gray tubular tongues that extend downward from the B3g horizon range from 1 inch to 2 inches in thickness and are 6 to 12 inches apart. The depth to the C horizon ranges from 36 to 60 inches.

Kings silty clay (Kg).—This soil is in depressions on lake terraces near the Wabash River. The slope range is 0 to 2 percent.

All the crops commonly grown in this county can be grown on this soil if a drainage system is established and maintained. Corn and soybeans are the main crops. Small grain and alfalfa are damaged by a high water table during winter and early in spring. Wetness is the major limitation. (Capability unit IIIw–2; woodland group 11)

Lyles Series

The Lyles series consists of deep, very poorly drained soils that have a medium-textured surface layer and a moderately fine textured to moderately coarse textured subsoil. These soils are in depressions on uplands and terraces. The native vegetation was swamp forest.

A typical profile has a 16-inch surface layer of loam, very dark gray in the upper 8 inches and very dark gray to very dark grayish brown in the lower part. The subsoil is about 22 inches thick. The upper 12 inches is dark-gray, mottled, friable heavy loam. The lower part is gray and yellowish-brown, friable, stratified light sandy clay loam and fine sandy loam. The underlying material is light-gray, brown, and brownish-yellow, mottled, friable fine sand stratified with loam to sandy clay loam. The reaction of the underlying material is mildly alkaline.

Permeability is moderate, surface runoff is slow or very slow, and the available moisture capacity is high. The organic-matter content is high. The surface layer is slightly acid or neutral.

Soils of this series occur in depressions on uplands and terraces in the western part of this county, just east of the bottom lands along the Wabash River.

Typical profile of Lyles loam in a cultivated field, at a point 120 feet south and 300 feet west of the northeast corner of sec. 32, T. 6 N., R. 9 W.

- Ap—0 to 8 inches, very dark gray (10YR 3/1) loam; moderate, fine and medium, granular structure; friable when moist; neutral; abrupt, smooth boundary.
- A1—8 to 16 inches, very dark gray (10YR 3/1) to very dark grayish-brown (10YR 3/2) loam; few, small, brown (10YR 4/3) stains; weak to moderate, medium, subangular blocky structure; friable when moist; neutral; clear, smooth boundary.
- B2g—16 to 28 inches, dark-gray (10YR 4/1) heavy loam; common, fine, distinct, light brownish-gray (10YR 6/2) and dark yellowish-brown (10YR 4/4) mottles; friable when moist; moderate, medium and coarse, subangular blocky structure; neutral; gradual, smooth boundary.
- B3g—28 to 38 inches, gray (10YR 5/1) and yellowish-brown (10YR 5/6), stratified light sandy clay loam and fine sandy loam; massive; friable when moist; neutral in upper part but becomes mildly alkaline in lower part; gradual, smooth boundary.
- C—38 to 50 inches +, mottled, light-gray (10YR 6/1), brown (10YR 5/3), and brownish-yellow (10YR 6/8) fine sand stratified with layers of loam to sandy clay loam; massive; friable when moist; calcareous.

The Ap horizon ranges from very dark gray to black in color. The B2g horizon ranges from sandy loam to light clay loam in texture. The depth to the C horizon ranges from 30 to 42 inches.

Lyles loam (Ly).—This soil is in depressions on terraces and uplands and is surrounded by sandy soils. The slope range is 0 to 2 percent. Included in mapping were small areas of soils that have a surface layer of fine sandy loam. Also included was a 40-acre tract of soil in the southwestern part of the county that has a surface layer of muck mixed with some sand.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Crops respond well to fertilizer. Wetness is the major limitation. (Capability unit IIw–1; woodland group 11)

Markland Series

The Markland series consists of deep, well drained and moderately well drained soils that have a medium-textured surface layer and a moderately fine textured to fine textured subsoil. These soils are on terraces. They formed in lacustrine material. The native vegetation was mixed hardwood forest.

A typical profile has a 7-inch surface layer of dark grayish-brown silt loam. The subsoil is about 19 inches thick. The uppermost 3 inches is brown to yellowish-brown, firm light silty clay loam. The middle 4 inches is yellowish-brown, very firm silty clay. The rest is dark yellowish-brown, very firm silty clay. The underlying material is brown, mottled, very firm clay or silty clay.

Permeability is slow, surface runoff is medium to very rapid, and the available moisture capacity is high. The organic-matter content is low. The surface layer is slightly acid or neutral.

Gently sloping to moderately steep soils of this series occur on terraces in the west-central and northwestern parts of this county.

Typical profile of Markland silt loam, at a point 325 feet north and 10 feet east of the southwest corner of the SE¼SW¼ sec. 7, T. 8 N., R. 10 W.

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B1t—7 to 10 inches, brown (10YR 5/3) to yellowish-brown (10YR 5/4) light silty clay loam; moderate, medium, subangular blocky structure; firm when moist; thin pale-brown (10YR 6/3) clay films on ped faces; slightly acid; clear, smooth boundary.

IIB21t—10 to 14 inches, yellowish-brown (10YR 5/4) silty clay; moderate to strong, medium, angular blocky structure; very firm when moist; thin pale-brown (10YR 6/3) clay films on ped faces; slightly acid; clear, smooth boundary.

IIB22t—14 to 26 inches, dark yellowish-brown (10YR 4/4) silty clay; strong, medium, angular blocky structure; very firm when moist; brown (10YR 5/3) clay films on ped faces; neutral; gradual, wavy boundary.

C—26 to 42 inches +, brown (10YR 5/3) clay or silty clay; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine and medium, angular blocky structure; very firm when moist; few, small, light-gray (10YR 7/2) concretions of lime; calcareous.

The Ap horizon ranges from dark grayish brown to yellowish brown in color. The B2t horizon ranges from silty clay loam to clay in texture. The structure of the B2t horizon ranges from angular blocky to weak prismatic. The depth to mottling ranges from about 16 inches to more than 40 inches.

Markland silt loam, 2 to 6 percent slopes, eroded (MaB2).—This soil is on slopes below ridgetops and at the head of drainageways, adjacent to nearly level, somewhat poorly drained soils. From 2 to 4 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were small areas of slightly eroded and severely eroded soils. Also included were small areas of moderately sloping soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Crops respond well to fertilizer. Erosion resulting from medium surface runoff is the major hazard. (Capability unit IIIe-11; woodland group 18)

Markland silt loam, 12 to 18 percent slopes, eroded (MaD2).—This soil is on side slopes of natural draws below ridgetops. From 2 to 4 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were small areas of slightly eroded soils.

Hay and pasture are suitable crops. Erosion resulting from rapid surface runoff is the major hazard. (Capability unit VIe-1; woodland group 18)

Markland silt loam, 18 to 25 percent slopes, eroded (MaE2).—This soil is along natural draws and on breaks along large streams. It has short slopes. From 2 to 4 inches of its original surface layer has been lost through erosion. Included in mapping were small areas of slightly eroded, steep soils and small areas of severely eroded soils.

This soil is suited to permanent pasture. Erosion resulting from very rapid surface runoff is the major hazard. (Capability unit VIe-1; woodland group 18)

Markland silty clay loam, 6 to 18 percent slopes, severely eroded (McD3).—This soil is on side slopes of natural draws and on breaks along large streams. From 5 inches to all of its original surface layer has been lost through erosion. The present surface layer is mostly original subsoil. Included in mapping were small areas of slightly eroded and moderately eroded soils. Also included were a few areas of Gullied land.

Hay and pasture are suitable crops. Erosion resulting from rapid surface runoff is the major hazard. (Capability unit VIe-1; woodland group 18)

McGary Series

The McGary series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and a moderately fine textured to fine textured subsoil. These soils are on terraces. They formed in lacustrine material. The native vegetation was mixed hardwood forest.

A typical profile has an 11-inch surface layer of silt loam, dark grayish brown in the upper 7 inches and light brownish gray to grayish brown in the lower part. The subsoil is about 29 inches thick and is grayish brown and mottled throughout. The upper 6 inches is firm, heavy silty clay loam. The lower part is very firm silty clay. The underlying material is brown, mottled, very firm silty clay.

Permeability is very slow, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The reaction is slightly acid to neutral.

Nearly level soils of this series occur on terraces in the west-central and northwestern parts of this county.

A typical profile of McGary silt loam in a cultivated field, at a point 450 feet north and 50 feet west of the southeast corner of the NE¼SE¼ sec. 7, T. 8 N., R. 10 W.

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable when moist; neutral; abrupt, smooth boundary.

A2—7 to 11 inches, light brownish-gray (10YR 6/2) to grayish-brown (10YR 5/2) silt loam; few, medium, distinct, yellowish-brown (10YR 5/4) mottles; weak, coarse, granular and weak, fine, subangular blocky structure; friable when moist; slightly acid; clear, smooth boundary.

IIB21t—11 to 17 inches, grayish-brown (10YR 5/2) heavy silty clay loam; common, medium, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular and angular blocky structure; firm when moist; slightly acid; clear, smooth boundary.

IIB22t—17 to 33 inches, grayish-brown (10YR 5/2) silty clay; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium, prismatic structure breaking to strong, medium and coarse, angular blocky; very firm when moist; few, small, very dark gray (10YR 3/1) concretions of iron and manganese; thin gray (10YR 5/1) clay films on ped faces; medium acid; clear, smooth boundary.

IIB23t—33 to 40 inches, grayish-brown (10YR 5/2) silty clay; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, coarse, angular blocky structure; very firm when moist; thin gray (10YR 5/1) clay films on ped faces; slightly acid; clear, irregular boundary.

IIC—40 to 50 inches +, brown (10YR 5/3) silty clay; common, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles; moderate, very coarse, angular blocky structure; very firm when moist; few small concretions of lime; calcareous.

The Ap horizon ranges from gray to dark gray to dark grayish brown in color. In some places all of the A2 horizon has been incorporated into the Ap horizon. The depth to the IIC horizon ranges from 35 to 50 inches. The IIC horizon is mainly silty clay or clay, but in some places it is heavy silty clay loam or heavy silty clay loam stratified with clay. The number of lime concretions in this horizon ranges from none to many.

McGary silt loam (Mg).—This soil is on terraces. The slope range is 0 to 2 percent. Included in mapping were small areas of gently sloping, moderately eroded soils next to drainageways.

Corn, soybeans, small grain, hay, and pasture can be grown if a drainage system is established and maintained. Crops respond well to fertilizer. Wetness and a very slowly permeable subsoil are the major limitations, and maintenance of the organic-matter content is a problem. (Capability unit IIIw–6; woodland group 5)

Mine Dumps

Mine dumps (Mn) consists of mixtures of carbonaceous shale and low-grade coal piled near shaft mines and at loading points where coal is cleaned and sorted.

Most of this material is too acid to support plant growth, but areas where the material is sufficiently leached are suitable for development as wildlife habitat. (Capability unit VIIIs–1; woodland group 16)

Muren Series

The Muren series consists of deep, moderately well drained soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are on uplands. They formed in silty loess. The native vegetation was mixed hardwood forest.

A typical profile has an 11-inch surface layer of silt loam, dark yellowish brown in the upper 7 inches and yellowish brown in the lower part. The subsoil is about 37 inches thick. The uppermost 9 inches is dark yellowish-brown, firm light silty clay loam. The middle 14 inches is light yellowish-brown, firm silty clay loam. The rest is yellowish-brown, firm light silty clay loam. The subsoil is mottled throughout. The underlying material is yellowish-brown, friable silt loam.

Permeability is moderate, surface runoff is medium, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Gently sloping soils of this series occur on the uplands in the central and southeastern parts of this county.

Typical profile of Muren silt loam in a cultivated field, at a point 400 feet north and 10 feet east of the southwest corner of the NW¼ sec. 33, T. 6 N., R. 8 W.

Ap—0 to 7 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium, granular structure; friable when moist; medium acid; abrupt, smooth boundary.

A2—7 to 11 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, platy structure; friable when moist; medium acid; clear, smooth boundary.

B1t—11 to 20 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; few, fine, faint, yellowish-brown (10YR 5/6) and common, fine, distinct, light brownish-gray (10YR 6/2) mottles; moderate, fine to medium, subangular blocky structure; firm when moist; few dark-brown (10YR 3/3) stains and clay films on ped faces; medium acid; clear, smooth boundary.

B21t—20 to 34 inches, light yellowish-brown (10YR 6/4) silty clay loam; common, medium, light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; firm when moist; thin dark yellowish-brown (10YR 4/4) clay films on ped faces; strongly acid; clear, smooth boundary.

B22t—34 to 48 inches, yellowish-brown (10YR 5/6) light silty clay loam; common, medium, distinct, pale-brown (10YR 6/3) mottles; moderate, medium to coarse, subangular blocky structure; firm when moist; thin dark yellowish-brown (10YR 4/4) clay films on ped faces; strongly acid; clear, smooth boundary.

C—48 to 70 inches +, yellowish-brown (10YR 5/6) silt loam; light brownish-gray (10YR 6/2) streaks and splotches; massive; friable when moist; slightly acid.

The Ap horizon ranges from dark grayish brown to dark yellowish brown in color. The clay content of the B horizon ranges from 27 to 35 percent. The C horizon is slightly acid to strongly acid. The thickness of the loess deposit ranges from 6 feet to 12 feet or more.

Muren silt loam, 2 to 6 percent slopes, eroded (MuB2).—This soil is on narrow ridges and slopes adjacent to the head of drainageways. From 4 to 6 inches of its surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the yellowish-brown subsoil. Included in mapping were small areas of nearly level soils and small areas of slightly eroded soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Crops respond well to lime and fertilizer. Erosion is the major hazard. (Capability unit IIe–3; woodland group 1)

Parke Series

The Parke series consists of deep, well-drained soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are on uplands. They formed in loess and sandy and gravelly outwash. The native vegetation was mixed hardwood forest.

A typical profile has a 9-inch surface layer of dark grayish-brown silt loam. The subsoil is about 97 inches thick. The uppermost 6 inches is brown to dark-brown, firm light silty clay loam. The next 27 inches is reddish-brown to yellowish-red, firm silty clay loam. The rest is yellowish-red to yellowish-brown, firm clay loam. The underlying material is reddish-yellow, friable, stratified silt loam and fine sand that contains many pebbles.

Permeability is moderate, surface runoff is medium to rapid, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Moderately sloping and strongly sloping soils of this series occur in this county. The areas are not extensive.

Typical profile of Parke silt loam in a cultivated field, at a point 350 feet east and 85 feet north of the southwest corner of the NE¼NW¼ sec. 26, T. 9 N., R. 10 W.

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable when moist; medium acid; abrupt, smooth boundary.

B1t—9 to 15 inches, brown to dark-brown (7.5YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; firm when moist; medium acid; clear, smooth boundary.

B21t—15 to 21 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm when moist; few, thin, light yellowish-brown (10YR 6/4) clay films on ped faces; very strongly acid; gradual, smooth boundary.

IIB22tb—21 to 42 inches, reddish-brown (5YR 4/4) to yellowish-red (5YR 4/6) silty clay loam; scattered pebbles in lower portion; moderate, medium and coarse, subangular blocky structure; firm when moist; very strongly acid; gradual, smooth boundary.

IIB31tb—42 to 68 inches, yellowish-red (5YR 4/6) clay loam; scattered pebbles; weak, medium, subangular and angular blocky structure; firm when moist; very strongly acid; gradual, smooth boundary.

IIB32tb—68 to 106 inches, yellowish-red (5YR 4/6) and yellowish-brown (10YR 5/6) clay loam; scattered pebbles; weak, medium, subangular blocky structure; firm when moist; very strongly acid.

IIC—106 to 110 inches +, reddish-yellow (5YR 6/8) stratified silt loam and fine sand; many pebbles; massive; friable when moist; strongly acid; black (10YR 2/1) coatings on ped faces.

The Ap horizon ranges from dark grayish brown to brown in color, and the B horizon from dark brown and reddish brown to yellowish red. The loess is 18 to 48 inches deep over outwash. The texture of the B horizon ranges from silty clay loam to clay loam to fine gravelly clay loam to gravelly sandy clay loam. The reaction of the underlying material is medium acid to mildly alkaline at a depth of 10 to 15 feet.

Parke silt loam, 6 to 12 percent slopes, severely eroded (PaC3).—This soil is on slopes below ridgetops. From 6 inches to all of its original surface layer has been lost through erosion. The present plow layer is mostly original subsoil. Included in mapping were small areas of Gullied land.

Small grain, hay, and pasture are suitable crops. An occasional row crop can be grown. Crops respond well to lime and fertilizer. Erosion resulting from medium surface runoff is the major hazard. (Capability unit IVe–3; woodland group 1)

Parke silt loam, 12 to 18 percent slopes, severely eroded (PaD3).—This soil is on side slopes of natural draws. From 6 inches to all of its original surface layer has been lost through erosion. The present surface layer is mostly original subsoil. Included in mapping were small areas of Gullied land.

Hay and pasture are suitable crops. They respond well to lime and fertilizer. Erosion resulting from rapid surface runoff is the major hazard. (Capability unit VIe–1; woodland group 1)

Patton Series

The Patton series consists of deep, very poorly drained soils that have a moderately fine textured surface layer and subsoil. These soils are in depressions on lake terraces. They formed in lacustrine material mantled with loess. The native vegetation consisted of mixed hardwoods, sedges, and swamp grass.

A typical profile has a 13-inch surface layer of silty clay loam, very dark gray in the upper 8 inches and black in the lower part. The subsoil is about 21 inches of firm silty clay loam. The upper 7 inches is dark gray, and the lower part is grayish brown to light brownish gray. The subsoil is mottled throughout. The underlying material is light brownish-gray, mottled, friable, stratified silt loam and silty clay loam.

Permeability is slow, surface runoff is very slow or ponded, and the available moisture capacity is high. The organic-matter content is high.

Nearly level soils of this series occur on lake terraces in the south-central and northwestern parts of this county.

A typical profile of Patton silty clay loam in a cultivated field, at a point 200 feet east and 50 feet north of the southwest corner of the SE¼ sec. 29, T. 7 N., R. 9 W.

Ap—0 to 8 inches, very dark gray (10YR 3/1) silty clay loam; weak, medium, granular structure; friable when moist; neutral; abrupt, smooth boundary.

A1—8 to 13 inches, black (10YR 2/1) silty clay loam; moderate, medium, subangular blocky structure; firm when moist; slightly acid; clear, smooth boundary.

B21tg—13 to 20 inches, dark-gray (10YR 4/1) silty clay loam; common, medium, distinct, brown (10YR 5/3) mottles; weak, coarse, prismatic structure breaking to moderate, medium, angular blocky; firm when moist; thin very dark gray (10YR 3/1) clay films on ped faces; numerous worm channels and root casts; slightly acid; gradual, irregular boundary.

B22tg—20 to 31 inches, grayish-brown (2.5Y 5/2) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium to coarse, prismatic structure breaking to moderate, medium, angular blocky; firm when moist; thin dark-gray (10YR 4/1) clay films on ped faces; many, fine, soft, black (10YR 2/1) concretions of iron and manganese; slightly acid; gradual, irregular boundary.

B3g—31 to 34 inches, light brownish-gray (2.5Y 6/2) light silty clay loam; many, medium, prominent, strong-brown 7.5YR 5/6) mottles; weak, coarse, prismatic structure breaking to weak, coarse, subangular blocky; firm when moist; thick dark-gray (10YR 4/1) clay films on ped faces and along vertical cracks; neutral; clear, wavy boundary.

C—34 to 48 inches +, light brownish-gray (2.5Y 6/2) stratified silt loam and silty clay loam; common, medium, prominent, brownish-yellow (10YR 6/6) mottles; massive; friable when moist; calcareous (soft lime concretions).

The Ap horizon ranges from very dark gray to black or very dark brown in color. The A horizon is 11 to 16 inches thick. The depth to carbonates ranges from 30 to 60 inches.

Patton silty clay loam (Pc).—This soil is in depressions on lake terraces. The slope range is 0 to 2 percent. Included in mapping were small areas that have a surface layer of silt loam.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Wetness is the major limitation. (Capability unit IIw–1; woodland group 11)

Petrolia Series

The Petrolia series consists of deep, somewhat poorly drained soils that have a moderately fine textured surface layer and subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was mixed hardwood forest.

A typical profile has an 8-inch surface layer of dark-gray silty clay loam. The subsoil is about 15 inches of dark-gray to gray, mottled, firm silty clay loam. The underlying material is gray to light brownish-gray, mottled, friable, stratified light silty clay loam to silt loam.

Permeability is slow, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is medium. The surface layer is neutral.

Nearly level soils of this series occur on bottom lands along the Wabash River.

Typical profile of Petrolia silty clay loam in a cultivated field, at a point 470 feet south and 520 feet west of the southeast corner of the SW¼ sec. 18, T. 9 N., R. 10 W.

Ap—0 to 8 inches, dark-gray (10YR 4/1) silty clay loam; weak, medium, granular structure; plastic when wet, hard when dry; neutral; abrupt, smooth boundary.

B21g—8 to 12 inches, dark-gray (10YR 4/1) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/4) and light brownish-gray (10YR 6/2) mottles; firm when moist; weak, medium, platy structure breaking to weak, medium, subangular blocky; neutral; clear, smooth boundary.

B22g—12 to 23 inches, dark-gray (10YR 4/1) and gray (10YR 5/1) silty clay loam; common, medium, distinct, light yellowish-brown (10YR 6/4) and brownish-yellow (10YR 6/6) mottles; weak, medium, granular structure; firm when moist; neutral; gradual, smooth boundary.

Cg—23 to 42 inches +, gray (10YR 5/1) and light brownish-gray (10YR 6/2) stratified light silty clay loam and silt loam; common, medium, distinct, light yellowish-brown (10YR 6/4) and brownish-yellow (10YR 6/6) mottles; friable when moist; neutral to mildly alkaline.

The Ap horizon ranges from dark gray to brownish gray in color. The depth to mottling ranges from 7 to 15 inches. The B horizon ranges from dark gray to pale brown in color and has common to many distinct mottles. The texture of the C horizon is commonly light silty clay loam and silt loam, but in some places strata of sandy loam, loam, or clay loam occur at a depth of more than 20 inches. The C horizon is slightly acid to mildly alkaline.

Petrolia silty clay loam (Po).—This soil is in swales on bottom lands along the Wabash River. It is likely to be flooded in winter and spring. The slope range is 0 to 2 percent. Included in mapping were small areas of moderately well drained soils.

Row crops, hay, and pasture can be grown if a drainage system is established and maintained. Alfalfa and small grain are likely to be severely damaged by flooding. Flooding between December and June is the major hazard, and wetness is the major limitation. (Capability unit IIw-7; woodland group 13)

Princeton Series

The Princeton series consists of deep, well-drained soils that have a moderately coarse textured surface layer and a moderately fine textured to moderately coarse textured subsoil. These soils are on uplands. The native vegetation was mixed hardwood forest.

A typical profile has an 11-inch surface layer of fine sandy loam, dark grayish brown in the upper 6 inches and dark yellowish brown in the lower part. The subsoil is about 31 inches thick. The upper 21 inches is brown, firm sandy clay loam, and the lower part is strong-brown and yellowish-brown, friable heavy sandy loam. The underlying material is yellowish-brown, very friable, very fine to fine sand and coarse silt.

Permeability is moderate, surface runoff is slow to rapid, and the available moisture capacity is medium. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Nearly level to very steeply sloping soils of this series occur on the uplands in the western part of this county.

Typical profile of Princeton fine sandy loam in a cultivated field, at a point 675 feet south and 10 feet east (road cut) of the northwest corner of sec. 8, T. 9 N., R. 10 W.

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, medium, granular structure; very friable when moist; neutral; clear, smooth boundary.

A2—6 to 11 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, coarse, granular structure; very friable when moist; neutral; clear, smooth boundary.

B21t—11 to 19 inches, brown (7.5YR 4/4) sandy clay loam; moderate, medium, subangular blocky structure; firm when moist; few, thin, reddish-brown (5YR 4/4) clay films on some ped faces; slightly acid; gradual, wavy boundary.

B22t—19 to 30 inches, brown (7.5YR 4/4) sandy clay loam; moderate, coarse, subangular blocky structure; firm when moist; thin reddish-brown (5YR 4/4) clay films on ped faces; strongly acid; clear, smooth boundary.

B23t—30 to 42 inches, strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/6) heavy sandy loam; weak, coarse, subangular blocky structure; friable when moist; thin brown (7.5YR 4/4) clay films on some ped faces; few concretions of iron and manganese; dark yellowish-brown (10YR 4/4) stains on ped faces; slightly acid; clear, smooth boundary.

C—42 to 60 inches +, yellowish-brown (10YR 5/4–5/8) very fine to fine sand and coarse silt; very friable when moist; neutral grading to mildly alkaline; calcareous.

The Ap horizon ranges from dark grayish brown to brown in color. The B2t horizon ranges from sandy clay loam to light clay loam in texture. The depth to the C horizon ranges from 36 to 60 inches.

Princeton fine sandy loam, 0 to 2 percent slopes (PrA).—This soil is on ridgetops. Included in mapping were small areas that have a surface layer of loam. Also included were small areas of gently sloping soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Orchard crops and alfalfa are well suited. The medium available moisture capacity is the major limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. (Capability unit IIs-5; woodland group 2)

Princeton fine sandy loam, 2 to 6 percent slopes, eroded (PrB2).—This soil is on ridgetops and side slopes. From 4 to 7 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were small areas of slightly eroded and severely eroded soils. Also included were small tracts that have a surface layer of loamy fine sand.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Orchard crops and alfalfa are well suited.

Crops respond well to fertilizer. Erosion is a hazard, and the medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. (Capability unit IIe–11; woodland group 11)

Princeton fine sandy loam, 6 to 12 percent slopes, eroded (PrC2).—This soil is in areas below ridgetops and adjacent to the head of drainageways. From 4 to 7 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were small areas of slightly eroded and severely eroded soils. Also included were small areas that have a surface layer of loamy fine sand.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Orchard crops and alfalfa are well suited. Crops respond well to lime and fertilizer. Erosion is a hazard, and the medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. (Capability unit IIIe–13; woodland group 2)

Princeton fine sandy loam, 12 to 18 percent slopes, eroded (PrD2).—This soil is on slopes below ridgetops along natural drainageways. From 4 to 7 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were a few small areas of slightly eroded and severely eroded soils.

Small grain, hay, and pasture are suitable crops. Orchard crops and alfalfa are well suited. An occasional row crop can be grown. Crops respond well to lime and fertilizer. Erosion resulting from medium surface runoff is a severe hazard, and the medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. (Capability unit IVe–15; woodland group 2)

Princeton fine sandy loam, 18 to 25 percent slopes, eroded (PrE2).—This soil is on short slopes below ridgetops and next to natural draws. From 4 to 7 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the subsoil. Included in mapping were small areas of slightly eroded and severely eroded soils.

Hay, pasture, and orchard fruits are suitable crops. Crops respond well to lime and fertilizer. Erosion resulting from rapid surface runoff is a severe hazard, and the medium available moisture capacity is a limitation. During prolonged dry periods, crops are damaged by drought. (Capability unit VIe–1; woodland group 2)

Princeton fine sandy loam, 25 to 50 percent slopes (PrG).—This soil is on short slopes along natural drainageways and on short breaks below ridgetops. Included in mapping were small areas of moderately eroded and severely eroded soils. Also included were small tracts that have a surface layer of loam.

This soil is suited to permanent pasture. Erosion resulting from rapid surface runoff is the major hazard. (Capability unit VIe–1; woodland group 2)

Ragsdale Series

The Ragsdale series consists of deep, very poorly drained soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are on uplands. They formed in silty loess. The native vegetation consisted of mixed swamp forest and swamp grasses.

A typical profile has a 15-inch surface layer of silt loam, very dark brown in the upper 9 inches and very dark grayish brown in the lower part. The subsoil is about 43 inches thick. The upper 19 inches is grayish-brown, mottled, firm silty clay loam. The lower part is yellowish-brown, mottled, firm to friable light silty clay loam. The underlying material is light yellowish-brown and brownish-yellow silt loam or silt with dark-gray streaks and splotches.

Permeability is slow, surface runoff is very slow, and the available moisture capacity is high. The organic-matter content is high. The surface layer is neutral or slightly acid.

Nearly level soils of this series occur in depressions on the uplands in the western half of this county.

Typical profile of Ragsdale silt loam in a cultivated field, at a point 250 feet east and 50 feet south of the northwest corner of the NE¼NE¼ sec. 33, T. 9 N., R. 9 W.

Ap—0 to 9 inches, very dark brown (10YR 2/2) silt loam; weak, medium, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

A1—9 to 15 inches, very dark grayish-brown (10YR 3/2) silt loam; few, fine, distinct, brown (10YR 5/3) mottles in lower part; moderate, coarse, granular structure to moderate, fine and medium, subangular blocky; friable when moist; slightly acid; clear, irregular boundary.

B21tg—15 to 34 inches, grayish-brown (10YR 5/2) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) to light brownish-gray (10YR 6/2) mottles; moderate, medium and coarse, subangular blocky structure; firm when moist; thin very dark grayish-brown (10YR 3/2) clay films on many ped faces; slightly acid to neutral; gradual, irregular boundary.

B22t—34 to 58 inches, yellowish-brown (10YR 5/6–5/8) light silty clay loam; many, medium, distinct, light brownish-gray (10YR 6/2) and grayish-brown (10YR 5/2) mottles; moderate, coarse and very coarse, subangular blocky structure; firm to friable when moist; thin dark-gray (10YR 4/1) clay films on ped faces and in crack fills; neutral; clear, wavy boundary.

C—58 to 70 inches +, light yellowish-brown (10YR 6/4) and brownish-yellow (10YR 6/8) silt loam or silt; dark-gray (10YR 4/1) streaks and splotches; massive; friable when moist; calcareous.

The Ap horizon ranges from black to very dark grayish brown in color. The A horizon ranges from 10 to 18 inches in thickness. The color of the B21t horizon is gray to grayish brown, and the texture is light silty clay loam to silty clay loam. The depth to the C horizon ranges from 48 to 60 inches.

Ragsdale silt loam (Ra).—This soil is in depressions on broad flats in the loessal uplands. The slope range is 0 to 2 percent. Included in mapping were small tracts that have a surface layer of silty clay loam.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Crops respond well to fertilizer. Wetness is the major limitation. (Capability unit IIw–1; woodland group 11)

Reesville Series

The Reesville series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and a moderately fine textured to medium-textured subsoil. These soils are on uplands. They formed in silty loess. The native vegetation was mixed hardwood forest.

A typical profile has an 8-inch surface layer of dark grayish-brown silt loam. The subsoil is about 27 inches thick. The uppermost 13 inches is brown, mottled, firm silty clay loam. The middle 9 inches is brown and yellowish-brown, mottled, firm light silty clay loam. The rest is light olive-brown and brownish-yellow, friable silt loam. The underlying material is light olive-brown and brownish-yellow, friable silt.

Permeability is slow, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Nearly level and gently sloping soils of this series occur on the uplands in the western half of this county.

Typical profile of Reesville silt loam in a cultivated field, at a point 100 feet north and 75 feet west of the southeast corner of the SE¼SW¼ sec. 18, T. 7 N., R. 9 W.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B21t—8 to 13 inches, brown (10YR 5/3) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; moderate, fine and medium, subangular blocky structure; firm when moist; few black (10YR 2/1) concretions of iron and manganese; medium acid; clear, wavy boundary.

B22t—13 to 21 inches, brown (10YR 5/3) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/6–5/8) and grayish-brown (10YR 5/2) mottles; moderate, medium, angular and subangular blocky structure; firm when moist; few gray (10YR 5/1) clay films on ped faces; few black (10YR 2/1) concretions of iron and manganese: strongly acid; clear, wavy boundary.

B23t—21 to 30 inches, brown (10YR 5/3) and yellowish-brown (10YR 5/4) light silty clay loam; common, medium, distinct, grayish-brown (10YR 5/2) mottles; moderate, medium and coarse, subangular blocky structure; firm when moist; few gray (10YR 5/1) clay films on ped faces and along cracks; slightly acid; clear, wavy boundary.

B3—30 to 35 inches, light olive-brown (2.5Y 5/4) and brownish-yellow (10YR 6/6) silt loam; weak, coarse, subangular blocky structure; friable when moist; dark-gray (10YR 4/1) clay films along a few vertical cleavage planes; weakly calcareous; clear, wavy boundary.

C—35 to 60 inches +, light olive-brown (2.5Y 5/6) and brownish-yellow (10YR 6/6) silt; massive; friable when moist; calcareous.

The Ap horizon ranges from dark grayish brown to grayish brown in color. The B22 horizon ranges from silty clay loam to heavy silt loam. The soil is silty to a depth of 5 to 8 feet. The depth to carbonates ranges from 30 to 42 inches.

Reesville silt loam, 0 to 2 percent slopes (ReA).—This soil is on broad flats in the loessal uplands. Included in mapping was a small tract that has a surface layer of loam.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Wetness is the major limitation. (Capability unit IIw–2; woodland group 5)

Reesville silt loam, 2 to 4 percent slopes, eroded (ReB2).—This soil is on ridgetops, on slopes, and at the head of drainageways. From 3 to 5 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were small tracts of slightly eroded soils and small areas of severely eroded soils.

Corn, soybeans, small grain, hay, and pasture can be grown if a drainage system is established and maintained and erosion is controlled. Wetness is the major limitation, and erosion is a hazard. (Capability unit IIw–2; woodland group 5)

Rensselaer Series

The Rensselaer series consists of deep, very poorly drained soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are on terraces. They formed in glacial outwash. The native vegetation consisted of swamp forest, reeds, and sedges.

A typical profile has a 15-inch surface layer of loam, black in the upper 8 inches and very dark gray in the lower part. The subsoil is about 35 inches thick. It is dark gray to gray and is mottled throughout. The upper 27 inches is firm clay loam, and the lower part is firm light clay loam to sandy clay loam. The underlying material is mottled gray, pale-brown, and yellowish-brown, stratified sandy clay loam, loam, and silt loam.

Permeability is slow, surface runoff is very slow, and the available moisture capacity is high. The organic-matter content is high. The surface layer is slightly acid or neutral.

Nearly level soils of this series are in depressions on terraces in the southwestern part of this county.

Typical profile of Rensselaer loam in a cultivated field, at a point 50 feet east and 75 feet south of the northwest corner of the SW¼NW¼ sec. 13, T. 6 N., R. 10 W.

Ap—0 to 8 inches, black (10YR 2/1) loam; weak, fine and medium, granular structure; friable when moist; neutral; abrupt, smooth boundary.

A1—8 to 15 inches, very dark gray (10YR 3/1) heavy loam; few, fine, brown (10YR 4/3) stains; weak to moderate, medium, subangular blocky structure; friable when moist; neutral; clear, smooth boundary.

B21tg—15 to 26 inches, dark-gray (10YR 4/1) clay loam; common, medium, distinct, light brownish-gray (10YR 6/2) and few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm when moist; thin gray (10YR 5/1) clay films on ped faces; neutral; clear, wavy boundary.

B22tg—26 to 42 inches, dark-gray (10YR 4/1) to gray (10YR 5/1) clay loam; common, medium, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/6) mottles; moderate, coarse, prismatic structure breaking to moderate, medium and coarse, subangular blocky; firm when moist; thin gray (10YR 5/1) clay films on ped faces; neutral; diffuse, irregular boundary.

B3tg—42 to 50 inches, gray (10YR 5/1) light clay loam to sandy clay loam; common, medium, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; firm when moist; thin very dark grayish-brown (10YR 3/2) clay films on most ped faces; neutral; gradual, smooth boundary.

C—50 to 66 inches +, mottled gray (10YR 5/1), pale-brown (10YR 6/3), and yellowish-brown (10YR 5/6), stratified, calcareous sandy clay loam, loam, and silt loam; small amounts of clay and fine sand.

The Ap horizon ranges from black to very dark gray in color. The B horizon ranges from clay loam to sandy clay loam in texture. The depth to calcareous material ranges from 47 to 70 inches.

Rensselaer loam (Rm).—This soil is in depressions on terraces. The slope range is 0 to 2 percent. Included in mapping were small areas that have a surface layer of light clay loam.

Corn, soybeans, small grain, hay, and pasture can be grown if a drainage system is established and maintained. Crops respond well to fertilizer. Wetness is the major limitation. (Capability unit IIw–1; woodland group 11)

Riverwash

Riverwash (Rr) is on small islands along the Wabash River. It consists of sand and gravel mixed with silty material. Most areas are only a few feet above normal streamflow. A single flood can change the size and shape of an area considerably or even remove an area entirely.

Riverwash supports a scanty growth of willows and shrubs. It is not suitable for farming. (Capability unit VIIIs–1; woodland group 16)

Rock Land

Rock land (Rs) is a steep and very steep land type in ravines and on cliff faces. It occurs in the western part of the county, as a long, narrow band beginning at Merom and extending northward to the county line. This land type consists of about 12 to 30 inches of channery loam or silt loam over clay shale or sandstone bedrock, with outcrops of shale and sandstone in places. Numerous gullies and draws expose the bedrock. Included in mapping were small tracts of stony soils.

This land type needs a cover of permanent vegetation. Most areas are in woodland or permanent pasture. Erosion resulting from rapid surface runoff is the major hazard. (Capability unit VIIe–1; woodland group 22)

Ross Series

The Ross series consists of deep, well-drained soils that have a medium-textured surface layer and subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation consisted of prairie grass.

A typical profile has a 17-inch surface layer of silt loam, very dark brown in the upper 8 inches and very dark brown to black in the lower part. The subsoil is about 23 inches of friable silt loam, dark brown in the upper 7 inches and dark yellowish brown in the lower part. The underlying material is brown to yellowish brown, friable, stratified silt loam, loam, and sandy loam.

Permeability is moderate, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is high. The reaction of the surface layer is slightly acid or neutral.

Nearly level soils of this series occur on bottom lands along the Wabash River.

Typical profile of Ross silt loam in a cultivated field, at a point 200 feet east and 300 feet north of the southwest corner of the SE¼NE¼ sec. 26, T. 8 N., R. 11 W.

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; moderate, fine, granular structure; friable when moist; relatively high content of organic matter; neutral; abrupt, smooth boundary.

A1—8 to 17 inches, very dark brown (10YR 2/2) to black (10YR 2/1) silt loam; weak to moderate, medium, granular structure; friable when moist; neutral; gradual, wavy boundary.

B21—17 to 24 inches, dark-brown (10YR 3/3–4/3) silt loam; weak, medium, subangular blocky structure; friable when moist; many very dark brown (10YR 2/2) casts and coatings; neutral; gradual, smooth boundary.

B22—24 to 40 inches, dark yellowish-brown (10YR 4/4) silt loam; massive; friable when moist; neutral; gradual, smooth boundary.

C—40 to 50 inches, brown (10YR 5/3) to yellowish-brown (10YR 5/4) stratified silt loam, loam, and sandy loam; massive; friable when moist; neutral to weakly calcareous.

The Ap horizon ranges from very dark brown to dark brown in color. The A horizon ranges from 12 to 20 inches in thickness. The B horizon ranges from dark brown to yellowish brown in color and from loam to light silty clay loam in texture. The depth to the stratified underlying material (C horizon) ranges from 24 to 40 inches, and the reaction from neutral to mildly alkaline.

Ross silt loam (Rt).—This soil is mostly on the higher parts of broad bottom lands along the Wabash River. The slope range is 0 to 2 percent. Occasional flooding is likely during winter and early in spring. Included in mapping were small areas of soils that have a surface layer of loam. Also included were small areas of moderately well drained soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Alfalfa and small grain are less suitable, because they are severely damaged during periods of prolonged flooding. Although occasional flooding is the major hazard, most areas of this soil are seldom affected by flooding. (Capability unit I–2; woodland group 23)

Shadeland Series

The Shadeland series consists of moderately deep, somewhat poorly drained soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are on benches. They formed in glacial till underlain by interbedded sandstone, siltstone, and acid shale at a depth of 20 to 34 inches. The native vegetation was mixed hardwood forest.

A typical profile has a 9-inch surface layer, very dark grayish-brown loam in the upper 6 inches and grayish-brown silt loam in the lower part. The subsoil is about 20 inches thick. The upper 11 inches is light brownish-gray, mottled, firm silty clay loam. The lower part is pale-brown, mottled, very firm heavy silty clay loam. The underlying material is sandstone and shale bedrock.

Permeability is slow, surface runoff is slow, and the available moisture capacity is medium or low. The organic-matter content is low. The surface layer is strongly acid unless it has been limed.

Soils of this series occur on benches in the northwestern part of this county.

Typical profile of Shadeland loam in a wooded area, at a point 20 feet east and 100 feet north of the southwest corner of the NE¼SW¼ sec. 18, T. 9 N., R. 10 W.

O—½ inch to 0, leaf litter in various stages of decomposition.
A1—0 to 6 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium, granular structure; friable when moist; slightly acid; clear, smooth boundary.
A2—6 to 9 inches, grayish-brown (10YR 5/2) silt loam; few, fine, faint, pale-brown (10YR 6/3) mottles; weak, medium, platy structure; friable when moist; medium acid; clear, smooth boundary.
B1t—9 to 13 inches, light brownish-gray (10YR 6/2) light silty clay loam; many, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, fine and medium, subangular blocky structure; firm when moist; strongly acid; clear, smooth boundary.
B21t—13 to 20 inches, light brownish-gray (10YR 6/2) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, angular and subangular blocky structure; firm when moist; few, thin, gray (10YR 5/1) clay films on ped faces; some gray (10YR 6/1) silt along vertical ped faces; strongly acid; clear, smooth boundary.
IIB22t—20 to 29 inches, pale-brown (10YR 6/3) heavy silty clay loam; common, medium, faint, light brownish-gray (10YR 6/2) and common, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, coarse, angular blocky structure; very firm when moist; strongly acid; abrupt, wavy boundary.
IIR—29 inches +, sandstone and shale bedrock.

In cultivated areas, the color of the surface layer ranges from grayish brown to dark grayish brown. The depth to mottling ranges from 6 to 8 inches. The depth to bedrock ranges from 20 to 34 inches.

Shadeland loam (Sh).—This soil is on benches at the base of steeply sloping soils. The slope range is 0 to 2 percent. A few areas are dissected by small drainageways that carry surface runoff from adjacent soils.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Crops respond well to lime and fertilizer. Wetness and the moderate depth to bedrock are the major limitations. In years when rainfall is less than normal or is poorly distributed, crops are severely damaged by drought. (Capability unit IIIw–7; woodland group 5)

Stendal Series

The Stendal series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was mixed hardwood forest.

A typical profile has a 10-inch surface layer of grayish-brown to light brownish-gray silt loam. The subsoil is about 20 inches of light brownish-gray, mottled, friable silt loam. The underlying material is light-gray, mottled, friable silt loam.

Permeability is moderate, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is strongly acid unless it has been limed.

Nearly level soils of this series occur on bottom lands along small streams in the eastern half of this county.

Typical profile of Stendal silt loam in a cultivated field, at a point 300 feet west and 135 feet north of the southeast corner of the NE¼SE¼ sec. 4, T. 7 N., R. 8 W.

Ap—0 to 10 inches, grayish-brown (10YR 5/2) to light brownish-gray (10YR 6/2) silt loam; weak, fine, granular structure; very friable when moist; medium acid; clear, smooth boundary.
B—10 to 30 inches, light brownish-gray (10YR 6/2) silt loam; many, medium, distinct, brown (10YR 5/3) mottles; weak, medium, granular structure; friable when moist; few to common, medium, black (10YR 2/1) concretions of iron and manganese; strongly acid; gradual, smooth boundary.
C—30 to 55 inches +, light-gray (10YR 7/2) silt loam; many, coarse, faint, gray (10YR 6/1) mottles and common, medium, prominent, yellowish-brown (10YR 5/8) mottles; massive; friable when moist; common, medium, black (10YR 2/1) concretions of iron and manganese; strongly to very strongly acid.

The Ap horizon ranges from very dark grayish brown to grayish brown in color. The depth to mottling ranges from 6 to 14 inches. The C horizon ranges from silt loam to loam and contains thin lenses of sand in some places.

Stendal silt loam (Sn).—This soil is on the bottom lands of small streams. The slope range is 0 to 2 percent. Flooding is likely during winter and early in spring. Included in mapping were small areas of dark-colored, poorly drained soils and a few areas that have a surface layer of loam.

Corn, soybeans, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Small grain and alfalfa are less suitable, because they are severely damaged by flooding. Crops respond well to lime and fertilizer. Flooding is a hazard, and wetness is a limitation. (Capability unit IIw–7; woodland group 13)

Strip Mines

Strip mines (St) include long, narrow mounds of mine spoil (a mixture of soil, till, shale, sandstone, and some coal) and a few open pits. Some of the pits contain water, and some are dry.

The surface material generally consists of heterogeneous soil material, or of large pieces of fractured shale or other rock mixed with coal fragments, or of mixtures of all of these. The material ranges from very strongly acid to neutral. The mounds are nearly level or gently sloping along the top and at the base. They have strongly sloping to very steep sides. Vertical escarpments border at least one side of most pits.

These areas are suitable for trees, wildlife habitat, and recreational facilities. Natural lakes (fig. 5) provide water for wildlife habitat and recreation. In places the spoil can be seeded to grass and legumes and used for pasture. (Capability unit VIIe–3; woodland group 16)

Vigo Series

The Vigo series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and mainly a moderately fine textured subsoil. A very firm claypan starts at a depth of 18 to 24 inches. These soils are on uplands. They formed in 40 to 60 inches of loess over material weathered from till. The native vegetation was mixed hardwood forest.

A typical profile has a 23-inch surface layer of silt loam. The uppermost 9 inches is grayish brown, the next 11 inches is light brownish gray and mottled, and the rest is gray and mottled. The subsoil is about 37 inches thick. It is gray and mottled. The upper 24 inches is very firm silty clay loam. The lower part is firm heavy silt loam to light silty clay loam. The underlying material

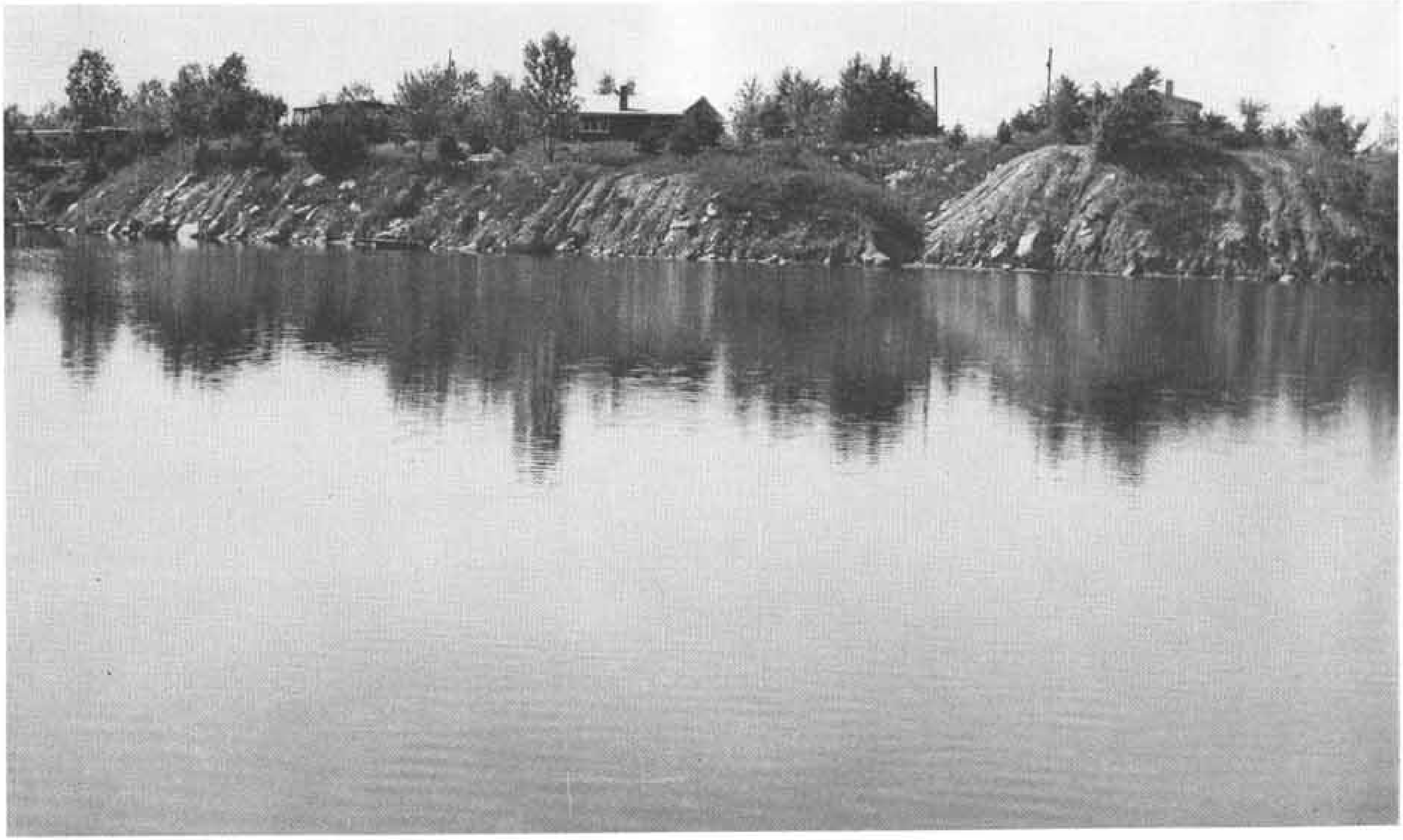

Figure 5.—**Lake formed by strip mining in Cincinnati soils, south of Dugger.**

is light yellowish-brown, mottled, friable clay loam to heavy loam.

Permeability is very slow, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is strongly acid unless it has been limed.

Nearly level soils of this series occur on the uplands in the northeastern part of the county.

Typical profile of Vigo silt loam in a cultivated field at the edge of a strip mine pit, at a point 275 feet west and 75 feet north of the southeast corner of the NE¼ sec. 35, T. 9 N., R. 8 W.

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam; moderate to weak, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

A21—9 to 20 inches, light brownish-gray (10YR 6/2) silt loam; common, fine, distinct, yellowish-brown (10YR 5/8) and dark yellowish-brown (10YR 4/4) mottles; moderate, medium to thick, platy structure; friable when moist; many, small, rounded, firm, black (10YR 2/1) concretions of iron and manganese; strongly acid; clear, smooth boundary.

A22—20 to 23 inches, gray (10YR 6/1) silt loam; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; weak, thick, platy structure; very weak, coarse, prismatic structure inherited from the B2 horizon; friable when moist; light-gray (10YR 7/1) silt films along crack fills; strongly acid; abrupt, irregular boundary.

B21t—23 to 33 inches, gray (10YR 6/1) silty clay loam; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; strong, coarse, prismatic structure breaking to strong, medium and coarse, angular blocky; very firm when moist; light-gray (10YR 7/1) silt films on many ped faces and in cracks and crawfish casts; thick gray (10YR 5/1) clay films on many ped faces; common, medium, black (10YR 2/1) concretions of iron and manganese; strongly acid; gradual, smooth boundary.

B22t—33 to 47 inches, gray (10YR 6/1) silty clay loam; many, medium, distinct, strong-brown (7.5YR 5/6–5/8) mottles; strong, very coarse, prismatic structure; the inside of prisms is structureless; very firm when moist; light-gray (10YR 7/2) silt films on many ped faces and in cracks and crawfish casts; thin to thick, light-gray (10YR 7/1) clay films on many ped faces; common, medium, black (10YR 2/1) concretions of iron and manganese; very strongly acid; gradual, irregular boundary.

B3t—47 to 60 inches, gray (10YR 6/1) heavy silt loam to light silty clay loam; many, coarse, distinct, yellowish-brown (10YR 5/8) and strong-brown (7.5YR 5/8) mottles; weak, very coarse, prismatic structure; firm when moist; thin grayish-brown (10YR 5/2) clay films on some ped faces and along vertical cracks and old root channels; medium acid; gradual, smooth boundary.

IIC—60 to 80 inches +, light yellowish-brown (10YR 6/4) clay loam to heavy loam; many, coarse, distinct, yellowish-brown (10YR 5/8) mottles; massive; friable when moist; many gray (10YR 6/1) streaks extending downward; slightly acid.

The Ap horizon ranges from dark grayish brown to grayish brown or brown in color. The depth to the B horizon ranges from 18 to 24 inches, and the depth to mottling from 6 to 14 inches. The IIC horizon ranges from loam to clay loam in texture. It is medium acid to slightly acid but grades to neutral at a depth of 7 to 8 feet.

Vigo silt loam, 0 to 2 percent slopes (VgA).—This soil is on broad flats and small ridgetops. Included in mapping were small areas of poorly drained soils. Also included were small areas of gently sloping soils.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Alfalfa is less suitable, because the very slowly permeable subsoil restricts the development of roots and the movement of water. Crops respond well to lime and fertilizer. Wetness and very slow permeability are the major limitations. (Capability unit IIIw-3; woodland group 5)

Vigo silt loam, 2 to 4 percent slopes, eroded (VgB2).—This soil is at the head of drainageways, at the base of steep slopes, and on long, uniform slopes. From 5 to 7 inches of its original surface layer has been lost through erosion. The present surface layer contains some of the light brownish-gray subsoil. Included in mapping were small areas of slightly eroded soils.

Corn, soybeans, and small grain can be grown on this soil if a drainage system is established and maintained and erosion is controlled. Hay and pasture are also suitable. The very slowly permeable subsoil restricts the development of roots and the movement of water. Wetness, very slow permeability, and the erosion hazard are the major limitations. (Capability unit IIIw-3; woodland group 5)

Wakeland Series

The Wakeland series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was mixed hardwood forest.

A typical profile has an 8-inch surface layer of dark grayish-brown silt loam. The subsoil is about 12 inches of mottled, friable silt loam, light brownish gray in the upper 5 inches and gray to dark yellowish brown in the lower part. The upper 26 inches of the underlying material is gray, mottled, friable silt loam, and the rest is gray, light brownish-gray, and pale-brown, friable silt.

Permeability is moderate, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is neutral to slightly acid.

Nearly level soils of this series occur on bottom lands along the Wabash River and along small streams in the deep loess uplands in the western half of this county.

Typical profile of Wakeland silt loam in a cultivated field, at a point 75 feet north and 175 feet west of the southeast corner of the NE¼SW¼ sec. 34, T. 8 N., R. 10 W.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B21—8 to 13 inches, light brownish-gray (10YR 6/2) silt loam; common, fine, distinct, brown (10YR 4/3) mottles; weak, medium, granular structure; friable when moist; neutral; clear, wavy boundary.

B22g—13 to 20 inches, gray (10YR 5/1) and dark yellowish-brown (10YR 4/4) silt loam; many, medium, faint, light brownish-gray (10YR 6/2) mottles; weak, fine and medium, granular structure; friable when moist; few, small, black (10YR 2/1) concretions; neutral; gradual, smooth boundary.

C1g—20 to 46 inches, gray (10YR 6/1) silt loam; many, common, medium, distinct, yellowish-brown (10YR 5/4) mottles; massive; friable when moist; common, small, black (10YR 2/1) concretions; neutral; gradual, smooth boundary.

C2g—46 to 55 inches +, gray (10YR 6/1), light brownish-gray (10YR 6/2), and pale-brown (10YR 6/3) silt; massive; friable when moist; neutral.

The Ap horizon ranges from dark grayish brown to brown in color and from neutral to slightly acid in reaction. The underlying material is mainly light silty clay loam to silt loam but contains strata of loam, sandy loam, or sandy clay loam in some areas. The C horizon is slightly acid to neutral.

Wakeland silt loam (Wa).—This soil is on bottom lands along small streams and in slight depressions at the base of uplands along the Wabash River. The slope range is 0 to 2 percent. Flooding is a hazard. Included in mapping were small areas of loam and sandy loam.

Row crops, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Alfalfa and small grain are severely damaged by prolonged floods. Crops respond well to fertilizer. Flooding is a hazard, and wetness is a limitation. (Capability unit IIw-7; woodland group 13)

Warsaw Series

The Warsaw series consists of deep, well-drained soils that have a medium-textured or moderately coarse textured surface layer and a moderately fine textured subsoil. These soils are on terraces. They formed in 24 to 42 inches of outwash over gravel and sand (fig. 6). The native vegetation was prairie grass.

A typical profile has a 14-inch surface layer of loam, very dark brown in the upper 7 inches and dark brown in the lower part. The subsoil is about 22 inches thick. The upper 16 inches is mostly dark-brown, firm gravelly sandy clay loam. The lower part is dark-brown and yellowish-brown, firm gravelly clay loam. The underlying material is light brownish-gray to brown, loose, stratified gravel and sand.

Permeability is moderate, surface runoff is slow to medium, and the available moisture capacity is medium to low. The organic-matter content is high.

Nearly level to moderately sloping soils of this series occur on gravelly terraces in the western part of this county.

Typical profile of Warsaw loam in a cultivated field at the edge of a gravel pit, at a point 45 feet west and 150 feet south of the northeast corner of the NW¼NE¼ sec. 23, T. 8 N., R. 11 W.

Ap—0 to 7 inches, very dark brown (10YR 2/2) loam; weak, fine, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

A1—7 to 14 inches, dark-brown (10YR 3/3) loam; moderate, medium, granular structure; friable when moist; slightly acid; clear, wavy boundary.

B21t—14 to 16 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; moderate, fine, subangular blocky structure; firm when moist; medium acid; gradual, wavy boundary.

B22t—16 to 30 inches, dark-brown (7.5YR 4/4) gravelly sandy clay loam; moderate, medium and coarse, subangular blocky structure; firm when moist; thin reddish-brown (5YR 4/3) clay films on ped faces; medium acid; clear, wavy boundary.

B23t—30 to 36 inches, dark-brown (7.5YR 3/2) and yellowish-brown (10YR 5/4) gravelly clay loam; moderate, coarse,

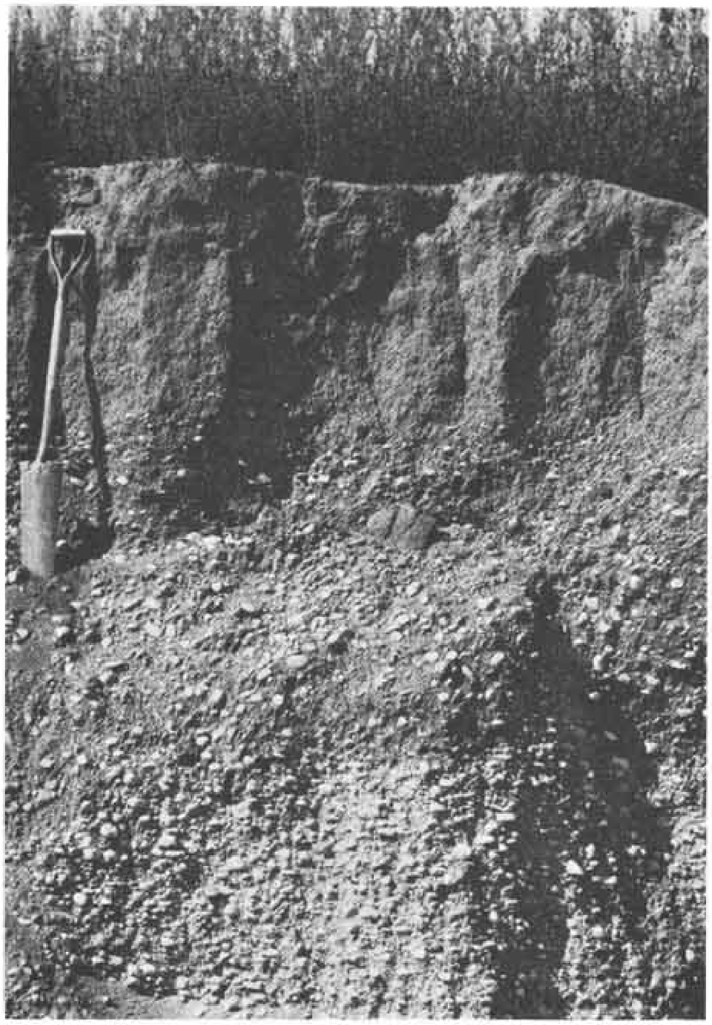

Figure 6.—Warsaw loam, 0 to 2 percent slopes. Profile is underlain by gravel and sand.

angular and subangular blocky structure; firm when moist; medium reddish-brown (5YR 4/3) clay films on ped faces; tongues of this material, as much as 6 to 8 inches thick, extend into the IIC horizon to a depth of 2 to 3 feet; slightly acid; abrupt, irregular boundary.

IIC—36 to 50 inches +, light brownish-gray (10YR 6/2) and brown (10YR 5/3), stratified gravel and sand; loose; calcareous.

The Ap horizon ranges from black to very dark grayish brown in color. The A horizon ranges from 12 to 16 inches in thickness. The B2 horizon ranges from heavy loam to clay loam, gravelly clay loam, or sandy clay loam in texture.

Warsaw sandy loam, 0 to 2 percent slopes (WrA).—This soil is on broad terraces. Included in mapping were small areas of loamy fine sand.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. The low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIIs-2; woodland group 23)

Warsaw sandy loam, 2 to 6 percent slopes (WrB).—This soil is on breaks on broad terraces. Included in mapping were small areas of loam to loamy fine sand. Also included were small tracts of moderately eroded soils.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Erosion is a hazard, and the low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIIe-13; woodland group 23)

Warsaw sandy loam, 6 to 12 percent slopes, eroded (WrC2).—This soil is on breaks on broad terraces. From 5 to 7 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the dark yellowish-brown subsoil. Included in mapping were small areas of slightly eroded soils. Also included were small areas of strongly sloping soils.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Erosion resulting from medium surface runoff is a hazard, and the low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIIe-13; woodland group 23)

Warsaw loam, 0 to 2 percent slopes (WsA).—This soil is on broad terraces. Included in mapping were small areas of soils that have a surface layer of silt loam.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. The medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIs-2; woodland group 23)

Westland Series

The Westland series consists of deep, very poorly drained soils that have a moderately fine textured surface layer and subsoil. These soils are on terraces along the Wabash River. They formed in 42 to 60 inches of outwash over gravel and sand. The native vegetation consisted of swamp forest and marsh grass.

A typical profile has a 13-inch surface layer of silty clay loam, very dark brown in the upper 7 inches and very dark gray in the lower part. The subsoil is about 39 inches thick. The uppermost 13 inches is dark-gray heavy silty clay loam, the middle 18 inches is gray gravelly clay loam, and the rest is gray sandy clay loam that contains some gravel. The subsoil is mottled and firm in all parts. The underlying material consists of gray, brown, and light yellowish-brown, loose, stratified gravel and sand.

Permeability is slow, surface runoff is very slow to ponded, and the available moisture capacity is high. The organic-matter content is high. The surface layer is slightly acid to neutral.

Nearly level soils of this series occur on outwash terraces in the southwestern part of this county.

Typical profile of Westland silty clay loam in a cultivated field, at a point 130 feet east and 250 feet north of the southwest corner of the NE¼ sec. 11, T. 6 N., R. 10 W.

Ap—0 to 7 inches, very dark brown (10YR 2/2) silty clay loam; moderate, fine, subangular blocky structure; friable when moist; neutral; abrupt, smooth boundary.

A1—7 to 13 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, subangular blocky structure; firm when moist; neutral; gradual, wavy boundary.

B21tg—13 to 26 inches, dark-gray (10YR 4/1) heavy silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, prismatic structure breaking to moderate, medium, angular blocky; firm when moist; few very dark gray (10YR 3/1) clay films on ped faces; few pebbles, increasing in number with depth; neutral; clear, wavy boundary.

B22tg—26 to 44 inches, gray (10YR 5/1) gravelly clay loam; many, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, prismatic structure breaking to moderate, medium and coarse, subangular blocky; firm when moist; few dark yellowish-brown (10YR 4/4) clay films on ped faces; neutral; clear, smooth boundary.

B3g—44 to 52 inches, gray (10YR 5/1) sandy clay loam; some gravel; many, medium, distinct, yellowish-brown (10YR 5/4) mottles; massive; firm when moist; neutral to mildly alkaline; clear, wavy boundary.

IIC—52 to 65 inches +, gray (10YR 6/1), brown (10YR 5/3), and light yellowish-brown (10YR 6/4), stratified gravel and sand; single grain; loose; calcareous.

The Ap horizon ranges from black to very dark gray or very dark brown in color. The A horizon ranges from 10 to 16 inches in thickness. The depth to loose sand and gravel ranges from 42 to 60 inches.

Westland silty clay loam (Wt).—This soil is in depressions on outwash terraces near the Wabash River, mainly in the southwestern part of the county. The slope range is 0 to 2 percent. Included in mapping were small areas of silt loam.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Wetness is the major limitation. (Capability unit IIw–1; woodland group 11)

Westland silty clay loam, shallow variant (Wv).—This soil is on outwash terraces, mainly in the northwestern part of the county. It differs from normal Westland silty clay loam in that the depth to bedrock is only 20 to 42 inches.

All the crops commonly grown in this county can be grown on this soil if a drainage system is established and maintained. The limited depth to bedrock makes drainage difficult. Corn, soybeans, small grain, and hay are the main crops. Alfalfa is less suitable, because of a high water table and a frost-heave hazard during winter and early in spring. Crops respond well to fertilizer. Wetness and the limited depth to bedrock are the major limitations. (Capability unit IIIw–5; woodland group 11)

Wilbur Series

The Wilbur series consists of deep, moderately well drained soils that have a medium-textured surface layer and subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was a mixed hardwood forest.

A typical profile has a surface layer of dark grayish-brown silt loam about 9 inches thick. The subsoil is about 33 inches of brown, friable silt loam; the lower part is mottled. The underlying material is pale-brown, friable silt.

Permeability is moderate, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is neutral to slightly acid.

Nearly level soils of this series occur on bottom lands along small tributaries of the Wabash River in the western half of this county.

Typical profile of Wilbur silt loam in a cultivated field, at a point 70 feet east and 150 feet south of the northwest corner of sec. 3, T. 7 N., R. 10 W.

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B21—9 to 20 inches, brown (10YR 5/3) silt loam; weak, medium, granular structure; friable when moist; clear, smooth boundary.

B22—20 to 42 inches, brown (10YR 5/3) silt loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive to very weak, medium, granular structure; friable when moist; neutral; clear, smooth boundary.

C—42 to 50 inches +, pale-brown (10YR 6/3) silt; common, medium, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/8) mottles; massive; friable when moist; few, medium, very dark brown (10YR 2/2) concretions of iron and manganese; neutral.

The Ap horizon ranges from dark grayish brown to brown in color. The depth to mottling ranges from 16 to 24 inches. The B horizon is 20 to 36 inches thick. The C horizon is silt to silt loam, and in places it contains lenses of fine sand. The reaction is slightly acid to mildly alkaline.

Wilbur silt loam (Ww).—This soil occurs as narrow areas on bottom lands along creeks. The slope range is 0 to 2 percent. Flooding is likely in spring. Included in mapping were a few small areas of somewhat poorly drained soils.

Corn, soybeans, hay, and pasture are suitable crops. Small grain is less suitable, because it is damaged by flooding. Crops respond well to fertilizer. Flooding is the major hazard, and wetness is a slight limitation. (Capability unit I–2; woodland group 8)

Zipp Series

The Zipp series consists of deep, very poorly drained soils that have a fine-textured surface layer and subsoil. These soils are on lake terraces and old river channels. They formed in water-deposited clayey sediment. The native vegetation was swamp forest.

A typical profile has an 8-inch surface layer of very dark grayish-brown silty clay. The subsoil is about 23 inches of dark-gray, mottled, very firm silty clay to clay. The underlying material is clay. The upper 29 inches is dark gray to gray, mottled, and very firm. The rest is gray to yellowish brown, mottled, and very plastic.

Permeability is very slow, surface runoff is very slow or ponded, and the available moisture capacity is high. The organic-matter content is high.

Soils of this series occur in depressions on lake terraces and in old stream channels along the Wabash River.

Typical profile of Zipp silty clay in a cultivated field, at a point 80 feet east and 50 feet south of the northwest corner of the SE¼NW¼ sec. 26, T. 6 N., R. 10 W.

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silty clay; moderate, medium and coarse, angular blocky structure; firm when moist; slightly acid; clear, smooth boundary.

B2g—8 to 31 inches, dark-gray (10YR 4/1) silty clay to clay; common, medium, distinct, dark-brown (7.5YR 4/4) mottles; moderate, very coarse, angular blocky structure; very firm when moist; slightly acid; clear, smooth boundary.

C1—31 to 60 inches, dark-gray (10YR 4/1) to gray (10YR 5/1) clay; many, medium, distinct, dark-brown (7.5YR 4/4) mottles; massive; very firm when moist; neutral; gradual, wavy boundary.

C2—60 to 70 inches +, gray (10YR 6/1) to yellowish-brown (10YR 5/6) clay; common, medium, gray (N 5/0) mottles; massive; very plastic; calcareous.

The Ap horizon ranges from very dark grayish brown to dark gray in color, and the B2 horizon from dark gray to gray. The C horizon is mainly silty clay to clay, but in some places it contains thin layers of silty clay loam or clay loam and an occasional layer of sandy clay loam.

Zipp silty clay (Zc).—This soil is in depressions on lake terraces and in old river channels near the Wabash River. The slope range is 0 to 2 percent. Flooding is likely during winter and spring. Included in mapping were small areas of soils that have a surface layer of clay loam.

Corn, soybeans, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Alfalfa and small grain are severely damaged by flooding. Crops respond well to fertilizer. Wetness is the major limitation. (Capability unit IIIw-2; woodland group 11)

Use and Management of the Soils

This section contains information about the use and management of the soils of Sullivan County as cropland, as woodland, as wildlife habitat, and as engineering material.

Use of the Soils for Crops

About two-thirds of the acreage of Sullivan County is used for crops and permanent pasture. The main cultivated crops are corn, soybeans, and wheat. The principal forage crops are clover, alfalfa, and grass. A small acreage is used for orchard and vegetable crops.

Sloping soils, such as those of the Cincinnati series, will erode when cultivated unless protective measures are used. Contour cultivation, stripcropping, diversion terraces, grassed waterways, proper use of crop residue, and the inclusion of grass and legumes in the rotation are effective in controlling erosion and also help to conserve moisture.

Wet soils, such as those of the Westland series, have to be drained artificially, by tile systems or by surface ditches, before they can be used profitably to grow crops.

According to the 1964 Census of Agriculture, 748 acres in Sullivan County were irrigated. The acreage of high-value crops irrigated is increasing every year.

Soil tests should be made to determine the amounts of lime and fertilizer needed for cultivated crops and pasture.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, 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, require special conservation practices, or both.

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

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

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

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-3 or IIIe-7. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Sullivan County are described and suggestions for the use and management of the soils are given. These units are not numbered consecutively, because not all of the units in the statewide system are represented in the county. The names of the soil series represented are mentioned in the description of each unit, but this does not mean that all the soils in a given series are in the unit. The capability classification of each individual soil is given in the "Guide to Mapping Units."

CAPABILITY UNIT I-2

This unit consists of deep, nearly level soils of the Cuba, Eel, Genesee, Iona, Ross, and Wilbur series. These soils are well drained or moderately well drained and medium textured or moderately coarse textured. Iona soils are on uplands in the western part of the county. The others are on bottom lands along the Wabash River and its tributaries.

The soils of this unit are moderately permeable or moderately slowly permeable. Most of them are low in organic-matter content, most have a slightly acid to mildly alkaline surface layer, and most have high available moisture capacity. The Ross soil is high in organic-matter content. The Cuba soil has a strongly acid or medium acid surface layer, and the Iona soil a medium acid surface layer. The Genesee soil, sandy variant, has medium available moisture capacity, and crops on it are subject to drought damage late in spring and in summer, when the weather is dry. All the soils except the Iona are flooded occasionally.

These soils are well suited to all the crops commonly grown in the county. Corn and soybeans are the main crops. Alfalfa and small grain are damaged by prolonged floods.

Crop residue and green-manure crops can be used to return organic matter. Increasing the organic-matter content would improve the available moisture capacity of the Genesee soil, sandy variant. Dikes and levees help to prevent flood damage.

CAPABILITY UNIT IIe-3

This unit consists of deep, gently sloping soils of the Alford, Iona, and Muren series. These soils are well drained or moderately well drained and are medium textured. They are on uplands in all parts of the county except the northeastern.

The soils of this unit are moderately eroded. The organic-matter content is low. The surface layer is medium acid unless it has been limed. The available moisture capacity is high. Permeability is moderate or moderately slow. Erosion is a moderate hazard, and the low organic-matter content is a limitation.

These soils are suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops.

Minimum tillage, contour cultivation (fig. 7), diversion terraces, and grassed waterways help to control runoff and erosion. Crop residue and green-manure crops can be used to return organic matter.

CAPABILITY UNIT IIe-7

This unit consists of deep, gently sloping, moderately well drained and well drained, medium-textured soils of the Ava and Cincinnati series. These soils are on ridgetops and at the head of drainageways on uplands.

The soils of this unit are moderately eroded. The organic-matter content is low. The surface layer is strongly acid unless it has been limed. The available moisture capacity is medium, and permeability is slow. A fragipan in the subsoil restricts penetration by roots and water. A perched water table early in spring often causes some delay in spring farming operations. In years when rainfall is less than normal or is poorly distributed, crops occasionally are subject to damage from drought. The hazard of further erosion is moderate.

These soils are suited to most of the crops commonly grown in the county. Corn, soybeans, wheat, clover, and grass are the main crops. Because of the restricted root zone, alfalfa does not grow well.

Minimum tillage, contour cultivation, grassed waterways, and diversion terraces help to control erosion. Crop residue and green-manure crops can be used to return organic matter and improve fertility.

CAPABILITY UNIT IIe-8

Elston loam, 2 to 6 percent slopes, is the only soil in this unit. It is a deep, well-drained, medium-textured soil on terraces in the southwestern part of the county.

The organic-matter content of this soil is high. The surface layer is medium acid unless it has been limed. The available moisture capacity is medium, and permeability is moderate. Erosion is a moderate hazard, and the medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to some damage from drought.

This soil is suited to all the crops commonly grown in the county. Corn, soybeans, grain sorghum, small grain, hay, and pasture are the main crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Because of the short, irregular slopes, practices for control of erosion are limited to minimum tillage, contour cultivation, and use of winter cover crops.

Figure 7.—**Contour cultivation on Alford silt loam, 2 to 6 percent slopes, eroded.**

CAPABILITY UNIT IIe–11

Princeton fine sandy loam, 2 to 6 percent slopes, eroded, is the only soil in this unit. It is a deep, well-drained soil that occurs in the western part of the county.

The organic-matter content of this soil is low. The surface layer is medium acid unless it has been limed. The available moisture capacity is medium, and permeability is moderate. Erosion is a moderate hazard, and the medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought.

This soil is suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Alfalfa and orchard crops also grow well.

Minimum tillage, use of crop residue, and use of green-manure crops help to increase the organic-matter content and maintain good tilth. These practices, along with a system of contour cultivation, terraces, and grassed waterways, help to control erosion.

CAPABILITY UNIT IIw–1

This unit consists of deep, nearly level, very poorly drained, medium-textured and moderately fine textured soils of the Lyles, Patton, Ragsdale, Rensselaer, and Westland series. These soils are in depressions on terraces and uplands in the western half of the county.

The organic-matter content of these soils is high. The surface layer is slightly acid to neutral. The available moisture capacity is high, and permeability is slow. Wetness is a moderate limitation.

The moderately fine textured soils are hard to keep in good tilth. If they are tilled when too dry or too wet, large clods are likely to form. When dry, these clods are very difficult to work down.

If artificially drained, the soils of this unit are suited to corn, soybeans, hay, and pasture. They are not suited to alfalfa, because of prolonged wetness and a hazard of frost heave.

Minimum tillage, use of crop residue, and cultivation of the silty clay loam soils when moisture conditions are favorable help to maintain good tilth.

CAPABILITY UNIT IIw–2

This unit consists of deep, nearly level and gently sloping, somewhat poorly drained, medium-textured and moderately coarse textured soils of the Ayrshire, Cory, Henshaw, Iva, and Reesville series. These soils are on uplands and terraces throughout the county.

Most of the soils of this unit are low in organic-matter content, and most are slowly permeable. The Cory soil is high in organic-matter content. The Ayrshire soils are moderately permeable. In all the soils, the available moisture capacity is high, and the surface layer is medium acid unless limed. The gently sloping soils have slow or medium surface runoff and are somewhat susceptible to erosion. Increasing and maintaining the organic-matter content is a problem with all the soils except the Cory. Wetness is a moderate limitation.

If artificially drained, these soils are suited to corn, soybeans, small grain, hay, and pasture. Vegetables are grown under irrigation on the nearly level Ayrshire soils.

Crop residue and green-manure crops can be used to return organic matter. Minimum tillage, contour cultivation, diversion terraces, and grassed waterways help to control erosion of the gently sloping soils.

CAPABILITY UNIT IIw-5

Ava silt loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, moderately well drained, medium-textured soil on uplands in the northern and eastern parts of the county.

The organic-matter content of this soil is low. The surface layer is strongly acid unless it has been limed. The available moisture capacity is medium, and permeability is slow. A fragipan at a depth of 22 to 34 inches restricts the downward movement of roots and water and limits the available moisture capacity. A perched water table early in spring often causes some delay in spring farming operations. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought.

This soil is suited to corn, soybeans, small grain, hay, and pasture. It is not well suited to alfalfa, because of a hazard of frost heave and the restricted root zone. Minimum tillage, use of crop residue, and use of green-manure crops help to increase the organic-matter content and to maintain good tilth.

CAPABILITY UNIT IIw-7

This unit consists of deep, somewhat poorly drained, medium-textured to moderately fine textured soils of the Petrolia, Stendal, and Wakeland series. These soils occur on bottom lands along the Wabash River and along small streams in all parts of the county.

The organic-matter content of these soils is low or medium. The available moisture capacity is high. Permeability is moderate or slow. The Petrolia soil has a neutral surface layer, the Stendal soil has a strongly acid surface layer, and the Wakeland soil has a neutral to slightly acid surface layer. Wetness is a moderate limitation, maintaining the organic-matter content is a problem, and flooding is a hazard.

If artificially drained (fig. 8), these soils are well suited to most of the crops commonly grown in the county. Corn, soybeans, hay, and pasture are the main crops. Small grain and alfalfa are severely damaged if floods are prolonged.

CAPABILITY UNIT IIw-10

Carlisle muck is the only soil in this unit. It is a deep, very poorly drained organic soil that occurs in depressions on terraces along the Wabash River in the vicinity of Merom Station. The slope range is 0 to 2 percent.

The available moisture capacity of this soil is high, and permeability is moderate to rapid. The surface layer is

***Figure 8.*—Open ditch in Wakeland silt loam, used as an outlet for surface and tile drainage systems.**

slightly acid to medium acid unless it has been limed. Wetness is a moderate limitation.

If artificially drained, this soil is suited to all the crops commonly grown in the county. Corn and soybeans are the main crops.

CAPABILITY UNIT IIs-1

Fox loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, nearly level, well-drained, medium-textured soil on gravelly terraces near the Wabash River, in the southwestern part of the county.

The organic-matter content of this soil is low. The available moisture capacity is medium, and permeability is moderate. In years when rainfall is less than normal or is poorly distributed, droughtiness is a moderate limitation.

This soil is suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Vegetables are grown under irrigation.

Minimum tillage, use of crop residue, and use of green-manure crops help to increase the organic-matter content and maintain good tilth. Planting early in spring helps to overcome the limitation of droughtiness.

CAPABILITY UNIT IIs-2

This unit consists of deep, nearly level, well-drained, medium-textured soils of the Elston and Warsaw series. These soils are on terraces in the western and southwestern parts of the county.

The organic-matter content of these soils is high. The surface layer is slightly acid or medium acid. The available moisture capacity is medium, and permeability is moderate. In years when rainfall is less than normal or is poorly distributed, droughtiness is a severe limitation.

These soils are suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Vegetables are grown under irrigation. Minimum tillage, use of crop residue, and planting early in spring help to prevent drought damage to crops.

CAPABILITY UNIT IIs-5

Princeton fine sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, nearly level, well-drained, moderately coarse textured soil on uplands in the western part of the county.

The organic-matter content of this soil is low. The surface layer is medium acid unless it has been limed. The available moisture capacity is medium, and permeability is moderate. In years when rainfall is less than normal or is poorly distributed, crops are subject to moderate damage from drought.

This soil is suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops.

Minimum tillage, use of crop residue, and use of green-manure crops help to maintain or increase the organic-matter content. Planting early in spring helps to prevent drought damage to crops.

CAPABILITY UNIT IIIe-3

This unit consists of deep, gently sloping and moderately sloping, well drained and moderately well drained, medium-textured soils of the Alford and Iona series. These soils occur on uplands in all parts of the county except the northeastern.

The soils of this unit are moderately and severely eroded. The organic-matter content is low. The surface layer is medium acid unless it has been limed. The available moisture capacity is high, and permeability is moderate to moderately slow. The hazard of further erosion is severe. The low organic-matter content is a limitation.

These soils are suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops.

Minimum tillage, use of crop residue, contour cultivation, diversion terraces, and grassed waterways help to control runoff and erosion. Winter cover crops and green-manure crops can be used to return organic matter.

CAPABILITY UNIT IIIe-7

This unit consists of deep, gently sloping and moderately sloping, well drained and moderately well drained, medium-textured soils of the Ava and Cincinnati series. These soils are on uplands in the northern and eastern parts of the county.

The soils of this unit are moderately and severely eroded. The organic-matter content is low. The available moisture capacity is medium. The surface layer is strongly acid unless it has been limed. A fragipan at a depth of 22 to 34 inches restricts the downward movement of water and roots and limits the available moisture capacity. Runoff and erosion are severe hazards.

These soils are suited to most of the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Alfalfa does not grow well, because the fragipan restricts root penetration. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought.

Crop residue and green-manure crops can be used to return organic matter. Minimum tillage, contour cultivation, diversion terraces, grassed waterways, and winter cover crops help to control runoff and erosion.

CAPABILITY UNIT IIIe-11

Markland silt loam, 2 to 6 percent slopes, eroded, is the only soil in this unit. It is a deep, well drained to moderately well drained, medium-textured soil that occurs on lacustrine terraces in the west-central and northwestern parts of the county.

The organic-matter content of this soil is low. The surface layer is neutral or slightly acid. The available moisture capacity is high, and permeability is slow. Erosion is a severe hazard, and the slowly permeable subsoil is a limitation.

This soil is suited to all the crops commonly grown in this county. Corn, soybeans, small grain, hay, and pasture are the main crops.

Minimum tillage, use of crop residue, and use of green-manure crops help to increase the organic-matter content and maintain good tilth. These practices, along with a system of terraces, contour cultivation, and grassed waterways, help to control runoff and erosion.

CAPABILITY UNIT IIIe-12

This unit consists of deep, moderately sloping, somewhat excessively drained, coarse-textured soils of the

Ade and Bloomfield series. These soils are on uplands above the Wabash River in the western part of the county.

The available moisture capacity of these soils is low, and permeability is rapid. The plow layer is medium acid unless it has been limed. The Ade soil is high in organic-matter content, and the Bloomfield soil is low. For both soils, erosion is a severe hazard and the low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought.

These soils are suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Apples, peaches, melons, and other specialty crops also can be grown.

Use of crop residue and use of green-manure crops are ways to return organic matter. These practices also help to conserve moisture. Contour cultivation, minimum tillage, and winter cover crops help to control erosion.

CAPABILITY UNIT IIIe-13

This unit consists of deep, gently sloping and moderately sloping, well-drained, moderately coarse textured soils of the Elston, Fox, Princeton, and Warsaw series. These soils are underlain at a depth of more than 24 inches by sand or by gravel and sand. They occur in the western part of the county. The Princeton soil is on uplands, and the other soils are on terraces.

The organic-matter content of the Fox and Princeton soils is low, and that of the Elston and Warsaw soils is high. The available moisture capacity of all the soils is low to medium. Permeability is moderate to rapid. The plow layer is medium acid unless it has been limed. Erosion is a severe hazard, and the low to medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought.

These soils are suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Peaches and apples are also grown. Vegetables are grown under irrigation on all except the Princeton soil.

Crop residue and green-manure crops can be used to return organic matter. Increasing the organic-matter content, in combination with minimum tillage and early planting, helps to conserve moisture and to prevent drought damage to crops. Minimum tillage, contour cultivation, and winter cover crops help to control erosion. Diversion terraces and grassed waterways can be used to control erosion on the Princeton soil but not on the soils of the terraces, because they have short and irregular slopes.

CAPABILITY UNIT IIIw-2

This unit consists of deep, very poorly drained, fine-textured soils of the Kings and Zipp series. These soils are in depressions on lake terraces and old stream channels along the Wabash River.

The organic-matter content of these soils is high. The surface layer is neutral or slightly acid unless it has been limed. The available moisture capacity is high, and permeability is very slow. Wetness is a severe limitation, and maintaining good tilth is a problem. If the soils are tilled when too wet or too dry, large clods are likely to form. When dry, these clods are very difficult to work down. Flooding is a severe hazard on the Zipp soil.

If artificially drained, the soils of this unit are suited to all the crops commonly grown in the county. Corn, soybeans, and hay are the main crops. Small grain and alfalfa are damaged by the high water table in winter and early in spring. Minimum tillage, plowing in fall, and use of crop residue, along with cultivation when moisture conditions are favorable, help to maintain good tilth.

CAPABILITY UNIT IIIw-3

This unit consists of deep, nearly level and gently sloping, somewhat poorly drained, medium-textured soils of the Vigo series. These soils are on uplands in the northeastern part of the county.

The organic-matter content of these soils is low. The surface layer is strongly acid unless it has been limed. The available moisture capacity is high. Permeability is very slow. A claypan is at a depth of 18 to 24 inches. Wetness is a severe limitation. Erosion is a hazard on slopes of more than 2 percent.

These soils are suited to most of the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Alfalfa is not well suited, because the claypan restricts the root zone.

Crop residue and green-manure crops can be used to return organic matter. Minimum tillage, contour cultivation, diversion terraces, and grassed waterways are needed to help control erosion on slopes of more than 2 percent.

CAPABILITY UNIT IIIw-5

Westland silty clay loam, shallow variant, is the only soil in this unit. It is a deep, very poorly drained, moderately fine textured soil on outwash terraces, mainly in the northwestern part of the county. The slope range is 0 to 2 percent. The depth to bedrock is 20 to 42 inches.

The organic-matter content of this soil is high, the available moisture capacity is high, and permeability is slow. Wetness is a severe limitation, and the limited depth to bedrock makes drainage difficult.

If artificially drained, this soil is suited to all the crops commonly grown in the county. Corn, soybeans, small grain, and hay are the main crops. Alfalfa is damaged by frost heave in winter and early in spring.

Minimum tillage, use of crop residue, and cultivation when moisture conditions are favorable are ways to maintain good tilth.

CAPABILITY UNIT IIIw-6

McGary silt loam is the only soil in this unit. It is a deep, somewhat poorly drained, medium-textured soil that has a moderately fine textured to fine textured, very slowly permeable subsoil. The slope range is 0 to 2 percent. This soil is on terraces in the west-central and northwestern parts of the county.

The organic-matter content of this soil is low. The surface layer is neutral to slightly acid. The available moisture capacity is high, and permeability is very slow. Wetness is a severe limitation.

If artificially drained, this soil is suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Minimum tillage, use of crop residue, and use of green-manure crops help to increase the organic-matter content and maintain good tilth.

CAPABILITY UNIT IIIw-7

Shadeland loam is the only soil in this unit. It is a moderately deep, somewhat poorly drained, medium-textured soil on benches in the northwestern part of the county. The slope range is 0 to 2 percent. The depth to bedrock is 20 to 42 inches.

The organic-matter content of this soil is low. The surface layer is strongly acid unless it has been limed. The available moisture capacity is medium or low, and permeability is slow. Wetness is a severe limitation.

If artificially drained, this soil is suited to most of the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought.

Minimum tillage, use of crop residue, and use of green-manure crops help to maintain or increase the organic-matter content and to conserve moisture.

CAPABILITY UNIT IIIw-10

Atkins silt loam is the only soil in this unit. It is a deep, well-drained, medium-textured soil in depressions on creek bottoms in the eastern part of the county. The slope range is 0 to 2 percent.

The organic-matter content of this soil is low. The surface layer is strongly acid unless it has been limed. Permeability is moderate, and the available moisture capacity is high. Wetness is a severe limitation, and flooding is a hazard.

If artificially drained, this soil is suited to corn, soybeans, hay, and pasture. Small grain and alfalfa are severely damaged by floods.

Minimum tillage, use of crop residue, and use of green-manure crops help to increase the organic-matter content and maintain good tilth.

CAPABILITY UNIT IIIs-1

This unit consists of deep, gently sloping, somewhat excessively drained, coarse-textured soils of the Ade and Bloomfield series. These soils are on uplands in the western part of the county, east of the Wabash River.

The organic-matter content of the Ade soil is high, and that of the Bloomfield soil is low. The surface layer is medium acid unless it has been limed. The available moisture capacity is low, and permeability is rapid. Surface runoff is slow. The low available moisture capacity is a severe limitation. Erosion is a hazard.

These soils are suited to all the crops commonly grown in the county. Melons, corn, soybeans, small grain, hay, and pasture are the main crops. Orchard fruits and alfalfa grow well.

Minimum tillage, contour farming, and grassed waterways help to control runoff and erosion. Crop residue and green-manure crops can be used to return organic matter and conserve moisture. Planting early in spring helps to prevent drought damage to crops.

367-524—70——4

CAPABILITY UNIT IIIs-2

This unit consists of deep, nearly level, well-drained, moderately coarse textured soils of the Fox, Elston, and Warsaw series. These soils are underlain at a depth of more than 24 inches by sand or by gravel and sand. They are on terraces in the western part of the county near the Wabash River.

The organic-matter content of these soils is low to high. The plow layer is medium acid unless it has been limed. The available moisture capacity is low to medium, and permeability is moderate. The low to medium available moisture capacity is a severe limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought.

These soils are suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation.

Crop residue and green-manure crops can be used to return organic matter. Increasing the organic-matter content, in combination with minimum tillage and planting early in spring, helps to conserve moisture and to prevent drought damage to crops.

CAPABILITY UNIT IVe-3

This unit consists of deep, moderately sloping and strongly sloping, well-drained, medium-textured soils of the Alford and Parke series. These soils are on uplands in all parts of the county except the northeastern.

The soils of this unit are moderately and severely eroded. The organic-matter content is low. The surface layer is medium acid unless it has been limed. The available moisture capacity is high, and permeability is moderate. Erosion is a very severe hazard, and the low organic-matter content is a limitation.

The very severe hazard of erosion limits the suitability of these soils for row crops. Small grain, hay, pasture, peaches, and apples are the main crops.

Minimum tillage, use of crop residue, contour cultivation, diversion terraces, and grassed waterways help to control runoff and erosion. Winter cover crops and green-manure crops can be used to return organic matter.

CAPABILITY UNIT IVe-7

This unit consists of deep, well-drained, medium-textured, moderately sloping and strongly sloping soils of the Cincinnati series. These soils are on uplands in the northern and eastern parts of the county. A fragipan occurs at a depth of 26 to 32 inches.

The soils of this unit are eroded and severely eroded. The organic-matter content is low. The available moisture capacity is medium. The surface layer is strongly acid unless it has been limed. The slowly permeable fragipan restricts the downward movement of water and roots and limits the available moisture capacity. Erosion is a very severe hazard.

The very severe hazard of erosion limits the suitability of these soils for row crops. Small grain, hay, and pasture are the main crops. Alfalfa does not grow well, because the fragipan restricts the root zone. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought.

Minimum tillage, use of crop residue, contour cultivation, diversion terraces, and grassed waterways help to control runoff and erosion. Winter cover crops and green-manure crops can be used to return organic matter.

CAPABILITY UNIT IVe-12

Bloomfield loamy fine sand, 12 to 18 percent slopes, is the only soil in this unit. It is a deep, somewhat excessively drained, coarse-textured soil that occurs on uplands, as a narrow band that roughly parallels the Wabash River.

The organic-matter content of this soil is low. The surface layer is medium acid unless it has been limed. Permeability is rapid, and the available moisture capacity is low. Erosion is a very severe hazard, and the low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. This soil is suited to small grain, alfalfa, hay, orchard crops, and melons.

Minimum tillage, use of crop residue, and use of green-manure crops help to increase and maintain the organic-matter content. These practices also help to prevent drought damage to crops. Contour cultivation and winter cover crops help to control erosion.

CAPABILITY UNIT IVe-15

Princeton fine sandy loam, 12 to 18 percent slopes, eroded, is the only soil in this unit. It is a deep, well-drained, moderately coarse textured soil on uplands in the western part of the county.

The soil of this unit is slightly or moderately eroded. The organic-matter content is low. The surface layer is medium acid unless it has been limed. Permeability is moderate, and the available moisture capacity is medium. Erosion is a very severe hazard, and the medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought.

This soil is well suited to alfalfa and orchard crops. It is also suited to small grain, hay, and pasture. Only an occasional row crop should be grown.

Crop residue and green-manure crops can be used to return organic matter. Increasing the organic-matter content, in combination with minimum tillage and early planting, helps to conserve moisture and to prevent drought damage to crops. Minimum tillage, contour cultivation, and winter cover crops help to control erosion.

CAPABILITY UNIT VIe-1

This unit consists of deep, moderately sloping to very steep, well drained and moderately well drained, moderately coarse textured to moderately fine textured soils of the Alford, Cincinnati, Hickory, Markland, Parke, and Princeton series. These soils occur on uplands throughout the county.

The available moisture capacity of these soils is medium to high, and permeability is slow to moderate. Surface runoff is rapid to very rapid. Erosion is a very severe hazard.

These soils are suited to permanent pasture. Meadow crops can be grown where the slope is less than 18 percent. Plowing for preparation of seedbeds should be on the contour. Pastures should not be overgrazed. A permanent cover of vegetation helps to control runoff and erosion.

CAPABILITY UNIT VIe-3

Bloomfield loamy fine sand, 18 to 40 percent slopes, is the only soil in this unit. It is a deep, somewhat excessively drained, coarse-textured soil on escarpments and breaks. It occurs on the uplands in the western part of the county and is roughly parallel to the Wabash River.

The soil of this unit is slightly or moderately eroded. The organic-matter content is low. The surface layer is medium acid unless it has been limed. Permeability is rapid, and the available moisture capacity is low. Erosion is a very severe hazard, and the low available moisture capacity is a limitation.

This soil is suited to permanent pasture and to trees. In years when rainfall is less than normal or is poorly distributed, pasture yields are generally low.

A permanent cover of vegetation helps to control erosion. Pastures must not be overgrazed.

CAPABILITY UNIT VIIe-1

This unit consists of Hickory silt loam, 35 to 50 percent slopes, and of Rock land. These soils are slightly eroded and moderately eroded. They are on deeply dissected uplands. The Hickory soil is deep, medium textured, and well drained. It occurs on escarpments and side slopes, mostly in the eastern and northern parts of the county. Rock land is shallow to moderately deep, steep to very steep, and well drained to somewhat excessively drained. It occurs as a long, narrow band that begins at Merom and extends northward to the county line.

The Hickory soil of this unit is moderately permeable and has a high available moisture capacity. Rock land is moderately permeable and has a low available moisture capacity. Erosion is a very severe hazard.

Most of this unit is suited to trees, but some of the less steep areas are suited to permanent pasture. Pastures should not be overgrazed.

CAPABILITY UNIT VIIe-3

This unit consists only of Strip mines, a land type made up partly of long, narrow mounds of mine spoil and partly of open pits. The spoil is a mixture of soil material, rock, shale, and some fragments of coal. It is strongly acid to neutral. The erosion hazard is very severe. Some of the pits contain water.

This land type is suitable for the production of timber. The water areas can be developed as wildlife habitat or as recreational areas. Some of the less steep areas of spoil can be used for pasture.

CAPABILITY UNIT VIIe-4

This unit consists only of Gullied land, a moderately sloping to strongly sloping land type that occurs on uplands throughout the county. Most areas are bare of vegetation, but weeds, grass, and a few trees are starting to grow in places. Permanent vegetation would help to stabilize the gullies, control runoff, and provide cover for wildlife. Some areas have been planted to trees. Most areas are well suited to Christmas trees.

CAPABILITY UNIT VIIIs-1

This unit is made up of Mine dumps and Riverwash. Mine dumps are piles of waste from shaft mines and from loading points where coal is cleaned and sorted. Riverwash consists of assorted sand and gravel on islands and sandbars along the Wabash River.

These land types are not suited to farming. Much of the mine waste is too acid to support plants. Riverwash and sufficiently leached areas of Mine dumps produce a limited amount of vegetation. They are suitable for development as wildlife habitat.

Estimated Yields

Table 2 shows average yields per acre of the principal crops, under two levels of management. The figures in columns A represent yields that can be expected under an average, or medium, level of management. Those in columns B represent yields that can be expected under an improved, or high, level of management.

The following are assumed to be part of an average management system:

1. Using cropping systems that maintain tilth and organic-matter content.
2. Controlling erosion well enough to prevent serious impairment of the quality of the soil.
3. Applying fertilizer and lime in moderate amounts, if need is indicated by soil tests.
4. Returning most of the crop residue to the soil.
5. Plowing and tilling by conventional methods.
6. Planting crop varieties that are generally adapted to the climate and the soils.
7. Controlling weeds fairly well by tillage and spraying.
8. Draining wet soils well enough to allow cropping but not always well enough to prevent limitation of yields.

The following are assumed to be part of an improved management system:

1. Using cropping systems that maintain tilth and organic-matter content.
2. Controlling erosion to the maximum extent possible, so that qualities of the soil will be maintained or improved, rather than impaired.
3. Maintaining a high level of fertility by means of frequent soil tests and use of fertilizer in accordance with recommendations of the State Agricultural Experiment Station.
4. Liming soils in accordance with the results of soil tests.
5. Using crop residue to the fullest extent to protect and improve the soil.
6. Following minimum tillage practices.
7. Planting only the crop varieties that are best adapted to the soils and climate.
8. Controlling weeds thoroughly by tillage and spraying.
9. Draining wet areas well enough that wetness does not restrict yields.

The estimates in table 2 are averages for a period of 5 to 10 years. They are based on farm records, on interviews with farmers and with members of the staff of the Purdue Agricultural Experiment Station, and on direct observations by soil scientists and soil conserva-

TABLE 2.—*Estimated average yields per acre of principal crops under two levels of management*

[Yields in columns A can be expected over a 10-year period under an average level of management; those in columns B can be expected under an improved level of management. Absence of yield indicates that the crop is either not commonly grown or is not suited to the soil specified]

Soil	Corn		Soybeans		Wheat		Mixed hay		Alfalfa	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Ade loamy fine sand, 2 to 6 percent slopes	60	80	20	30	20	30	1.5	2.5	2.5	3.0
Ade loamy fine sand, 6 to 12 percent slopes	50	70	18	25	20	30	1.5	2.5	2.5	3.0
Alford silt loam, 2 to 6 percent slopes, eroded	70	95	25	35	30	50	2.0	3.0	3.0	4.0
Alford silt loam, 2 to 6 percent slopes, severely eroded	60	85	20	30	15	20	1.0	2.0	2.0	3.0
Alford silt loam, 6 to 12 percent slopes, eroded	55	80	23	31	30	40	2.0	3.0	3.0	4.0
Alford silt loam, 6 to 12 percent slopes, severely eroded	50	75	18	28	15	20	1.0	2.0	2.0	3.0
Alford silt loam, 12 to 18 percent slopes, eroded	----	----	----	----	30	40	1.5	2.5	2.5	3.5
Alford silt loam, 12 to 18 percent slopes, severely eroded	----	----	----	----	15	25	1.3	2.2	2.0	3.0
Alford silt loam, 18 to 25 percent slopes	----	----	----	----	----	----	----	----	----	----
Alford silt loam, 25 to 50 percent slopes	----	----	----	----	----	----	----	----	----	----
Atkins silt loam	60	70	20	30	18	25	2.0	3.0	----	----
Ava silt loam, 0 to 2 percent slopes	65	90	27	38	26	36	2.0	3.0	----	----
Ava silt loam, 2 to 6 percent slopes, eroded	60	82	25	35	25	34	2.0	3.0	----	----
Ava silt loam, 2 to 6 percent slopes, severely eroded	40	65	20	30	20	29	1.7	2.5	----	----
Ayrshire fine sandy loam, 0 to 2 percent slopes	73	96	28	40	25	35	2.0	3.0	2.5	3.5
Ayreshire fine sandy loam, 2 to 4 percent slopes	70	90	25	40	25	35	2.0	3.0	2.5	3.5
Ayreshire loam, 0 to 2 percent slopes	75	100	30	40	25	35	2.0	3.0	2.5	3.5
Bloomfield loamy fine sand, 2 to 6 percent slopes	60	80	22	30	25	35	1.2	1.5	2.5	3.0
Bloomfield loamy fine sand, 6 to 12 percent slopes	47	65	22	28	20	30	1.2	1.5	2.5	3.0
Bloomfield loamy fine sand, 12 to 18 percent slopes	----	----	----	----	20	30	1.2	1.5	2.5	3.0
Bloomfield loamy fine sand, 18 to 40 percent slopes	----	----	----	----	----	----	----	----	----	----
Carlisle muck	80	100	28	40	----	----	----	----	----	----
Cincinnati silt loam, 2 to 6 percent slopes, eroded	50	80	25	35	25	35	2.0	3.0	3.0	4.0

TABLE 2.—*Estimated average yields per acre of principal crops under two levels of management*—Continued

Soil	Corn		Soybeans		Wheat		Mixed hay		Alfalfa	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Cincinnati silt loam, 6 to 12 percent slopes, eroded	40	65	20	30	20	27	2.0	3.0	----	----
Cincinnati silt loam, 6 to 12 percent slopes, severely eroded	40	60	18	25	18	25	1.5	2.5	----	----
Cincinnati silt loam, 12 to 18 percent slopes, eroded	35	60	----	----	20	30	2.0	2.5	----	----
Cincinnati silt loam, 12 to 18 percent slopes, severely eroded	----	----	----	----	----	----	1.5	2.5	----	----
Cory silt loam	75	100	30	40	30	35	2.0	3.0	2.5	4.0
Cuba silt loam	70	100	28	40	32	40	2.0	3.0	2.5	4.0
Eel silt loam	65	100	30	40	30	35	2.5	4.0	2.5	4.0
Elston fine sandy loam, 0 to 2 percent slopes	65	75	20	30	30	42	1.5	2.5	2.5	3.5
Elston fine sandy loam, 2 to 6 percent slopes	65	75	20	30	30	42	1.5	2.5	2.5	3.5
Elston loam, 0 to 2 percent slopes	70	85	20	30	30	42	2.0	3.0	2.5	3.5
Elston loam, 2 to 6 percent slopes	70	80	20	30	30	42	2.0	3.0	2.5	3.5
Fox sandy loam, 0 to 2 percent slopes	50	70	20	30	30	40	1.5	2.0	2.0	3.2
Fox sandy loam, 2 to 6 percent slopes	50	70	20	30	28	37	1.5	2.0	2.0	3.2
Fox loam, 0 to 2 percent slopes	70	85	20	30	30	42	2.0	3.0	2.5	3.5
Genesee silt loam	70	100	28	40	32	40	2.0	3.0	2.5	4.0
Genesee fine sandy loam, sandy variant	65	90	25	35	32	40	2.0	3.0	2.5	4.0
Gullied land	----	----	----	----	----	----	----	----	----	----
Henshaw silt loam, 0 to 2 percent slopes	70	95	25	35	30	40	2.0	3.0	2.5	4.0
Henshaw silt loam, 2 to 4 percent slopes, eroded	70	95	25	35	30	40	2.0	3.0	2.5	4.0
Hickory silt loam, 18 to 25 percent slopes	----	----	----	----	----	----	----	----	----	----
Hickory silt loam, 25 to 35 percent slopes	----	----	----	----	----	----	----	----	----	----
Hickory silt loam, 18 to 25 percent slopes, severely eroded	----	----	----	----	----	----	----	----	----	----
Hickory silt loam, 35 to 50 percent slopes	----	----	----	----	----	----	----	----	----	----
Iona silt loam, 0 to 2 percent slopes	75	100	30	40	35	45	2.0	3.0	3.0	4.0
Iona silt loam, 2 to 6 percent slopes, eroded	70	95	25	35	35	45	2.0	3.0	3.0	4.0
Iona silt loam, 2 to 6 percent slopes, severely eroded	70	95	23	32	35	45	2.0	3.0	3.0	4.0
Iva silt loam, 0 to 2 percent slopes	75	100	30	40	30	42	2.0	3.0	2.5	4.0
Iva silt loam, 2 to 4 percent slopes, eroded	75	100	30	40	30	42	2.0	3.0	2.5	4.0
Kings silty clay	60	80	25	30	30	35	2.8	3.5	3.2	3.8
Lyles loam	70	100	30	40	30	42	2.0	3.0	3.0	5.0
Markland silt loam, 2 to 6 percent slopes, eroded	50	70	18	30	20	33	2.0	3.0	3.0	4.0
Markland silt loam, 12 to 18 percent slopes, eroded	----	----	----	----	----	----	1.3	2.2	2.0	3.0
Markland silt loam, 18 to 25 percent slopes, eroded	----	----	----	----	----	----	----	----	----	----
Markland silty clay loam, 6 to 18 percent slopes, severely eroded	----	----	----	----	----	----	1.3	2.2	2.0	3.0
McGary silt loam	50	70	23	28	26	34	2.0	3.0	1.5	2.0
Mine dumps	----	----	----	----	----	----	----	----	----	----
Muren silt loam, 2 to 6 percent slopes, eroded	75	95	35	40	33	42	2.0	3.0	3.0	4.0
Parke silt loam, 6 to 12 percent slopes, severely eroded	60	75	20	30	25	35	1.5	2.5	2.5	3.0
Parke silt loam, 12 to 18 percent slopes, severely eroded	----	----	----	----	----	----	1.3	2.2	2.0	3.0
Patton silty clay loam	70	100	30	40	30	35	2.0	3.0	3.0	5.0
Petrolia silty clay loam	75	90	30	40	25	40	1.5	2.5	2.0	2.5
Princeton fine sandy loam, 0 to 2 percent slopes	65	85	23	34	25	37	2.0	3.0	3.0	4.0
Princeton fine sandy loam, 2 to 6 percent slopes, eroded	60	80	20	30	23	34	2.0	3.0	3.0	4.0
Princeton fine sandy loam, 6 to 12 percent slopes, eroded	50	70	20	30	20	30	1.5	2.5	3.0	4.0
Princeton fine sandy loam, 12 to 18 percent slopes, eroded	----	----	----	----	20	30	1.5	2.5	3.0	4.0
Princeton fine sandy loam, 18 to 25 percent slopes, eroded	----	----	----	----	----	----	1.3	2.2	2.0	3.0
Princeton fine sandy loam, 25 to 50 percent slopes	----	----	----	----	----	----	----	----	----	----
Ragsdale silt loam	75	110	25	30	35	42	2.0	3.0	3.0	5.0
Reesville silt loam, 0 to 2 percent slopes	75	100	25	35	30	42	2.0	3.0	2.5	4.0
Reesville silt loam, 2 to 4 percent slopes, eroded	70	95	25	35	30	42	2.0	3.0	2.5	4.0
Rensselaer loam	75	100	25	35	28	40	2.0	3.0	3.0	5.0
Riverwash	----	----	----	----	----	----	----	----	----	----
Rock land	----	----	----	----	----	----	----	----	----	----
Ross silt loam	75	110	25	35	30	40	2.0	3.0	2.5	4.0
Shadeland loam	40	75	20	25	23	30	1.5	2.5	2.0	3.0
Stendal silt loam	65	90	25	35	15	25	1.5	2.5	2.0	2.5
Strip mines	----	----	----	----	----	----	----	----	----	----
Vigo silt loam, 0 to 2 percent slopes	55	85	20	30	25	35	2.5	3.0	----	----
Vigo silt loam, 2 to 4 percent slopes, eroded	50	80	20	30	20	30	2.5	3.0	----	----
Wakeland silt loam	80	100	25	35	18	28	1.5	2.5	2.0	2.5
Warsaw sandy loam, 0 to 2 percent slopes	50	90	20	30	30	42	1.5	2.0	2.0	3.2
Warsaw sandy loam, 2 to 6 percent slopes	50	90	20	30	30	42	1.5	2.0	2.0	3.2
Warsaw sandy loam, 6 to 12 percent slopes, eroded	50	75	18	26	30	42	1.5	2.5	2.5	3.5
Warsaw loam, 0 to 2 percent slopes	70	90	22	32	30	42	1.5	2.5	2.5	3.5
Westland silty clay loam	65	100	25	36	26	40	2.0	3.0	3.0	5.0
Westland silty clay loam, shallow variant	40	75	25	35	26	40	2.0	3.0	----	----
Wilbur silt loam	70	100	25	35	32	40	2.0	3.0	2.5	4.0
Zipp silty clay	60	80	25	30	30	35	2.8	3.5	3.2	3.8

tionists. Considered in making the estimates were the prevailing climate, the characteristics of the soils, and the influence of different kinds of management on the soils.

These figures are not intended to apply directly to specific tracts of land for any particular year, because the soils vary somewhat from place to place, management practices differ from farm to farm, and weather conditions vary from year to year. Nevertheless, these estimates are useful in showing relative productivity of the soils and how soils respond to different levels of management.

Woodland [2]

Hardwood forest originally covered most of Sullivan County. Prairie grass covered bottom lands and terraces along the Wabash River in the western part of the county. In 1959 about 47,000 acres was woodland. Much of the present forest cover is on steep to very steep slopes in upland areas. Many small tracts are on nearly level wet soils.

The soils vary widely in their suitability for trees. Productivity is affected by such things as available moisture capacity, depth of the root zone, thickness of the surface layer, texture, consistence, aeration, natural fertility, and depth to the water table.

[2] By JOHN O. HOLWAGER, woodland conservationist, Soil Conservation Service.

Upland oaks, tulip-poplar, pin oak, and sweetgum are the principal woodland crops in Sullivan County.

Upland oaks are predominant on the well-drained sites. The Alford soils, for example, are well suited to upland oaks and associated species. White oak, red oak, black oak, chinquapin oak, hickory, white ash, sugar maple, and tulip-poplar are the dominant species.

Tulip-poplar usually grows on the lower part of steep slopes, on cool aspects (north and northeast slopes), and in coves. The Princeton soils, for example, are well suited to tulip-poplar and associated species. Associated species include white ash, red oak, basswood, white oak, hickory, beech, black walnut, and sugar maple. Tulip-poplar is the species to be preferred in management.

Pin oak grows on poorly drained soils on uplands, terraces, and bottom lands. The Reesville soils (fig. 9), for example, are well suited to pin oak and associated species. Associated species include soft maple, sweetgum, swamp white oak, elm, and ash.

Sweetgum is a major forest type on poorly drained upland and terrace soils and on poorly drained and

Figure 9.—A typical small woodlot with well-spaced hardwood trees on Reesville silt loam, 0 to 2 percent slopes.

somewhat poorly drained bottom-land soils. The Stendal soils, for example, are well suited to sweetgum and associated species. Associated species include soft maple, red river birch, hickory, ash, and sycamore. Sweetgum is a minor component of several timber types.

Woodland groups

To assist woodland owners in planning the use of their soils, the soils of this county have been placed in 14 woodland groups, which are listed in table 3. Each woodland group is made up of soils that have similar characteristics that affect the growth of trees. Site index ratings for upland oaks, tulip-poplar, pin oak, and sweetgum are given for each group of soils on which these trees grow. Site index is the average height of the dominant trees in a stand at age 50. For example, a site index of 80 for upland oaks means that the dominant oak trees on a given site will average 80 feet in height when they are 50 years old. The woodland classification of each individual soil is given in the "Guide to Mapping Units."

Height-growth data for determining the site index ratings of the four woodland crops were obtained from the following sources: For upland oaks, from USDA Tech. Bul. 560 (*5*); for tulip-poplar, from data assembled for the Forest Service in 1957, but unpublished; for pin oak, from age-height data for sweetgum given in the Forestry Handbook, published in 1955 by the Society of American Foresters (*7*).

Site index can be converted to growth and yield data by following the methods shown in USDA Tech. Bul. 560 (*5*), as adapted by Case, Gingrich, and Lloyd in 1962; and Agricultural Handbook 181 (*4*), as adapted by Case in 1962.

In table 3, each woodland group is rated according to the capabilities, limitations, and hazards of the soils for woodland use. Groups are numbered on a statewide basis. Some of the groups do not occur in Sullivan County; consequently, the group numbers in the table are not consecutive. The factors, other than site index, on which the groupings are based are explained in the following paragraphs.

Seedling mortality refers to the expected loss of natural or planted seedlings attributable to the characteristics of the soils, the hazard of erosion, and the direction of slope. The rating is slight if natural regeneration ordinarily is adequate for restocking. The rating is moderate if natural regeneration cannot always be relied upon for adequate and immediate restocking. It is severe if consider-

TABLE 3.—*Suitability of*

[Dashed lines indicate that the species is not numerous

Group	Site index				Seedling mortality
	Upland oaks	Tulip-poplar	Pin oak	Sweetgum	
Group 1: AfB2, AfB3, AfC2, AfC3, AfD2, AfD3, FxA, IoA, IoB2, IoB3, MuB2, PaC3, PaD3.	85–95	90–105	----------	70–80	Slight to moderate------
Group 2: AfE, AfF, FsA, FsB, HkE, HkF, HkF3, PrA, PrC2, PrD2, PrE2, PrG.	85–95	95–105	----------	----------	Slight to moderate------
Group 3: Gu----------	----------	----------	----------	----------	Moderate to severe------
Group 4: HkG----------	80–90	90–100	----------	----------	Slight to moderate------
Group 5: AsA, AsB, AyA, HeA, HeB2, IvA, IvB2, Mg, ReA, ReB2, Sh, VgA, VgB2.	80–90	90–100	85–100	75–85	Slight----------
Group 8: Cu, Es, Gs, Gn, Ww----------	----------	95–105	----------	95–105	Slight----------
Group 9: AlA, AlB2, AlB3, CnB2, CnC2, CnC3, CnD2, CnD3.	70–85	90–100	----------	80–85	Slight----------
Group 11: Ak, Kg, Ly, Pc, PrB2, Ra, Rm, Wt, Wv, Zc.	95–105	90–105	85–105	85–95	Moderate----------
Group 13: Po, Sn, Wa----------	----------	----------	90–105	85–95	Slight----------
Group 15: BlB, BlC, BlD, BlF----------	80–85	75–85	----------	----------	Slight to moderate------
Group 16: Mn, Rr, St----------	----------	----------	----------	----------	Slight----------
Group 18: MaB2, MaD2, MaE2, McD3----------	70–80	----------	----------	----------	Slight----------
Group 22: Rs----------	45–55	----------	----------	----------	Moderate to severe------
Group 23: AdB, AdC, Ca, Co, EtA, EtB, EuA, EuB, Rt, WrA, WrB, WrC2, WsA.	----------	----------	----------	----------	----------

able replanting, special preparation of seedbed, and use of superior planting techniques are required to assure satisfactory stands.

Erosion hazard refers to the risk when the soil is used for production of woodland crops.

Windthrow hazard depends on soil characteristics that control development of tree roots and affect windfirmness (fig. 10). The rating is slight if there is no special problem and individual trees can be expected to remain standing if released on all sides; moderate if development of roots is adequate for stability except during periods of excessive soil wetness or high wind; and severe if development of roots is not adequate for stability and individual trees can be expected to blow over if released on all sides.

Equipment limitation is rated on the basis of soil characteristics that restrict or prohibit the use of equipment commonly used for tending and harvesting the woodland crop. The limitation is slight if there is no restriction on the kind of equipment used or on the time of year it can be used; moderate if there is a seasonal restriction of less than 3 months or if there is a moderate restriction caused by slope, wetness, stoniness, or other physical characteristics; and severe if there is a seasonal restriction of more than 3 months when equipment cannot be used or if there are other severe restrictions caused by steep slopes, wetness, stoniness, or numerous gullies.

The trees listed as *most desirable species in natural stands* are those that have the most rapid growth rate combined with the highest value and marketability.

Suitable species for planting are listed in order of priority of preference. This is not a complete list of suitable trees.

Wildlife [3]

A well-planned and well-managed system of farming that maintains the soils will provide food and cover for wildlife. Farming that depletes the soils eliminates food and cover and thus reduces the potential population of desirable species of wildlife. An unbalanced wildlife population leads to an increase in the number of destructive insects, rodents, and other undesirable animal life.

On most farms, the wildlife habitat can be improved by practices that supply or increase food and cover (*9*). To get the maximum wildlife population on a farm, as

[3] By JAMES MCCALL, biologist, USDA, Soil Conservation Service.

the soils for woodland

enough on the soils of the given group to be a major crop]

Erosion hazard	Windthrow hazard	Equipment limitation	Most desirable species in natural stands	Species suitable for planting
Slight to moderate	Slight	Slight to moderate	Tulip-poplar, white ash, red oak, black walnut, and white oak.	White pine, shortleaf pine, black locust, and red pine.
Slight to severe	Slight	Slight to moderate (slopes are steep and short).	Tulip-poplar, white ash, red oak, black walnut, and white oak.	White pine, shortleaf pine, black locust, Virginia pine, and red pine.
Severe	Slight	Severe	Few, if any, existing stands; planting mainly to control erosion.	Black locust, red pine, white pine, Virginia pine, and shortleaf pine.
Moderate to severe	Slight	Severe	Red oak, white oak, black oak, tulip-poplar, and black walnut.	White pine, red pine, shortleaf pine, and black locust.
Slight	Moderate to severe	Moderate	Sweetgum, pin oak, soft maple, white ash, tulip-poplar, and swamp white oak.	White pine, sweetgum, soft maple, and sycamore.
Slight	Slight	Slight	Cottonwood, sycamore, tulip-poplar, black walnut, white ash, and southern red oak.	White pine, cottonwood, black locust, sycamore, and black walnut.
Slight to moderate	Moderate	Slight	White oak, white ash, tulip-poplar, and black oak.	White pine, red pine, shortleaf pine, and Virginia pine.
Slight	Moderate to severe	Severe	Sweetgum, pin oak, soft maple, bur oak, white ash, tulip-poplar, and swamp white oak.	Planting very rarely needed.
Slight	Moderate	Moderate	Sweetgum, pin oak, soft maple, tulip-poplar, and ash.	White pine, cottonwood, sycamore, and sweetgum.
Moderate	Slight	Slight to moderate	Black oak, tulip-poplar, red oak, white oak, and black walnut.	White pine, shortleaf pine, and Virginia pine.
Slight to moderate	Slight	Severe	Cottonwood, sycamore, soft maple and green ash.	Virginia pine, shortleaf pine, and white pine.
Slight to moderate	Slight	Moderate	White oak, black oak, and bur oak.	White pine, shortleaf pine, and black locust.
Moderate	Moderate to severe	Moderate to severe	Chestnut oak, white oak, and Virginia pine.	Shortleaf pine, Virginia pine, pitch pine, and loblolly pine.
				White pine, red pine, Norway spruce, and arborvitae.

Figure 10.—Tree uprooted by wind on Atkins silt loam, which has a shallow root zone.

many habitat areas as possible should be developed. A single area is good, but increasing the number of travel lanes and placing borders of different kinds of vegetative food and cover on all parts of a farm will increase the carrying capacity for desirable species of wildlife.

Food and cover

The balance between food and cover for wildlife is ideal on only a few farms in this county. Some farms in the Wabash River bottoms consist almost entirely of class I soils that are used to produce grain crops. On these farms, food for wildlife may be abundant but cover is likely to be scarce. Other farms consist largely of class VI and class VII soils. On these farms, pasture and woods furnish ample cover but food is likely to be scarce.

The soils in the different classes can be managed so that both food and cover are available. On the soils in classes I, II, and III, where food is ample but cover is scarce, cover can be provided by establishing fence rows, windbreaks, and perennial borders and by planting vegetation in waterways and on the banks of drainage ditches and streams. Both food and cover can be established in odd areas and areas around ponds and in marshes on soils in classes III, IV, and VI. On soils in class VI and class VII, food can be provided by planting borders that produce seed and fruit and by planting small areas to grass and conifers.

Strip mines, once they start to revegetate, usually go through rather rapid changes in plant life and associated changes in animal population. The herbaceous and early brush stages of the plant succession are favorable for bobwhite quail and cottontail rabbit; the brush and early timber stages are favorable for white-tailed deer; and the climax forest stage for tree squirrel. The water in the pits is commonly acid at first, but it neutralizes with age, and eventually the pits become suitable for game fish.

Distribution of wildlife

Strip mines offer plentiful cover but may lack food for quail and some songbirds. During the migration seasons, ducks may be found on bottom lands along the Wabash River in areas of Genesee, Eel, and Wakeland soils. Wood ducks commonly nest in hollow trees and compete with raccoons for trees near water where they can raise a brood of young. A few mallards and blue-winged teals nest in open idle areas and meadows near water. Mallards and black ducks are the most numerous of the more than 25 species of waterfowl that migrate along the flight lanes in spring and fall. Sloughs along the Wabash River could be developed as wildlife refuges. A waterfowl refuge is of esthetic value to the landowner, and it increases the opportunities for hunting in surrounding areas during open season.

Songbirds of many kinds are numerous most of the year. These birds have esthetic value, and they help to control insects. Seedeaters can be attracted by planting a patch of grain sorghum near escape cover. Fruit-producing shrubs are attractive to birds also, both for the food they produce and as nesting sites.

Deer habitat of excellent quality occurs in areas of Hickory, Princeton, Alford, Cincinnati, and Zipp soils and of Strip mines.

Rabbits and squirrels are the most abundant game mammals in the county. Rabbits prefer the kind of food and cover to be found in and around cultivated fields. Squirrels like large wooded areas, which are found mostly on wooded escarpments of Alford and Hickory soils. Fox squirrels prefer small woodlots next to cultivated fields.

Fish in the Wabash River include bass, bluegill, channel catfish, and perch (fresh water drumfish), all common in Indiana. Carp, sucker, buffalofish, and pan fish are also numerous.

Furbearing animals, such as raccoon, muskrat, mink, skunk, and opossum, are hunted by sportsmen in this county. Raccoon and opossum are abundant and are increasing in numbers in the wooded areas and along streams.

Preying animals and birds, including foxes, hawks, and owls, are numerous. Most of these predators are of value because of the large numbers of mice and other rodents they consume.

Recreation

The landscape and resources of Sullivan County and the location of the county in relation to centers of population make it possible to develop some recreational enterprises that could produce income. The most likely enterprises include hunting areas, shooting preserves, improved picnic areas, fishing waters, and water sports. Several recreational facilities have been established and are in use. These include Shakamak State Park and Greene-Sullivan State Forest.

Watershed development in upland areas offers a potential for impoundment of multipurpose bodies of water of different sizes. Impoundments of water in watershed areas and in Strip mines offer excellent potential for development of fishing and hunting areas. Many bodies of water provide opportunities for boating, water skiing, and swimming.

The Outdoor Recreation Resources Review Commission predicts that the need for outdoor recreational facilities will greatly increase during the latter half of the twentieth century (*3*). The Commission recommends that land-use planning include planning for outdoor recreation.

Well-drained soils in upland areas are well suited for use as picnic grounds, intensive play areas, and tent and trailer campsites, and for cottages and utility buildings. Many places in Strip mine areas are suitable for development as picnic grounds, campsites, and hiking trails, and for cottages and utility buildings.

Engineering Uses of the Soils

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, water-storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the properties most important to engineers are permeability to water, shear strength, compaction characteristics, drainage, shrink-swell characteristics, grain size, plasticity, and pH. Topography, depth to water table, and depth to bedrock also are important. This section discusses the properties of the soils in Sullivan County that most affect engineering. Tables 4, 5, and 6 provide soils data useful in engineering. Only the data in table 4 are from actual laboratory tests. The estimates in tables 5 and 6 are based on comparisons of soils with those tested. The information contained in this section can be used in—

1. Planning and designing of agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving soil.
2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating probable sources of sand, gravel, or rock suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational areas.

With the use of the soil map for identification, the engineering interpretations reported here can be useful for many purposes. They do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads or excavations deeper than the depths of layers here reported. Even in these situations, the soil map is useful in planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some terms used by soil scientists may be unfamiliar to engineers. Other terms, for example, *soil*, *clay*, *silt*, *sand*, and *aggregate*, have special meanings in soil science. These terms and others are defined in the Glossary at the back of this soil survey.

Information useful in engineering can be obtained from the soil map. It will often be necessary, however, to refer to other parts of the report. By using the information in the soil map, the soil profile descriptions, and the tables in this section, the engineer can plan a detailed investigation of the soil at the construction site.

TABLE 4.—*Engineering*

[Tests performed by Purdue University in cooperation with Indiana State Highway Department and the American Association of State

Soil name and location of sample	Parent material	Purdue report No.	Depth	Moisture-density data[1]		California bearing ratio test[2]			
				Maximum dry density	Optimum moisture	Molded specimen: Dry density	Molded specimen: Moisture content	CBR	Swell
			In.	*Lb. per cu. ft.*	*Pct.*	*Lb. per cu. ft.*	*Pct.*	*Pct.*	*Pct.*
Alford silt loam:									
SE¼NW¼ sec. 26, T. 8 N., R. 10 W. (Modal)	Loess over glacial till.	77-10-1	0-7	102	20	100.2	18.6	4	0.07
		77-10-2	23-36	103	20	---	---	---	---
		77-10-3	53-63	112	16	111.7	15.9	9	.13
SW¼SE¼ sec. 4, T. 8 N., R. 10 W. (Nonmodal)	Loess over glacial till.	77- 1-1	3-11	100	22	99.7	21.6	2	.44
		77- 1-2	29-45	106	18	106.2	18.6	7	.24
		77- 1-3	50-70	112	16	---	---	---	---
SE¼SW¼ sec. 9, T. 6 N., R. 8 W. (Nonmodal)	Loess over glacial till.	77- 5-1	7-11	106	19	104.1	18.7	8	0
		77- 5-2	27-39	106	19	---	---	---	---
		77- 5-3	49-59	116	14	---	---	---	---
Iva silt loam:									
SE¼NE¼ sec. 10, T. 8 N., R. 9 W. (Modal)	Loess.	77-11-1	0-9	101	22	98.3	21.2	2	.09
		77-11-2	12-17	102	20	101.6	21.0	6	.42
		77-11-3	40-50	114	15	112.2	14.7	6	.40
SW¼SE¼ sec. 12, T. 6 N., R. 9 W. (Road cut)	Loess.	77- 7-1	8-14	107	18	---	---	---	---
		77- 7-2	21-32	100	22	100.8	22.5	7	.42
		77- 7-3	40-60	113	15	112.9	15.7	6	.31
NW¼SE¼ sec. 15, T. 9 N., R. 8 W. (Coarse lower C horizon)	Loess.	77-12-1	0-9	115	15	---	---	---	---
		77-12-2	26-37	105	19	101.9	21.2	5	.58
		77-12-3	52-65	108	18	106.9	18.6	4	.60
Ragsdale silt loam:									
NE¼NE¼ sec. 33, T. 9 N., R. 9 W. (Modal)	Loess.	77- 6-1	0-9	97	24	94.5	24.0	2	.25
		77- 6-2	34-58	104	20	105.2	20.3	6	1.045
		77- 6-3	58-70	108	18	106.0	19.6	6	.87
SW¼SE¼ sec. 29, T. 9 N., R. 9 W.	Loess.	77- 8-1	0-9	106	19	102.3	18.2	8	.22
		77- 8-2	22-43	100	21	102.2	22.0	6	.89
		77- 8-3	60-70	116	15	114.1	15.5	8	.31
SW¼ sec. 23, T. 6 N., R. 9 W.	Loess.	77- 9-1	0-9	104	20	101.3	19.5	5	.13
		77- 9-2	24-50	108	18	105.3	18.9	8	.31
		77- 9-3	50-60	110	16	---	---	---	---
Vigo silt loam:									
SE¼NE¼ sec. 35, T. 9 N., R. 8 W. (Modal)	Illinoian till.	77- 2-1	9-20	104	20	108.7	16.6	4	.11
		77- 2-2	33-47	108	18	103.6	21.5	8	.65
		77- 2-3	60-80	110	16	117.0	14.3	6	.44
NW¼ sec. 15, T. 8 N., R. 8 W. (Nonmodal)	Illinoian till.	77- 3-1	6-16	108	18	107.0	18.6	7	.24
		77- 3-2	26-42	106	19	103.6	21.1	8	.67
		77- 3-3	49-70	116	14	116.3	14.2	4	.29
SW. cor. SE¼SE¼ sec. 35, T. 8 N., R. 8 W. (Nonmodal)	Illinoian till.	77- 4-1	8-18	108	18	107.4	17.0	5	.02
		77- 4-2	33-45	99	22	100.4	23.2	5	.02
		77- 4-3	56-80	118	13	113.6	14.9	5	.02

[1] Based on Moisture-Density Relations of Soils Using 5.5-lb. Rammer and 12-in. Drop, AASHO Designation T 99-57, Method A (*1*).

[2] The soil sample is prepared according to AASHO Designation T 87-49 (*1*). Water is added to bring moisture content to within ±0.5 percent of optimum. Specimens are compacted according to AASHO Designation T 99-57, Method B, to within ±1 pound per cubic foot of maximum dry density, a surcharge of 35 pounds is added, and the specimen is soaked from top to bottom for 4 days. The penetration is performed at a rate of 0.05 inch per minute, while the 35-pound surcharge is on the specimen. The CBR value is for 0.1-inch penetration.

[3] Mechanical analysis according to AASHO Designation T 88 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrom-

test data

U.S. Department of Commerce, Bureau of Public Roads, in accordance with standard procedures of Highway Officials (AASHO) (*1*)]

Mechanical analysis [3]								Liquid limit	Plasticity index	Classification	
Percentage passing sieve—				Percentage smaller than—						AASHO	Unified [4]
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.	*Pct.*			
---------	100	98	90	86	60	23	15	30	8	A-4(8)	ML-CL
---------	---------	100	96	92	71	36	30	44	19	A-7-6(12)	ML-CL
---------	100	98	87	81	60	27	22	34	15	A-6(10)	CL
---------	100	99	91	88	63	28	20	30	10	A-4(8)	CL
---------	---------	100	90	84	64	35	30	40	22	A-6((13)	CL
---------	---------	100	93	89	62	28	22	31	11	A-6(8)	CL
---------	---------	100	95	92	70	29	19	31	11	A-6(8)	CL
---------	---------	100	97	93	71	36	29	43	20	A-7-6(13)	CL
---------	100	99	85	78	56	26	19	27	9	A-4(8)	CL
---------	100	97	90	86	70	30	20	34	11	A-6(8)	ML-CL
---------	100	98	90	88	65	35	27	45	23	A-7-6(14)	CL
---------	100	96	75	70	53	28	23	37	22	A-6(13)	CL
---------	100	94	88	86	69	30	20	33	11	A-6(8)	ML-CL
---------	100	98	96	93	75	42	37	54	33	A-7-6(19)	CH
---------	100	99	92	86	61	26	21	33	18	A-6(11)	CL
100	99	96	84	80	60	24	19	26	6	A-4(8)	ML-CL
---------	100	98	88	85	72	40	32	49	30	A-7-6(18)	CL
100	99	96	80	77	62	35	28	42	27	A-7-6(15)	CL
---------	100	98	96	93	74	35	33	40	16	A-6(10)	ML-CL
---------	100	98	94	91	77	45	38	58	32	A-7-6(20)	CH
---------	100	99	95	90	70	35	28	46	26	A-7-6(16)	CL
---------	100	98	87	82	59	25	19	32	10	A-4(8)	ML-CL
---------	100	97	94	92	76	45	37	54	35	A-7-6(19)	CH
---------	100	96	79	75	56	30	26	35	17	A-6(11)	CL
100	99	97	90	86	60	22	15	31	11	A-6(8)	CL
---------	100	98	93	88	55	30	26	41	21	A-7-6(13)	CL
---------	100	99	93	86	59	22	18	34	14	A-6(10)	CL
100	99	95	85	82	65	32	25	29	10	A-4(8)	CL
---------	100	96	88	84	70	42	34	48	31	A-7-6(18)	CL
100	99	92	60	55	48	29	23	34	23	A-6(10)	CL
100	97	93	85	81	64	23	15	30	9	A-4(8)	ML-CL
---------	100	95	90	87	70	39	31	44	24	A-7-6(14)	CL
100	98	94	70	65	49	27	21	26	13	A-6(8)	CL
---------	100	95	84	78	60	28	19	28	10	A-4(8)	CL
---------	100	98	89	86	73	44	37	51	32	A-7-6(18)	CH
---------	100	98	77	70	55	30	25	33	17	A-6(11)	CL

eter method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes of soil.

[4] Soil Conservation Service and Bureau of Public Roads have agreed that any soil having a plasticity index within 2 points of the A-line is to be given a borderline classification. ML-CL is an example of such a classification.

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Ft.	*In.*			
Ade: AdB, AdC	More than 10.	0–19	Loamy fine sand	SM	A–2
		19–35	Fine sand	SM	A–2
		35–60	Fine sand with lenses of sandy loam to sandy clay loam.	SM	A–2
		60–70	Loose fine sand	SM	A–2
Alford: AfB2, AfB3, AfC2, AfC3, AfD2, AfD3, AfE, AfF.	More than 10.	0–15	Silt loam	ML or CL	A–4
		15–36	Light silty clay loam	CL or ML–CL	A–6 or A–7
		36–63	Silt loam	CL	A–6
Atkins: [1] Ak	Less than 1.	0–45	Silt loam and loam	ML or CL	A–4
Ava: AlA, AlB2, AlB3	More than 10.	0–22	Silt loam to light silty clay loam	ML or CL	A–4 or A–6
		22–48	Silty clay loam	CL	A–6
		48–55	Gritty silt loam	ML or CL	A–4
		55–100	Loam till	ML	A–4
Ayrshire: AsA, AsB, AyA	2 or less.	0–18	Fine sandy loam and loam	ML	A–4
		18–46	Sandy clay loam and heavy sandy loam.	SC	A–4 or A–6
		46–55	Stratified silt and fine sand	SM	A–2 or A–4
Bloomfield: BlB, BlC, BlD, BlF	More than 10.	0–25	Loamy fine sand	SM–SP or SM	A–2
		25–70	Fine sand with lenses of sandy clay loam and sandy loam.	SM–SP or SM	A–2
		70–120	Fine sand	SM–SP or SM	A–2
Carlisle: Ca	1 or less.	0–42	Muck over peat	Pt	
Cincinnati: CnB2, CnC2, CnC3, CnD2, CnD3.	More than 10.	0–11	Silt loam	ML	A–4
		11–29	Silty clay loam	CL	A–6
		29–51	Gritty silt loam	ML	A–4 or A–6
		51–130	Loam to clay loam	CL	A–6
		130–140	Loam	ML	A–4
Cory: Co	1 to 3.	0–8	Silt loam	ML	A–4
		8–19	Heavy silt loam	ML or CL	A–4 or A–6
		19–42	Silty clay loam	CL	A–6
		42–60	Light silty clay loam to silt loam.	CL or ML	A–6 or A–4
Cuba: [2] Cu	1 to 4.	0–50	Silt loam	ML	A–4
Eel: [2] Es	More than 5.	0–16	Silt loam to silty clay loam	ML or CL	A–4
		16–30	Silt loam with layers of fine sandy loam.	ML	A–4
		30–50	Silt loam, loam, and sandy loam	ML	A–4
Elston: EtA, EtB, EuA, EuB	More than 10.	0–14	Loam	ML	A–4
		14–25	Heavy loam	CL	A–4
		25–37	Light sandy clay loam	SC	A–6 or A–4
		37–58	Sandy loam	SM or SC	A–2, A–4
		58–64	Loose stratified sand and gravel	SM–SP or SM	A–1
Fox: FsA, FsB, FxA	More than 10.	0–8	Loam	ML	A–4
		8–19	Clay loam	CL	A–6 or A–7
		19–41	Gravelly clay loam	CL	A–6
		41–60	Stratified gravel and sand	SM–SP	A–1
Genesee: [2] Gs	More than 5.	0–50	Silt loam and loam (and fine sandy loam in the lower part).	ML	A–4
Genesee, sandy variant: Gn	More than 5.	0–12	Fine sandy loam	SM	A–4
		12–24	Loam to fine sandy loam	SM	A–4
		24–48	Stratified loam, fine sandy loam, and loamy fine sand.	SM–SP or SM	A–1

See footnotes at end of table.

engineering properties

Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Frost-heave potential	Shrink-swell potential
No. 10	No. 40	No. 200					
			In. per hr.	*In. per in. of soil*	*pH*		
95–100	90–100	10–20	5. 0–10. 0	0. 07	6. 0–6. 5	Low	Low.
95–100	90–100	10–20	5. 0–10. 0	. 04	5. 5–6. 0	Low	Low.
95–100	60–70	10–20	5. 0–10. 0	. 06	5. 5–6. 0	Low	Low.
95–100	60–70	10–20	5. 0–10. 0	. 05	6. 1–7. 8	Low	Low.
95–100	95–100	85–95	0. 8–2. 5	. 20	5–5–6. 5	Moderate to high	Low.
95–100	95–100	85–95	0. 8–2. 5	. 18	5. 0–5. 5	Moderate to high	Moderate.
95–100	95–100	85–95	0. 8–2. 5	. 20	6. 0–6. 5	Moderate to high	Moderate.
95–100	90–100	70–80	0. 8–2. 5	. 21	5. 0–6. 0	Moderate to high	Low to moderate.
95–100	90–95	90–95	0. 8–2. 5	. 20	5. 1–6. 0	Moderate	Low to moderate.
95–100	90–95	80–90	0. 2–0. 8	. 18	4. 6–5. 5	Moderate	Moderate.
95–100	85–95	80–90	0. 05–0. 2	. 16	5. 1–5. 5	Moderate	Low to moderate.
95–100	75–85	60–70	0. 8–2. 5	. 18	5. 1–6. 6	Moderate	Low.
95–100	85–95	55–65	0. 8–2. 5	. 16	5. 6–6. 5	Moderate	Low.
95–100	65–75	35–45	0. 8–2. 5	. 18	5. 6–6. 5	Moderate	Moderate to low.
95–100	65–75	30–40	0. 8–2. 5	. 16	7. 4–7. 8	Moderate	Low.
95–100	80–85	10–15	5. 0–10. 0	. 07	5. 5–6. 5	Low	Low.
95–100	80–85	10–15	5. 0–10. 0	. 08	5. 5–6. 0	Low	Low.
95–100	80–85	10–15	>10. 0	. 05	7. 4–7. 8	Low	Low.
----------	----------	----------	0. 8–10. 0	. 25	6. 0–6. 5	Low	Low.
95–100	90–95	90–95	0. 8–2. 5	. 20	5. 6–6. 0	Moderate	Low to moderate.
95–100	90–95	80–90	0. 2–0. 8	. 18	5. 1–5. 5	Moderate	Moderate to high.
95–100	85–95	80–90	0. 05–0. 2	. 16	5. 1–5. 5	Moderate	Moderate to high.
95–100	70–80	60–70	0. 8–2. 5	. 18	5. 6–6. 0	Moderate	Moderate to high.
95–100	75–85	60–70	0. 8–2. 5	. 18	5. 6–7. 8	Moderate	Moderate to high.
100	90–100	75–85	0. 8–2. 5	. 23	5. 5–6. 0	Moderate	Moderate.
100	90–100	85–95	0. 8–2. 5	. 20	4. 5–5. 0	Moderate	Moderate.
100	95–100	80–90	0. 05–0. 2	. 18	5. 5–6. 0	Moderate	Moderate to high.
100	95–100	75–85	0. 8–2. 5	. 18	6. 0–6. 5	Moderate	Moderate.
100	95–100	70–80	0. 8–2. 5	. 20	5. 0–6. 0	Moderate to high	Low to moderate.
100	95–100	70–80	0. 8–2. 5	. 20	6. 6–7. 3	Moderate	Low to moderate.
95–100	85–95	75–85	0. 8–2. 5	. 20	6. 6–7. 3	Moderate	Low to moderate.
100	90–100	65–75	0. 8–2. 5	. 20	6. 6–7. 8	Moderate	Low to moderate.
95–100	75–85	65–75	0. 8–2. 5	. 18	5. 6–6. 0	Moderate to high	Low.
95–100	80–90	60–70	0. 8–2. 5	. 18	5. 6–6. 0	Moderate	Low to moderate.
90–95	55–65	35–45	0. 2–2. 5	. 18	5. 1–6. 0	Moderate	Low to moderate.
95–100	75–85	25–45	2. 5–5. 0	. 13	5. 1–5. 5	Moderate	Low.
95–100	20–30	5–15	5. 0–10. 0	. 04	6. 0–8. 4	Low	Low.
95–100	75–85	55–65	0. 8–2. 5	. 18	5. 6–6. 0	Low	Low.
95–100	80–90	75–85	0. 8–2. 5	. 18	5. 6–6. 0	Low	Moderate.
95–100	80–90	60–70	0. 8–2. 5	. 16	5. 1–6. 0	Low	Moderate.
95–100	15–30	5–10	>10. 0	. 04	7. 4–7. 8	Low	Low.
100	95–100	75–85	0. 8–2. 5	. 20	6. 6–7. 3	Moderate to high	Low.
95–100	60–70	35–45	2. 5–5. 0	. 13	6. 6–7. 3	Moderate	Low.
95–100	65–75	35–45	2. 5–5. 0	. 18	6. 6–7. 3	Moderate	Low.
95–100	80–90	10–15	2. 5–5. 0	. 08	6. 6–7. 3	Low to moderate	Low.

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Ft.	*In.*			
Gullied land: Gu. Properties were not estimated.					
Henshaw: HeA, HeB2	1 to 2.	0–12	Silt loam	ML	A–4
		12–42	Silty clay loam	CL	A–7 or A–6
		42–60	Stratified silty clay loam and silt loam.	CL or ML	A–4
Hickory: HkE, HkF, HkF3, HkG	More than 10.	0–11	Silt loam	ML	A–4
		11–50	Gritty silty clay loam to clay loam.	CL	A–7 or A–6
		50–60	Loam till	CL	A–6
Iona: IoA, IoB2, IoB3	More than 10.	0–7	Silt loam	ML	A–4
		7–34	Silty clay loam	CL	A–7 or A–6
		34–50	Silt loam	ML	A–4
Iva: IvA, IvB2	2 to 4.	0–17	Silt loam	ML or CL	A–4 or A–6
		17–40	Silty clay loam	CL	A–7 or A–6
		40–50	Silt loam	CL	A–6
Kings: Kg	Less than 1.	0–16	Silty clay	CH or OH	A–7
		16–37	Silty clay	CH	A–7
		37–60	Silty clay	CH	A–7
Lyles: Ly	1 to 2.	0–16	Loam	ML or OL	A–4
		16–28	Heavy loam	CL	A–4
		28–38	Stratified light sandy clay loam and fine sandy loam.	SC	A–4 or A–6
		38–50	Fine sand stratified with loam to sandy clay loam.	SP–SM	A–3
Markland: MaB2, MaD2, MaE2, McD3.	More than 10.	0–10	Silt loam to light silty clay loam.	ML or CL	A–6
		10–26	Silty clay	CH	A–7
		26–42	Clay or silty clay	CH	A–7
McGary: Mg	1 to 2.	0–11	Silt loam	ML	A–4
		11–40	Silty clay loam to silty clay	CH or CL	A–7 or A–6
		40–50	Silty clay	CH	A–7
Mine dumps: Mn. Properties were not estimated.					
Muren: MuB2	More than 10.	0–11	Silt loam	ML	A–4
		11–48	Light silty clay loam to silty clay loam.	CL	A–6 or A–7
		48–70	Silt loam	ML	A–4
Parke: PaC3, PaD3	More than 10.	0–15	Silt loam to light silty clay loam.	ML or CL	A–4 or A–6
		15–42	Silty clay loam	CL	A–6
		42–106	Clay loam	CL	A–6
		106–110	Stratified silt loam and fine sand.	SM	A–2
		110	Sandstone and shale.		
Patton: Pc	1 to 2.	0–20	Silty clay loam	CL	A–6
		20–34	Silty clay loam	CL	A–6 or A–7
		34–48	Stratified silt loam and silty clay loam.	CL	A–6
Petrolia:[1] Po	1 to 2.	0–8	Silty clay loam	CL	A–6
		8–23	Silty clay loam	CL	A–6 or A–7
		23–42	Light silty clay loam and silt loam.	CL	A–6
Princeton: PrA, PrB2, PrC2, PrD2 PrE2, PrG.	More than 10.	0–11	Fine sandy loam	SM	A–4
		11–30	Sandy clay loam	SM	A–4
		30–42	Sandy loam	SM	A–2
		42–60	Fine sand and coarse silt	SM–SP	A–2 or A–3

See footnotes at end of table.

engineering properties—Continued

Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Frost-heave potential	Shrink-swell potential
No. 10	No. 40	No. 200					
			In. per hr.	*In. per in. of soil*	*pH*		
95–100	95–100	75–85	0. 8–2. 5	. 20	6. 5–7. 3	Moderate to high	Low.
95–100	90–100	85–95	0. 05–0. 2	. 19	5. 0–5. 5	Moderate	Moderate to high.
95–100	90–100	80–90	0. 2–0. 8	. 19	6. 6–7. 3	Moderate	Moderate to high.
95–100	90–95	90–95	0. 8–2. 5	. 20	4. 5–5. 0	Moderate	Low.
95–100	95–100	80–90	0. 8–2. 5	. 18	5. 1–6. 0	Low	Low.
95–100	75–85	60–70	0. 8–2. 5	. 18	7. 4–7. 8	Low	Low.
95–100	95–100	75–90	0. 8–2. 5	. 20	5. 5–6. 0	Moderate	Low.
95–100	95–100	85–95	0. 2–0. 8	. 18	5. 0–6. 0	Moderate to high	Moderate to high.
95–100	90–100	80–90	0. 8–2. 5	. 19	6. 5–7. 8	Moderate to high	Moderate.
95–100	90–100	90–95	0. 8–2. 5	. 20	6. 0–6. 5	Moderate to high	Moderate to high.
95–100	95–100	85–95	0. 05–0. 2	. 18	5. 5–6. 0	Moderate to high	Moderate to high.
95–100	95–100	75–85	0. 8–2. 5	. 20	6. 5–7. 3	Moderate to high	Moderate to high.
----------	100	90–100	<0. 05	. 18	6. 5–7. 3	High	High.
----------	100	90–100	<0. 05	. 15	6. 5–7. 3	High	High.
----------	100	90–100	<0. 05	. 15	7. 4–7. 8	High	High.
95–100	75–85	65–75	0. 8–2. 5	. 18	6. 6–7. 3	Moderate to high	Low.
95–100	80–90	65–75	0. 8–2. 5	. 18	6. 6–7. 3	Moderate	Low.
95–100	65–75	35–45	0. 8–2. 5	. 18	7. 4–7. 8	Moderate	Low.
95–100	50–60	10–20	2. 5–5. 0	. 13	7. 4–7. 8	Low to moderate	Low.
100	90–100	80–90	0. 8–2. 5	. 20	6. 6–7. 3	Moderate	Moderate.
100	95–100	85–95	0. 05–0. 2	. 18	6. 6–7. 3	Moderate	High.
100	95–100	90–100	0. 05–0. 2	. 16	7. 4–7. 8	Moderate	High.
100	90–100	80–90	0. 8–2. 5	. 20	6. 6–7. 3	Moderate	Low.
100	95–100	85–95	<0. 05	. 15	5. 6–6. 5	Moderate	High.
100	95–100	90–100	<0. 05	. 16	7. 4–7. 8	Moderate	High.
95–100	95–100	85–95	0. 8–2. 5	. 20	5. 5–6. 0	Moderate to high	Low.
95–100	95–100	85–95	0. 8–2. 5	. 18	5. 5–6. 0	Moderate to high	Moderate to high.
95–100	95–100	85–95	0. 8–2. 5	. 20	6. 5–7. 3	Moderate to high	Moderate.
95–100	95–100	75–85	0. 8–2. 5	. 20	5. 6–6. 0	Moderate to high	Low.
95–100	95–100	85–95	0. 8–2. 5	. 18	4. 5–5. 5	Moderate	Moderate to high.
95–100	90–100	65–75	0. 8–2. 5	. 18	4. 5–5. 5	Moderate	Moderate to high.
95–100	45–55	20–30	2. 5–5. 0	. 06	4. 5–5. 5	Low	Low.
100	95–100	85–95	0. 2–0. 8	. 19	6. 0–6. 5	Moderate to high	Moderate.
100	95–100	85–95	0. 05–0. 2	. 17	5. 5–6. 0	Moderate to high	Moderate to high.
100	95–100	85–95	0. 05–0. 2	. 19	7. 4–7. 8	Moderate to high	Moderate.
100	95–100	85–95	0. 05–0. 2	. 19	6. 6–7. 0	Moderate to high	Moderate.
100	95–100	85–95	0. 05–0. 2	. 17	6. 6–7. 0	Moderate to high	Moderate to high.
100	95–100	85–95	0. 2–0. 8	. 19	6. 6–7. 8	Moderate to high	Moderate.
95–100	75–85	35–45	2. 5–5. 0	. 13	6. 5–7. 3	Moderate	Low.
95–100	55–65	35–45	0. 8–2. 5	. 15	5. 1–6. 5	Moderate	Low.
95–100	75–85	20–30	2. 5–5. 0	. 13	6. 1–6. 5	Low	Low.
95–100	50–65	0–10	5. 0–10. 0	. 06	6. 6–7. 3	Low	Low.

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Ft.	*In.*			
Ragsdale: Ra	1 to 2.	0–15	Silt loam	ML	A–6
		15–34	Silty clay loam	CL or CH	A–6 or A–7
		34–58	Light silty clay loam	CL or CH	A–6 or A–7
		58–70	Silt loam or silt	ML or CL	A–6 or A–7
Reesville: ReA, ReB2	2 to 4.	0–8	Silt loam	ML	A–4
		8–21	Silty clay loam	CL	A–6
		21–30	Light silty clay loam	CL	A–6
		30–60	Silt loam and silt	ML or CL	A–4
Rensselaer: Rm	1 to 2.	0–15	Loam	ML or CL	A–4 or A–6
		15–50	Clay loam	CL	A–6 or A–7
		50–66	Stratified sandy clay loam, silt loam, and loam.	CL	A–4 or A–6
Riverwash: Rr. Properties were not estimated.					
Rock land: Rs. Properties were not estimated.					
Ross:[2] Rt	More than 5.	0–17	Silt loam	ML	A–4
		17–40	Silt loam	ML	A–4
		40–50	Stratified silt loam, loam, and sandy loam.	ML	A–4
Shadeland: Sh	1 to 2.	0–6	Loam	SM	A–4
		6–13	Silt loam to light silty clay loam.	ML or CL	A–4 or A–6
		13–29	Silty clay loam	CL	A–6 or A–7
		29	Sandstone and shale bedrock.		
Stendal:[1] Sn	1 to 2.	0–10	Silt loam	ML	A–4
		10–55	Silt loam	ML	A–4
		55	Silt loam, loam, and coarse sand with some gravel.	ML	A–4
Strip mines: St. Properties were not estimated.					
Vigo: VgA, VgB2	1 to 3.	0–23	Silt loam	CL	A–4
		23–47	Silty clay loam	CL	A–7 or A–6
		47–60	Silt loam to silty clay loam	CL	A–6 or A–7
		60–80	Clay loam to loam	CL	A–6
Wakeland:[1] Wa	1 to 2.	0–55	Silt loam and silt	ML	A–4
Warsaw: WrA, WrB, WrC2, WsA	More than 10.	0–14	Loam	ML	A–4
		14–36	Gravelly sandy clay loam.	CL	A–6
		36–50	Stratified gravel and sand	SM	A–2
Westland:[3] Wt, Wv	Less than 2.	0–7	Silty clay loam	CL	A–6
		7–26	Silty clay loam	CL	A–6 or A–7
		26–44	Gravelly clay loam	CL	A–6 or A–7
		44–52	Sandy clay loam	SC or SM	A–4
		52–65	Stratified gravel and sand	SP–SM	A–1
Wilbur:[2] Ww	More than 5.	0–50	Silt loam or silt	ML	A–4
Zipp:[1] Zc	Less than 1.	0–31	Silty clay to clay	CH	A–7
		31–70	Clay	CH	A–7

[1] Subject to frequent flooding.
[2] Subject to occasional flooding.

engineering properties—Continued

Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Frost-heave potential	Shrink-swell potential
No. 10	No. 40	No. 200					
			In. per hr.	*In. per in. of soil*	*pH*		
100	90–100	90–100	0. 8–2. 5	. 23	6. 0–6. 5	Moderate to high	Low to moderate.
95–100	95–100	85–95	0. 05–0. 2	. 18	6. 5–7. 3	Moderate to high	Moderate.
95–100	95–100	85–95	0. 05–0. 2	. 19	6. 8–7. 4	Moderate to high	Moderate.
95–100	90–100	90–100	0. 2–0. 8	. 20	7. 4–7. 8	Moderate to high	Moderate.
100	95–100	75–85	0. 2–0. 8	. 20	6. 5–7. 3	Moderate to high	Low to moderate.
95–100	95–100	80–90	0. 05–0. 2	. 18	5. 1–5. 5	Moderate	Moderate.
95–100	95–100	85–95	0. 8–2. 5	. 19	6. 0–6. 5	Moderate to high	Moderate.
95–100	95–100	65–75	0. 8–2. 5	. 20	7. 4–7. 8	Moderate to high	Low to moderate.
95–100	95–100	80–90	0. 8–2. 5	. 18	6. 0–6. 3	Moderate	Low to moderate.
95–100	95–100	80–90	0. 05–0. 2	. 17	6. 5–7. 3	Moderate	Moderate to high.
95–100	95–100	75–85	0. 8–2. 5	. 18	6. 5–7. 3	Moderate	Moderate to low.
100	95–100	75–85	0. 8–2. 5	. 20	6. 5–7. 3	Moderate to high	Low to moderate.
100	95–100	60–75	0. 8–2. 5	. 20	6. 5–7. 3	Moderate	Low to moderate.
100	95–100	75–85	0. 8–2. 5	. 20	6. 6–7. 8	Moderate	Low to moderate.
95–100	75–85	35–45	0. 8–2. 5	. 20	6. 0–6. 5	Moderate to high	Low.
95–100	95–100	85–95	0. 2–0. 8	. 19	5. 4–6. 0	Moderate	Moderate.
95–100	90–100	85–95	0. 05–0. 2	. 15	5. 0–5. 5	Moderate	Moderate to high.
100	95–100	75–85	0. 8–2. 5	. 20	5. 5–6. 0	High	Low.
100	95–100	75–85	0. 8–2. 5	. 20	4. 5–5. 5	High	Low.
100	95–100	70–80	0. 8–2. 5	. 18	4. 0–5. 0	Moderate to high	Low to moderate.
100	95–100	80–90	0. 05–0. 2	. 21	5. 1–5. 5	Moderate	Moderate.
100	95–100	85–95	<0. 05	. 16	4. 6–5. 5	Moderate	Moderate to high.
95–100	95–100	75–85	0. 2–0. 8	. 16	5. 6–6. 6	Moderate	Moderate to high.
95–100	95–100	60–75	0. 8–2. 5	. 15	6. 0–6. 5	Moderate	Moderate.
100	95–100	75–85	0. 8–2. 5	. 20	6. 5–7. 3	Moderate to high	Low to moderate.
95–100	75–85	60–70	0. 8–2. 5	. 18	6. 0–6. 5	Moderate to low	Low.
95–100	85–95	75–85	2. 5–5. 0	. 16	5. 5–6. 5	Moderate	Moderate.
95–100	95–100	0–10	5. 0–10. 0	. 04	7. 4–7. 8	Low	Low.
95–100	95–100	85–95	0. 05–2. 0	. 19	6. 5–7. 3	Moderate	Moderate.
95–100	90–100	80–90	0. 05–0. 2	. 15	6. 5–7. 3	Moderate	Moderate to high.
95–100	85–95	75–85	2. 5–5. 0	. 16	6. 5–7. 3	Moderate	Moderate to high.
90–95	55–65	35–45	0. 8–2. 5	. 13	6. 8–7. 5	Moderate	Low.
95–100	20–30	5–10	5. 0–10. 0	. 04	7. 4–7. 8	Low	Low.
100	95–100	75–85	0. 8–2. 5	. 20	6. 5–7. 3	Moderate to high	Low to moderate.
100	100	90–100	<0. 05	. 16	6. 5–7. 3	High	High.
100	100	90–100	<0. 05	. 15	7. 4–7. 8	High	High.

[3] Bedrock is at a depth of 20 to 42 inches in the shallow variant of these soils (mapping unit Wv).

TABLE 6.—*Interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road subgrade material	Highway location
Ade: AdB, AdC	Fair: low available moisture capacity.	Not suitable	Good	Deep sand
Alford: AfB2, AfB3, AfC2, AfC3, AfD2, AfD3, AfE, AfF.	Good	Not suitable	Subsoil very poor: moderate shrink-swell potential; fair to poor compaction characteristics. Substratum fair: poor compaction characteristics.	Moderate to high frost heave; cuts and fills needed.
Atkins: Ak	Good	Not suitable	Fair: poor to fair compaction characteristics.	Seasonal high water table; flooding; moderate to high frost heave.
Ava: AlA, AlB2, AlB3	Good	Not suitable	Fair: moderate to low shrink-swell potential.	Moderately good drainage; moderate frost heave; seep areas.
Ayrshire: AsA, AsB, AyA	Fine sandy loam (AsA, AsB) fair: low available moisture capacity. Loam (AyA) good.	Not suitable	Subsoil fair: moderate to low shrink-swell potential. Substratum good.	Seasonal high water table.
Bloomfield: BlB, BlC, BlD, BlF.	Poor: low organic-matter content; low available moisture capacity.	Fair: some inter-bedded sands.	Good	Deep sand
Carlisle: Ca	Good	Not suitable	Not suitable	Not suitable
Cincinnati: CnB2, CnC2, CnC3, CnD2, CnD3.	Good	Not suitable	Fair: moderate to high shrink-swell potential.	Cuts and fills needed; seep areas; moderate frost heave.
Cory: Co	Good	Not suitable	Subsoil poor: fair to poor compaction; high to moderate shrink-swell potential. Substratum fair: moderate shrink-swell potential.	Seasonal high water table; moderate frost heave.
Cuba: Cu	Good	Not suitable	Fair: low to moderate shrink-swell potential; moderate to high frost heave.	Flooding
Eel: Es	Good	Not suitable	Fair: low to moderate shrink-swell potential; moderate frost heave.	Flooding
Elston: EtA, EtB, EuA, EuB	Fine sandy loam (EtA, EtB) fair: low available moisture capacity. Loam (EuA, EuB) good.	Not suitable	Fair: moderate frost heave.	Loose sand hinders hauling.

of engineering properties

Soil features affecting—Continued: Farm ponds: Reservoir areas	Farm ponds: Embankments, dikes, and levees	Agricultural drainage	Terraces and diversions	Grassed waterways	Soil limitations for sewage disposal fields
Rapid permeability.	Fair to poor stability; moderate permeability when compacted; poor resistance to piping.	Somewhat excessive drainage.	Not needed: rapid permeability.	Not needed: rapid permeability.	Slight where slope is 0 to 6 percent. Moderate where slope is 6 to 12 percent.
Slow seepage	Low permeability when compacted; good resistance to piping.	Good drainage	Severe hazard of erosion; not suited where slope is more than 12 percent.	Severe hazard of erosion during construction.	Slight where slope is 0 to 6 percent. Moderate where slope is 6 to 12 percent. Severe where slope is more than 12 percent.
Seasonal high water table; seepage.	Fair to poor stability; moderate to low permeability when compacted; fair resistance to piping.	Seasonal high water table; outlets for tile usually inadequate; flooding.	Not needed: nearly level slopes.	Not needed: nearly level slopes.	Severe: seasonal high water table; flooding.
Slow seepage	Low permeability when compacted; good resistance to piping.	Moderately good drainage.	Slowly permeable fragipan.	Slowly permeable fragipan.	Severe: slow permeability.
Rapidly permeable subsurface layer.	Subsoil: fair to good stability and compaction; good resistance to piping. Substratum: poor stability; high permeability when compacted; fair to poor resistance to piping.	Seasonal high water table.	Soil features favorable.	Seasonal high water table.	Moderate: seasonal high water table.
Rapid permeability.	Moderate to high permeability when compacted; fair to poor resistance to piping.	Somewhat excessive drainage.	Not needed: rapid permeability.	Low available moisture capacity.	Slight.
Seasonal high water table; poor stability; rapid seepage.	Poor stability; high permeability; poor resistance to piping.	Poor stability; outlets difficult to obtain; moderate subsidence.	Not needed: in depressions.	Not needed: nearly level.	Severe: seasonal high water table; ponding.
Slow seepage	Low permeability when compacted; good resistance to piping.	Good drainage	Slowly permeable fragipan.	Slowly permeable fragipan.	Severe: slow permeability.
Seasonal high water table; slow seepage.	Subsoil: fair to poor stability; slow permeability when compacted; good resistance to piping. Substratum: fair stability; fair compaction; low permeability when compacted; fair resistance to piping.	Seasonal high water table; slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; slow permeability.
Seepage and flooding.	Fair to poor stability; moderate permeability when compacted; fair resistance to piping.	Good drainage	Not needed: nearly level.	Not needed: nearly level.	Severe: flooding.
Seepage and flooding.	Fair to poor stability; moderate permeability when compacted; fair resistance to piping.	Moderately good drainage.	Not needed: nearly level.	Not needed: nearly level.	Severe: flooding.
Rapid seepage	Fair to good stability and compaction; moderate to low permeability when compacted; fair to poor resistance to piping.	Good drainage	Not needed: slow runoff.	Not needed: slow runoff.	Slight.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability as source of— Topsoil	Sand and gravel	Road subgrade material	Soil features affecting— Highway location
Fox: FsA, FsB, FxA	Sandy loam (FsA, FsB) fair: low available moisture capacity. Loam (FxA) good.	Good: strata of sand and gravel at a depth of 24 to 42 inches.	Good	Soil features favorable
Genesee: Gs	Fair: low available moisture capacity.	Fair: some stratified sand and gravel in places.	Fair: moderate frost heave.	Occasional overflow
Genesee, sandy variant: Gn	Good	Not suitable	Fair: moderate frost heave	Occasional overflow
Gullied land: Gu. No interpretations made for purposes listed.				
Henshaw: HeA, HeB2	Good	Not suitable	Fair: moderate to high shrink-swell potential; moderate to high frost heave.	Seasonal high water table; moderate to high frost heave.
Hickory: HkE, HkF, HkF3, HkG.	Fair to poor: thin; low organic-matter content.	Not suitable	Fair: fair to poor compaction.	Unstable slopes; cuts and fills needed.
Iona: IoA, IoB2, IoB3	Good	Not suitable	Fair: moderate to high shrink-swell potential; moderate to high frost heave.	Moderately well drained; moderate to high frost heave.
Iva: IvA, IvB2	Good	Not suitable	Poor: moderate to high shrink-swell potential; moderate to high frost heave.	Seasonal high water table; moderate frost heave.
Kings: Kg	Poor: clayey	Not suitable	Poor: high shrink-swell potential; fair to poor compaction.	Seasonal high water table; flooding; high frost heave.
Lyles: Ly	Good	Not suitable	Good	Seasonal high water table; flooding.
Markland: MaB2, MaD2, MaE2, McD3.	Poor: thin; low organic-matter content.	Not suitable	Poor: high shrink-swell potential; fair to poor compaction.	Plastic soil material; cuts and fills needed.
McGary: Mg	Fair: thin	Not suitable	Poor: high shrink-swell potential; fair to poor compaction.	Seasonal high water table; plastic soil material.
Mine dumps: Mn. No interpretations made for purposes listed.				
Muren: MuB2	Good	Not suitable	Fair: moderate to high shrink-swell potential; moderate to high frost heave.	Moderately good drainage; moderate to high frost heave.
Parke: PaC3, PaD3	Good	Not suitable	Subsoil: moderate to high shrink-swell potential. Substratum: good.	Cuts and fills needed; side slopes subject to erosion.

engineering properties—Continued

Soil features affecting—Continued					Soil limitations for sewage disposal fields
Farm ponds		Agricultural drainage	Terraces and diversions	Grassed waterways	
Reservoir areas	Embankments, dikes, and levees				
Rapid seepage	Subsoil: fair to good stability; low permeability when compacted; low resistance to piping. Substratum: not suitable.	Good drainage	Not needed: slow runoff.	Not needed: slow runoff.	Slight: hazard of pollution.
Rapid seepage	Moderate permeability when compacted; fair to poor resistance to piping.	Good drainage	Not needed: nearly level.	Not needed: nearly level.	Severe: flooding.
Seepage	Poor stability; moderate permeability when compacted; poor resistance to piping.	Good drainage	Not needed: nearly level.	Not needed: nearly level.	Severe: flooding.
Seasonal high water table; slow seepage.	Poor to fair stability and compaction; low permeability when compacted; fair resistance to piping.	Seasonal high water table; slow permeability.	Not needed: slow runoff.	Not needed: slow runoff.	Severe: seasonal high water table; slow permeability.
Slow seepage	Fair compaction; low permeability when compacted; good resistance to piping.	Good drainage	Topography too steep.	Moderately steep to very steep slopes; high erosion potential.	Severe where slope is more than 12 percent.
Slow seepage	Fair to good stability and compaction; low permeability when compacted; good resistance to piping.	Moderately good drainage.	Slow or medium runoff; moderately slow permeability.	Severe hazard of erosion during construction.	Severe: moderately slow permeability.
Seasonal high water table; slow seepage.	Fair to good stability and compaction; low permeability when compacted; good resistance to piping.	Seasonal high water table; slow permeability.	Soil features favorable.	Soil features favorable.	Severe: seasonal high water table; slow permeability.
Seasonal high water table; slow seepage.	Fair to poor stability and compaction.	Seasonal ponding; very slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: flooding.
Seepage; seasonal high water table.	Fair to poor stability; moderate permeability when compacted; fair to poor resistance to piping.	Seasonal high water table; ponding.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; flooding.
Slow seepage	Fair to poor stability and compaction.	Moderately good to good drainage.	Many short slopes; slow permeability.	Difficult to establish vegetation; severe hazard of erosion during construction.	Severe: slowly permeable subsoil.
Seasonal high water table; slow seepage.	Fair to poor stability and compaction.	Seasonal high water table; very slowly permeable subsoil.	Not needed: nearly level.	Not needed: nearly level; somewhat poor drainage.	Severe: seasonal high water table; very slowly permeable subsoil.
Slow seepage	Fair to poor stability and compaction; good resistance to piping.	Moderately good drainage.	Slow or medium runoff.	Severe hazard of erosion during construction.	Slight.
Rapid seepage	Subsoil: fair to poor resistance to piping. Substratum: moderate permeability when compacted; poor resistance to piping.	Good drainage	Severe hazard of erosion; not suited where slope is more than 12 percent.	Severe hazard of erosion during construction.	Moderate where slope is 6 to 12 percent. Severe where slope is more than 12 percent.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability as source of— Topsoil	Sand and gravel	Road subgrade material	Soil features affecting— Highway location
Patton: Pc	Poor: silty clay loam texture.	Not suitable	Poor: moderate to high shrink-swell potential; fair to poor compaction.	Seasonal high water table; ponding; moderate to high frost heave.
Petrolia: Po	Poor: silty clay loam texture.	Not suitable	Poor: moderate to high shrink-swell potential; fair to poor compaction.	Flooding
Princeton: PrA, PrB2, PrC2, PrD2, PrE2, PrG.	Fair: low available moisture capacity.	Poor: minor amounts of stratified sand.	Good	Soil features favorable
Ragsdale: Ra	Good	Not suitable	Poor: moderate shrink-swell potential; moderate to high frost heave.	Seasonal high water table; moderate to high frost heave.
Reesville: ReA, ReB2	Good	Not suitable	Poor: moderate shrink-swell potential; moderate to high frost heave.	Seasonal high water table; moderate to high frost heave.
Rensselaer: Rm	Good	Not suitable	Fair: moderate to high shrink-swell potential.	Seasonal high water table; flooding; moderate frost heave.
Riverwash: Rr. No interpretations made for purposes listed.				
Rock land: Rs. No interpretations made for purposes listed.				
Ross: Rt	Good	Not suitable	Fair: low to moderate shrink-swell potential.	Occasional flooding
Shadeland: Sh	Poor: thin; low organic-matter content.	Not suitable	Poor: moderate to high shrink-swell potential; bedrock at depth of 20 to 34 inches.	Seasonal high water table; moderate to high frost heave; bedrock at depth of 20 to 34 inches.
Stendal: Sn	Good	Not suitable	Fair: high frost heave	Seasonal high water table; flooding.
Strip mines: St. No interpretations made for purposes listed.				
Vigo: VgA, VgB2	Fair: low organic-matter content.	Not suitable	Poor: moderate to high shrink-swell potential; moderate frost heave.	Seasonal high water table; moderate frost heave.
Wakeland: Wa	Good	Not suitable	Fair: low to moderate shrink-swell potential; moderate to high frost heave.	Seasonal high water table; flooding.
Warsaw: WrA, WrB, WrC2, WsA.	Sandy loam (WrA, WrB, WrC2) fair: low available moisture capacity. Loam (WsA) good.	Good: interbedded sand and gravel below a depth of 24 to 42 inches.	Good	Soil features favorable

engineering properties—Continued

Soil features affecting—Continued					Soil limitations for sewage disposal fields
Farm ponds		Agricultural drainage	Terraces and diversions	Grassed waterways	
Reservoir areas	Embankments, dikes, and levees				
Seasonal high water table; slow seepage.	Fair to poor stability and compaction.	Seasonal high water table; slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; slow permeability.
Flooding; seepage	Fair to poor stability and compaction.	Flooding; slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; flooding; slow permeability.
Rapid seepage	Moderate to high permeability when compacted; fair to poor resistance to piping.	Good drainage	Severe hazard of erosion on slopes when not stabilized.	Hazard of erosion during construction.	Slight where slope is 0 to 6 percent. Moderate where slope is 6 to 12 percent. Severe where slope is more than 12 percent.
Seasonal high water table; slow seepage.	Fair to poor stability and compaction; good resistance to piping.	Seasonal high water table; slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; slow permeability.
Seasonal high water table; slow seepage.	Fair to poor stability and compaction; fair resistance to piping.	Seasonal high water table; slow permeability.	Soil features favorable.	Soil features favorable.	Severe: seasonal high water table; slow permeability.
Seasonal high water table; seepage.	Low permeability when compacted; good resistance to piping.	Seasonal high water table; slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; flooding; slow permeability.
Seepage	Low to moderate permeability when compacted; fair resistance to piping.	Good drainage	Not needed: nearly level.	Not needed: nearly level.	Severe: occasional overflow.
Shallow to bedrock.	Good resistance to piping; bedrock at depth of 20 to 34 inches.	Seasonal high water table; slow permeability; bedrock at depth of 20 to 34 inches.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; bedrock at depth of 20 to 34 inches.
Seasonal high water table; seepage.	Poor stability and compaction; poor resistance to piping.	Seasonal high water table; flooding.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; frequent overflow.
Seasonal high water table; slow seepage.	Slow permeability when compacted; good resistance to piping.	Seasonal high water table; very slow permeability.	Very slowly permeable claypan.	Very slowly permeable claypan; difficult to establish vegetation.	Very severe: very slowly permeable claypan.
Seasonal high water table; seepage; flooding.	Poor stability and compaction; poor resistance to piping.	Seasonal high water table; flooding.	Not needed: nearly level.	Not needed: nearly level.	Severe: flooding.
Rapid seepage	Subsoil: good resistance to piping; low permeability when compacted. Substratum: high permeability when compacted; fair resistance to piping.	Good drainage	Irregular slopes	Irregular slopes	Slight where slope is 0 to 6 percent. Moderate where slope is 6 to 12 percent. Hazard of pollution.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability as source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road subgrade material	Highway location
Westland: Wt, Wv	Poor: silty clay loam texture.	Poor: sand and gravel at depths below 5 feet.	Subsoil fair: moderate to high shrink-swell potential. Substratum good.	Seasonal high water table; ponding.
Wilbur: Ww	Good	Not suitable	Fair: moderate to low shrink-swell potential; moderate to high frost heave.	Seasonal high water table; flooding.
Zipp: Zc	Poor: clayey	Not suitable	Poor: high shrink-swell potential; fair to poor compaction.	Seasonal high water table; flooding and ponding; high frost heave.

Engineering classification systems

Two systems of classifying soils for engineering purposes are used in this soil survey. Most highway engineers classify soils in accordance with the system approved by the American Association of State Highway Officials (AASHO) (*1*). In this system soils are placed in seven principal groups, based on mechanical analysis and plasticity test data. The groups range from A-1, which consists of gravelly soils of high bearing capacity, the best soils for subgrades, to A-7, which consists of clayey soils that have low strength when wet, the poorest soils for subgrades. Highly organic soils, such as peat and muck, are not included in this classification, because they are not suitable for use as construction material or foundation material. The relative engineering values of soils within each group are indicated by group index numbers. The numbers range from 0 for the best material to 20 for the poorest. In table 4 the group index number is shown in parentheses following the soil group symbol, for example, A-4 (8). Group index numbers can be established only by laboratory tests. Estimated AASHO classifications for all the soils of the county are given in table 5.

Some engineers prefer the Unified soil classification system (*12*), which was developed by the Waterways Experiment Station, Corps of Engineers. This system is based on the identification of soils according to their texture and plasticity and their performance as engineering construction materials. In the Unified system, soils are identified as coarse grained (eight classes), fine grained (six classes), or highly organic (one class). Table 4 shows the Unified classifications of the soils tested, and table 5 shows estimated Unified classifications of all the soils in the county.

Engineering test data

Table 4 presents test data on samples of four soil series taken from twelve locations in the county. These samples were tested by standard procedures in the laboratories of the Joint Highway Research Project at Purdue University, under sponsorship of the Bureau of Public Roads. The samples do not represent all the soils in Sullivan County, nor do they include the entire range of characteristics of any series sampled. Not all layers of each profile were sampled. The test results, however, have been used as a general guide in estimating the engineering properties of the soils of the county. Tests were made for moisture-density relationships, liquid limit, and plastic limit. Texture was determined by mechanical analysis.

Moisture-density relationships indicate the moisture content at which soil material can be compacted to maximum dry density. If a soil is compacted at successively higher moisture content, assuming that the compactive effort remains the same, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The ovendry weight, in pounds per cubic foot, of soil material that was compacted at optimum moisture content is termed the maximum dry density. Data on the relationship of moisture to density is important in planning earthwork, for generally a soil is most stable if compacted to about its maximum dry density when it is at approximately the optimum moisture content.

The California bearing ratio test measures the load-bearing capacity of soil material.

The tests for liquid limit and plastic limit indicate the effect of water on the consistence of soil material. The liquid limit is the moisture content at which the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Mechanical analysis to determine the particle-size distribution of the soil material was made by a combination of the sieve and hydrometer methods. The names of the various particle sizes—sand, silt, and clay—do not mean

engineering properties—Continued

Soil features affecting—Continued					Soil limitations for sewage disposal fields
Farm ponds		Agricultural drainage	Terraces and diversions	Grassed waterways	
Reservoir areas	Embankments, dikes, and levees				
Seasonal high water table; seepage.	Moderate to slow permeability when compacted; fair resistance to piping.	Seasonal high water table; slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; slow permeability.
Seepage	Poor stability and compaction; moderate permeability; poor resistance to piping.	Seasonal high water table; flooding.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; flooding.
Seasonal high water table; slow seepage.	Fair to poor stability and compaction.	Seasonal ponding; very slowly permeable subsoil.	Not needed: nearly level.	Not needed: nearly level; very poor drainage.	Severe: seasonal high water table; flooding; very slow permeability.

the same when used by engineers as when they are used by soil scientists. For example, to soil scientists "clay" means mineral grains less than 0.002 millimeter in diameter, but to engineers it may mean all particles less than 0.005 millimeter in diameter.

Estimated properties

Table 5 gives estimates of soil properties that affect engineering significantly. Since actual tests were made only for the four soils listed in table 4, it was necessary to estimate the engineering properties for the rest of the soils. Estimates were based upon a comparison of these soils with those that were sampled and tested and upon experiences gained from working with and observing similarly classified soils in other areas. These estimates provide information that an engineer would otherwise have to obtain for himself, but the estimates are not a substitute for the detailed tests needed at a specific site selected for construction purposes. The information in this table applies, in general, to a depth of 5 feet or less. The depth at which bedrock occurs is not given, because in this county there are only two soils—Shadeland loam and Westland silty clay loam, shallow variant—that are less than 5 feet deep to bedrock.

A brief explanation of each column in table 5 follows:

Depth to seasonal high water table.—The highest level of free water in the soil at any time during the year.

Depth from surface.—Normally, only the major horizons and their depths are listed. Special horizons are listed when they have engineering properties significantly different from those of the adjacent horizons.

USDA texture.—The United States Department of Agriculture textural classification is based on the relative amounts of sand, silt, and clay particles in a soil.

Unified.—This classification of soil materials is according to the Unified soil classification system (*12*).

AASHO.—This classification of soil materials is according to the system of the American Association of State Highway Officials (*1*).

Percentage passing sieves 10, 40, and 200.—The values in these columns are estimates rounded off to the nearest 5 percent. Gravel-size material does not pass the No. 10 sieve. The material that passes the No. 200 sieve is mainly silt and clay, but the smaller grains of very fine sand also pass it.

Permeability.—This term refers to the downward movement of water through undisturbed soil material. Estimates are based mostly on texture, structure, and consistence.

Available moisture capacity.—The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Reaction.—This column lists estimated ranges in field pH values for each major horizon.

Frost-heave potential.—Frost action includes heave caused by ice lenses forming in a soil and the subsequent loss of strength as a result of excess moisture during periods of thawing. Three conditions must exist for frost heave to become a major consideration: (1) a susceptible soil, (2) a source of water during the freezing period, and (3) freezing temperatures that persist long enough to penetrate the ground.

Shrink-swell potential.—This is the quality of the soil that determines its volume change in proportion to its moisture content. The shrink-swell potential of a soil is estimated primarily on the basis of the amount and kind of clay in a soil.

Interpretations of soil properties

Table 6 gives interpretations of the suitability of the soils for specific engineering uses. The interpretations include: (1) the suitability of the soils as sources of topsoil, sand and gravel, and road subgrade; (2) soil features affecting use for highway location, farm ponds, agricultural drainage, terraces and diversions, and grassed waterways; and (3) soil limitations for sewage disposal fields. These interpretations apply to the repre-

367-524—70——5

sentative profile of each soil series, as described in the section "Descriptions of the Soils."

Some soil features may be helpful in one kind of engineering work and a hindrance in another kind. For example, a permeable substratum would make a soil unsuitable as a site for a farm pond but might be favorable for highway location. The column headings and ratings of suitability in table 6 are explained here.

Topsoil.—This refers to soil material, preferably high in organic-matter content, used to topdress back slopes, embankments, lawns, gardens, and other areas. The suitability ratings are based mainly on texture and organic-matter content.

Sand and gravel.—The ratings apply to soil material within a depth of 5 to 7 feet. Sand or sand and gravel occur at variable depths within soils of the same series. Test pits are needed to determine the extent and availability of sand or sand and gravel.

Road subgrade material.—The suitability of the soil depends upon its performance when used as borrow for subgrade. Both the subsoil and the substratum are rated if they have different characteristics.

Highway location.—The entire profile is evaluated. The ratings are for undisturbed soil without artificial drainage. Soil features considered are those that affect overall performance of the soil.

Farm pond reservoir areas.—Permeability, which affects seepage, is the main feature considered.

Farm pond embankments, dikes, and levees.—The features considered are those that affect the use of disturbed soil material for construction of embankments to impound surface water.

Agricultural drainage.—Texture, permeability, topography, seasonal water table, and restricting layers are considered in rating soils for this purpose.

Terraces and diversions.—The features considered are those that affect the layout and construction of terraces and diversions. Such features include topography, texture, and depth to soil material not suited to crops.

Grassed waterways.—Suitability depends on soil features that affect establishment, growth, and maintenance of vegetation and the layout and construction of the waterways.

Sewage disposal fields.—Factors evaluated are permeability, seasonal water table, the hazard of flooding, topography, and depth to bedrock.

Formation and Classification of the Soils

This section discusses the major factors of soil formation, the processes of soil formation as they relate to Sullivan County, and the system of classifying soils.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on material deposited or accumulated by natural forces. The characteristics of a soil are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are the active factors of soil genesis. They act on parent material that has accumulated through the weathering of rocks and slowly bring about the formation of genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can form and, in extreme cases, determines it almost entirely. Finally, time is needed for changing parent material into a soil. Usually, a long period of time is needed for distinct horizons to develop.

Few generalizations can be made regarding the effect of any one factor of soil formation, because the effect of each is related to the other four. Many of the processes of soil formation are unknown.

Parent material

The parent material from which the soils of Sullivan County formed consisted of glacial till of Illinoian age, lacustrine deposits and outwash of Wisconsin age, and loess (fig. 11).

A major part of the county was invaded by the Illinoian glacier. Before glaciation, the area had some landscape development. This preglacial topography determined the important features of the present landscape. The ice rounded the hills, deepened the valleys, and steepened the valley walls.

As the ice receded from the uplands, a mixture of stones, sand, silt, and clay, known as glacial till, was deposited over the bedrock. The great volume of water from melting ice carried large amounts of sand and gravel and deposited them in stratified layers known as glacial outwash. Both the till and the outwash are called glacial drift.

The till on ridges and slopes ranges from a few inches to more than 15 feet in depth, but that in the valleys can be 50 feet or more in depth. Soils of the Cincinnati, Ava, and Cory series formed mostly in glacial till.

In the southwestern and western parts of the county, immediately west of the sandhills, preglacial valleys were filled with outwash.

When the ice receded, lakes formed in many of the valleys that were blocked by glacial drift or rock divides. In these temporary lakes, sand and silt were deposited first by the relatively fast-moving water from the melting ice; then, as the ice receded and the water backed in slowly, the finer material (clay and silt) settled in the lakes.

Soils in the valley of the Wabash River formed in Wisconsin glacial material. The Fox, Elston, and Warsaw soils formed in outwash, and the Markland, McGary, and Kings soils formed in lacustrine material.

Sometime after the Illinoian glacial period, loess was deposited over the entire area. The mantle of loess ranged from a few inches to more than 25 feet in depth. Most of the silt in the steeper areas washed away, but in the nearly level to moderately sloping areas it remained and is a part of the soil profiles. Soils of the Alford, Iva, and Muren series formed in loess.

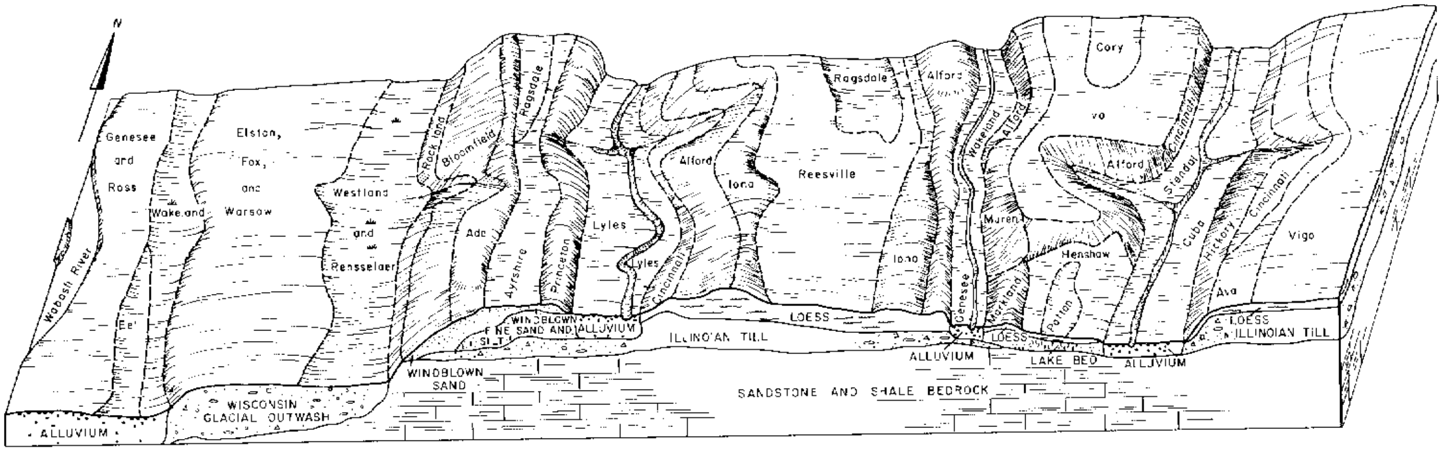

Figure 11.—**Relief and parent material of the major soils in Sullivan County.**

It is believed that a considerable amount of time elapsed after the Illinoian glacial period before the silt was deposited to any extent. This belief is based on the fact that many buried profiles have been identified at a point of contact between the mantle of silt and drift.

Coarser textured sand and silt was blown up out of the Wabash River valley and deposited on the uplands near the Wabash River. This material is of Wisconsin age. It was first deposited in the valley by glacial melt water. The deposits range from a few feet to more than 20 feet in thickness. Soils of the Princeton and Bloomfield series formed in this material.

Climate

The climate of Sullivan County is midcontinental. It is characterized by wide ranges in temperature from summer to winter. The mean daily maximum temperature in July is 88° F., and the mean daily minimum temperature in January is 22°. The climate is so nearly uniform throughout the county that differences among the soils cannot be explained on the basis of differences in climate alone.

Rainfall, on the average, is 38 inches annually. It is well distributed throughout the year but is slightly heavier in spring and summer than in fall and winter. The plentiful rain has leached plant nutrients from the surface layer and has prevented the accumulation of free calcium carbonate.

Climatic forces act upon rocks to form the parent materials from which soils formed, but many of the more important soil characteristics would not develop without the activity of plants and animals. Without the changes brought about by plants and animals, the soils would consist of residual or transported material derived from weathered rock, although some soils might have definite layers formed by the addition of alluvial or colluvial material or by differential weathering or leaching.

Climate, acting alone on the parent material, would be largely destructive. Rain and melting snow would wash the soluble materials out of the soils. The effects of climate become constructive when they are combined with the activities of plants and animals. Plants draw nutrients from the lower part of the soil; then, when the plants die, the nutrients are returned to the upper part. In Sullivan County, the climate is such that leaching of plant nutrients takes place faster than the replacement of plant nutrients. This accounts for the fact that most of the soils are leached, acid, and low in fertility.

Plant and animal life

Higher plants, micro-organisms, earthworms, and other forms of life contribute to soil formation. The higher plants bring moisture and plant nutrients from the lower part of the profile to the upper part and return organic matter to the soil. Bacteria and fungi are micro-organisms that cause dead vegetation to decompose into organic matter and to be incorporated into the soil. Before Sullivan County was settled, the native vegetation was most important in the complex of living organisms that affect soil formation.

The native vegetation of this county consisted largely of hardwood trees. Tulip-poplar, oak, hickory, elm, maple, and ash were the common species. Trees return a comparatively small amount of organic matter to the soils. In uncleared areas of the uplands, thin layers of forest litter and leaf mold cover the surface, and the topmost inch or so of the soil contains a small amount of organic matter derived from decayed leaves and twigs. In a comparatively small area in the western part of the county, the native vegetation consisted of prairie grasses. A large amount of organic matter from these grasses was returned to the soils. In small areas of the county where Patton, Zipp, and Westland soils occur, the native vegetation consisted of swamp grasses, sedges, and water-tolerant trees. The soils in these areas were covered with water much of the time. The leaves and other organic matter that fell into the water decayed slowly, and some of the organic matter accumulated.

The vegetation is fairly uniform throughout the county. Major differences among the soils, therefore, cannot be explained on the basis of differences in vegetation. Some comparatively minor variations in the vegetation are associated with different soils, but these variations are probably mainly the result, not the cause, of differences among the soils.

Relief

Relief influences soil formation by its controlling effect upon runoff and drainage.

The relief in Sullivan County ranges from nearly level to very steep. Most of the county has been dissected by weathering and stream cutting. The lowest point is 420 feet above sea level. It is in section 2, T. 5 N., R. 10 W., where the old channel of Busseron Creek crosses over into Knox County. The highest point is 640 feet above sea level. It is in the southwest quarter of the southwest quarter of section 3, T. 6 N., R. 8 W. The large flats west of Shelburn are at an elevation of 540 feet.

Differences in relief affect moisture and air conditions within the soils. Steep soils are not so well developed as level or sloping soils, even though the parent material was of the same type. The weaker development results from more rapid normal erosion, less thorough leaching, and less water to promote the vigorous growth of plants. The degree of profile development that takes place within a given time, on a given parent material, and under the same type of vegetation, depends largely on the amount of water that passes through the soil material.

The soils of the Alford series show the effects of variations in relief on development of soils that formed in the same kind of parent material. These soils formed in deep loess. The Iva soils, which are nearly level, are somewhat poorly drained and slowly permeable. They are gray and mottled. The Alford soils, which are sloping to steep, are well drained and moderately permeable. They are brown in color.

Time

Generally, the longer the period of soil formation, the greater the degree of horizon development; but because of differences in parent material, relief, and climate, some soils mature more slowly than others. A soil that has well-developed A and B horizons produced by the natural processes of soil formation is a mature soil. One that has little or no horizon differentiation is an immature soil.

Soils that formed in alluvium or colluvium are immature because the parent material is young and new materials are deposited periodically. Steep soils are also likely to be immature because geologic erosion removes the soil material as fast as it accumulates and because more water is lost through runoff and less percolates through the soil. Some kinds of parent rock are so resistant to weathering that soil development is very slow, even though other conditions are favorable.

The soils that formed in Illinoian drift and lacustrine material have well-developed profiles and are considered to be mature or nearly so. These soils are about 300,000 years old. The terrace and lacustrine soils of the Fox, Warsaw, Henshaw, McGary, and Patton series developed from Wisconsin drift and are 20,000 to 30,000 years old. These soils are along the Wabash River. They are not so deeply leached nor so thoroughly leached as the soils that developed in Illinoian drift, and they have a less well developed profile.

The young soils are on bottom lands where new materials are deposited periodically. Sandy windblown material, generally in the uplands near the Wabash River, was deposited during or after the time of the Wisconsin glacial period. Soils developed in this material are not so deeply leached nor so thoroughly leached as the soils that formed in Illinoian drift, and they have an immature profile.

Processes of Soil Formation

Most of the soils of Sullivan County have moderate to distinct horizons. A few have faint horizons. The differentiation of horizons is the result of one or more of the soil-forming processes. These processes are the accumulation of organic matter, the leaching of carbonates and salts more soluble than calcium carbonates, the translocation of silicate clay minerals, and the reduction and transfer of iron.

Some organic matter has accumulated in the surface layer of all the soils in this county. The organic-matter content of some soils is very low, but that of others is fairly high. Bloomfield loamy fine sand has a surface layer that is low in organic-matter content; whereas, Warsaw loam has a thick, dark-colored surface layer that is high in organic-matter content.

Carbonates and salts have been leached from nearly all the soils of this county, but the leaching has had little effect on horizon differentiation. The effect has been indirect. The leaching preceded translocation of silicate clay minerals in some soils. Most of the well-drained soils have been completely leached of carbonates and salts. Even in the wettest soils some leaching is indicated by the absence of carbonates and by an acid reaction. Leaching of wet soils is slow because water moves slowly through the soil. Leaching has made little progress in soils formed from recent sediments, such as the alluvial soils along the Wabash River.

The translocation of silicate clay minerals has contributed to the formation of most of the soils in this county. Soils of the Alford, Cincinnati, and Princeton series are representative of the soils formed primarily by this process. Dark coatings on ped faces and clay films in old root channels in the B horizon indicate translocation of silicate clay minerals from the A horizon. The leaching of carbonates and salts from the upper horizons is believed to precede the translocation of silicate clay minerals.

The reduction and transfer of iron, or gleying, has occurred in all of the very poorly drained, poorly drained, and somewhat poorly drained soils and, to some extent, in deeper horizons of moderately well drained soils, such as Iona silt loam. In the naturally wet soils, the process has been significant in horizon differentiation. The gray color of the subsoil indicates the reduction of iron oxides. The reduction is commonly accompanied by some transfer of the iron, either from upper horizons to lower horizons or completely out of the profile. Yellowish-red, strong-brown, or yellowish-brown mottles or concretions, which occur in the lower horizons of many of the soils, indicate segregation of iron.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics, assemble knowledge about them, see their relationships to each other and to the whole environment, and develop principles that will help us to understand their behavior and response to use. First through classification and then through the use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Two systems of classifying soils above the series level have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and was later revised (*8*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965 and was supplemented in March 1967 (*11*). This system is under continual study. Readers interested in the development of the system should refer to the latest literature available (*6*).

The current system consists of six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are measurable or observable, but the properties are selected so that soils of similar genesis are grouped together. Placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 7 shows the classification of the soil series of

TABLE 7.—*Classification of soil series*

Series	Current system			Great soil group 1938 system—
	Family	Subgroup	Order	
Ade	Coarse-loamy, mixed, mesic	Psammentic Argiudolls	Mollisol	Brunizems.
Alford	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisol	Gray-Brown Podzolic soils.
Atkins [1]	Fine-silty, mixed, acid, mesic	Fluventic Haplaquepts	Inceptisol	Low-Humic Gley soils.
Ava	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisol	Gray-Brown Podzolic soils.
Ayrshire	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisol	Gray-Brown Podzolic soils.
Bloomfield	Coarse-loamy, mixed, mesic	Psammentic Hapludalfs	Alfisol	Gray-Brown Podzolic soils.
Carlisle	[2]	[2]	Histosol	Organic soils.
Cincinnati	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisol	Gray-Brown Podzolic soils.
Cory	Fine-silty, mixed, mesic	Mollic Ochraqualfs	Alfisol	Gray-Brown Podzolic soils.
Cuba	Fine-silty, mixed, mesic	Fluventic Dystrochrepts	Inceptisol	Alluvial soils.
Eel	Fine-loamy, mixed, mesic	Aquic Fluventic Eutrochrepts.	Inceptisol	Alluvial soils.
Elston	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisol	Brunizems.
Fox	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Hapludalfs	Alfisol	Gray-Brown Podzolic soils.
Genesee	Fine-loamy, mixed, mesic	Fluventic Eutrochrepts	Inceptisol	Alluvial soils.
Henshaw	Fine-silty, mixed, mesic	Aquic Hapludalfs	Alfisol	Gray-Brown Podzolic soils.
Hickory	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisol	Gray-Brown Podzolic soils.
Iona	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisol	Gray-Brown Podzolic soils.
Iva	Fine-silty, mixed, mesic	Aeric Ochraqualfs	Alfisol	Gray-Brown Podzolic soils.
Kings	Fine, montmorillonitic, noncalcareous, mesic.	Vertic Haplaquolls	Mollisol	Humic Gley soils.
Lyles	Fine-loamy, mixed, noncalcareous, mesic.	Typic Haplaquolls	Mollisol	Humic Gley soils.
Markland	Fine, mixed, mesic	Typic Hapludalfs	Alfisol	Gray-Brown Podzolic soils.
McGary	Fine, mixed, mesic	Aeric Ochraqualfs	Alfisol	Gray-Brown Podzolic soils.
Muren	Fine-silty, mixed, mesic	Aquic Hapludalfs	Alfisol	Gray-Brown Podzolic soils.
Parke	Fine-silty, mixed, mesic	Ultic Hapludalfs	Ultisol	Gray-Brown Podzolic soils.
Patton	Fine-silty, mixed, noncalcareous, mesic.	Typic Haplaquolls	Mollisol	Humic Gley soils.
Petrolia	Fine-silty, mixed, nonacid, mesic	Fluventic Haplaquepts	Inceptisol	Alluvial soils.
Princeton	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisol	Gray-Brown Podzolic soils.
Ragsdale	Fine-silty, mixed, noncalcareous, mesic.	Typic Argiaquolls	Mollisol	Humic Gley soils.
Reesville [3]	Fine-silty, mixed, mesic	Aeric Ochraqualfs	Alfisol	Gray-Brown Podzolic soils.
Rensselaer	Fine-loamy, mixed, noncalcareous, mesic.	Typic Argiaquolls	Mollisol	Humic Gley soils.
Ross	Fine-loamy, mixed, mesic	Cumulic Hapludolls	Mollisol	Alluvial soils.
Shadeland	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisol	Gray-Brown Podzolic soils.
Stendal	Fine-silty, mixed, acid, mesic	Aeric Fluventic Haplaquepts	Inceptisol	Alluvial soils.
Vigo	Fine-silty, mixed, mesic	Typic Glossaqualfs	Alfisol	Planosols.
Wakeland	Coarse-silty, mixed, nonacid, mesic	Aeric Fluventic Haplaquepts	Inceptisol	Alluvial soils.
Warsaw	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Argiudolls	Mollisol	Brunizems.
Westland	Fine-loamy, noncalcareous, mixed, mesic.	Typic Argiaquolls	Mollisol	Humic Gley soils.
Wilbur	Coarse-silty, mixed, mesic	Aquic Fluventic Eutrochrepts.	Inceptisol	Alluvial soils.
Zipp	Fine, mixed, nonacid, mesic	Typic Haplaquepts	Inceptisol	Humic Gley soils.

[1] Soils like those correlated in this survey as of the Atkins series will in the future be classified in the Bonnie series.
[2] Histosols are not classified at the subgroup and family levels, because classification at these levels was provisional at the time the survey went to the printer.
[3] In this county these soils are slightly less gray than the soils described for Aeric Ochraqualfs.

Sullivan County according to both the current system and the great soil group of the 1938 system. The categories of the current system are defined briefly in the following paragraphs.

ORDER.—Soils are grouped into orders according to properties that seem to have resulted from the same processes acting to about the same degree on the parent material. Ten soil orders are recognized in the current system: Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates. Five of the ten soil orders occur in Sullivan County: Inceptisols, Mollisols, Alfisols, Ultisols, and Histosols.

Inceptisols occur mostly on young, but not recent, land surfaces. Mollisols have a thick, dark-colored surface layer, moderate to strong structure, and a base saturation of more than 50 percent. Alfisols have a clay-enriched B horizon and a base saturation of more than 35 percent. Ultisols have a clay-enriched B horizon but are low in base saturation. Histosols have a high organic-matter content. They developed from plant remains and some mineral matter, in water.

SUBORDER.—Each order is divided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The soil properties used are mainly those that reflect either the presence or absence of waterlogging, or differences in climate or vegetation. The climatic range of the suborders is narrower than that of the orders.

GREAT GROUPS.—Each suborder is divided into great groups, on the basis of uniformity in the kinds and sequence of major horizons and soil features. The horizons considered are those in which clay, iron, or humus has accumulated and those that have pans that interfere with the growth of roots or the movement of water. The features considered are the self-mulching properties of clays, soil temperature, chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like.

SUBGROUPS.—Each group is divided into subgroups, one representing the central (typic) segment of the group, and other groups, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order.

FAMILY.—Families are established within a subgroup primarily on the basis of properties that affect the growth of plants or the behavior of soils when used for engineering purposes. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES.—The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile.

Additional Facts About the County

This section gives general facts about Sullivan County. It briefly discusses farming and natural resources, climate, water supply, and drainage. It also discusses industries, transportation, and markets.

Farming and Natural Resources

The 1964 Census of Agriculture shows 70.8 percent of the land in Sullivan County, or 207,041 acres, was in farms. The number of farms was 1,053, and the average size was 196.6 acres. Of these farms, 602 were run by full owners, 355 by part owners, and 96 by tenants.

Grain farming and the raising of livestock, chiefly hogs and cattle, are the major enterprises in Sullivan County. The soils in the western and central parts of the county are best suited to the grain-hog type of farming; those in the eastern third of the county are best suited to general farming.

Corn and soybeans are the main crops. Wheat also grows well. Meadow crops, mostly Ladino clover, red clover, and grass, provide pasture for livestock. In recent years, straight fescue pastures have been highly successful.

In 1959, 44 percent of the farm income was from livestock and livestock products. The number of cattle has remained steady during the last few years, but the number of hogs has fluctuated.

Vegetable crops are grown in many small areas for local sale and home use. Increasing acreages are being used for growing potatoes for sale to a processor in Terre Haute. Small acreages of sweet corn and snap beans are grown under contract annually. These crops are grown on the area of excessively drained soils on broad terraces west of Carlisle. This area has an abundant supply of water for irrigation and, thus, is well suited to vegetable crops.

Coal, gravel, sand, oil, and limestone are important resources in Sullivan County.

Climate [4]

The climate of Sullivan County is interior continental. The temperature varies widely from summer to winter, but precipitation is fairly uniform throughout the seasons. Monthly precipitation averages between 2 and 5 inches. Evaporation exceeds rainfall in summer, but in spring rainfall exceeds evaporation. The temperature varies widely because the county is several hundred miles away from the moderating influence of the oceans and solar radiation is about three times as great in summer as in winter. Temperature changes are least severe in midsummer and most severe in winter. Table 8 gives temperature and precipitation data based on 51 years of record at Farmersburg. These data are considered representative for the county.

Rainfall is adequate for crops in most years. A complete crop failure resulting from lack of rainfall has never occurred, but a reduction in yields may result if a period

[4] By LAWRENCE A. SCHAAL, State climatologist, U.S. Weather Bureau.

TABLE 8.—*Temperature and precipitation data*

[Data from Farmersburg. Most statistics cover a period of 51 years]

Month	Temperature			Precipitation					Mean number of days with—			
							Snow or sleet		Maximum temperature of—		Minimum temperature of—	
	Mean daily minimum	Monthly mean	Mean daily maximum	One year in 10 will have less than—	Mean	One year in 10 will have more than—	Mean	Maximum monthly	90° F. or above	32° F. or below	32° F. or below	0° F. or below
	° F.	*° F.*	*° F.*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Days*	*Days*	*Days*	*Days*
January	22	31	39	0.7	2.7	7.3	4.0	16	0	7	25	2
February	24	33	41	.5	1.9	3.6	3.4	19	0	5	22	2
March	33	43	53	1.4	3.4	7.0	2.7	22	0	2	16	(2)
April	42	53	64	1.7	3.3	6.3	.2	2	0	(2)	5	0
May	53	64	74	1.3	4.6	8.9	(1)	(1)	(2)	0	(2)	0
June	61	72	82	1.6	4.0	7.5	0	0	6	0	0	0
July	65	77	88	1.0	2.9	5.6	0	0	13	0	0	0
August	63	75	86	1.0	3.4	6.4	0	0	9	0	0	0
September	57	69	80	1.0	3.7	6.3	0	0	4	0	(2)	0
October	45	57	68	.7	2.9	5.7	.1	1	(2)	(2)	3	0
November	34	44	53	1.1	2.6	4.6	.6	6	0	1	13	(2)
December	25	33	41	.7	2.4	4.7	3.4	12	0	7	23	(2)
Year	44	54	64	28.7	37.8	46.3	14.4	[3] 40	32	22	107	4

[1] Trace. [2] Less than half a day. [3] Greatest annual amount during period of record.

of low rainfall occurs in summer, when crops need a lot of water and evaporation is rapid because of wind and high temperatures.

Table 8 gives indications of low and high monthly amounts of rainfall. In July, for example, rainfall is less than 1.0 inch in 1 year out of 10 and more than 5.6 inches in 1 year out of 10. The probability of too much rain in spring is high. Heavy rain early in spring can cause flooding along the Wabash River, and such rains a little later in spring can delay planting of crops. If planting is delayed and the crop season has a late start, an early frost in fall is detrimental. Tender crops are sometimes killed by an unusually late spring freeze. Ordinarily, the number of days between the last spring freeze and the first fall freeze is sufficient for the common crops to mature.

In 51 years the temperatures at Farmersburg, in the northern part of Sullivan County, ranged from −24° to 111° F. In a typical year the temperature ranges from about 0° to 96°. Adapted crops are not damaged by the high temperatures of summer if moisture is adequate, but high temperatures accelerate evaporation and remove moisture rapidly.

The cold temperatures of winter cause some problems in overwintering crops. In some winters the freezing or thawing of soils can heave or lift some of the young plants of a small-grain or forage crop. A snow cover protects crops from the cold and from alternate freezing and thawing. Snowfall averages a little more than 14 inches a winter season but is extremely variable.

Extremely low temperatures kill fruit trees. Orchardists need to select sites for orchards with care, avoiding cold-air pockets and choosing south-facing slopes, in order to get the maximum benefit from solar radiation.

The wind is from the southwest most of the time, but in some winters the prevailing wind is from the west or northwest. Damaging winds seldom occur. Tornadoes are so small and infrequent that property loss and casualties resulting from them are less than those resulting from lightning. Only five tornadoes have been reported in a 44-year period.

Relative humidity commonly is nearly 100 percent at the time of the day when the temperature is lowest, usually just before sunrise. If it remains near 100 percent for a period of time during the night, heavy dew or frost accumulates. If other factors are normal, relative humidity declines as the temperature rises. A relative humidity of 40 to 50 percent is common on summer afternoons. In winter the relative humidity is 10 to 20 percent higher.

Fog at night and early in the morning is associated with 100 percent relative humidity, a calm wind, and cold-air pooling. Such fog is most prevalent in the lowlands along the Wabash River.

Water Supply

Drilled wells are the principal type of water wells in this county. A small number of driven wells and dug wells are still in use, and occasionally a new one is constructed (*13*).

In upland areas sandstone is the principal source of ground water. It has been tapped for many domestic wells and stock wells and for a few small industrial wells. These wells are 40 to 500 feet deep but are most commonly about 100 feet deep. They produce from 0.1 gallon to more than 50 gallons per minute. Some dry holes are reported.

Farther to the north, on broad terraces and bottom lands along the Wabash River, are large deposits of

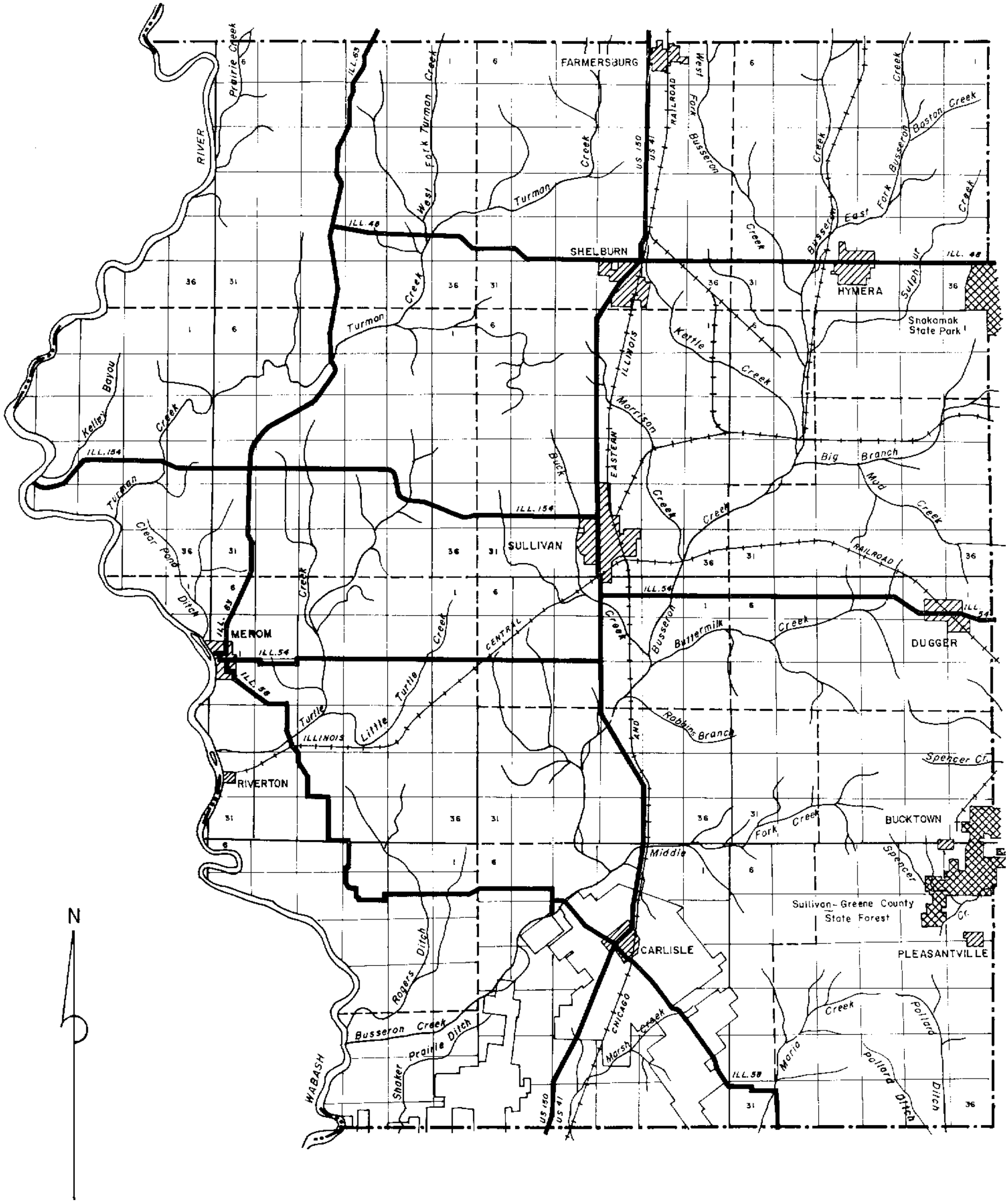

Figure 12.—**Drainage map of Sullivan County.**

glaciofluvial sand and gravel. These deposits are an important source of ground water for domestic, stock, and industrial needs and for irrigation. They also supply the water for most of the towns and cities in the county. The town of Dugger obtains its water from similar deposits along the White River in Greene County. Wells in these deposits are 45 to 75 feet deep but are most commonly about 55 feet deep. They produce from 3 to more than 1,000 gallons per minute.

Lacustrine deposits and glacial till along Busseron, Turman, and Turtle Creeks are not used extensively as a source of ground water, but they are potential sources for small domestic and livestock supplies. These deposits overlie bedrock or are interbedded with or overlie glaciofluvial sand and gravel. Wells in these deposits are 40 to 120 feet deep and produce from 0.5 to 30 gallons per minute.

The quality of water from drilled wells varies greatly. In most of the county the content of iron and, locally, the content of either chloride or sulfate exceed the 1946 U.S. Public Health Service standards for drinking water.

In areas where the yield from ground-water sources is low, or where the content of chloride or sulfate is excessive, the water supply must come from lakes and ponds. During the past few years a large number of farm ponds have been constructed. These ponds supply water for stock, for fire protection, and for wildlife habitat.

Drainage

Almost all of Sullivan County is drained by the Wabash River and its many tributaries (fig. 12). The Wabash is the western boundary of the county.

Busseron Creek, the largest tributary of the Wabash River, drains the northeastern half, the central part, and the southwestern corner of the county. Turtle Creek, Turman Creek, and Rogers Ditch drain the northwestern and western parts. Maria Creek and Pollard Ditch drain the extreme southern and southeastern parts.

The Wabash River is bordered by broad bottoms that are subject to occasional flooding, but levees protect most areas from severe flooding.

Busseron Creek is bordered by valleys that are 1½ miles to a few rods in width. The valleys are surrounded by short, moderate to extremely steep slopes. These bottom-land areas are somewhat poorly drained to poorly drained and are frequently flooded. Maria Creek, Turman Creek, Turtle Creek, and Pollard Ditch are bordered by valleys that are narrow to medium in width. These bottom-land areas are somewhat poorly drained and are occasionally to frequently flooded.

Other small streams in the county are tributaries of Busseron Creek. These are Boston Creek, Kettle Creek, Sulphur Creek, Mud Creek, Morrison Creek, Middle Fork Creek, Buck Creek, and Big Branch. These small streams are bordered by narrow bottom lands surrounded by short, moderate to extremely steep slopes.

Industries, Transportation, and Markets

The largest and fastest growing industry in Sullivan County is the manufacture of prefabricated homes. Several small sawmills supply lumber and other building materials for homes and other structures. Coal mining is still an important industry in the eastern part of the county. There are a number of producing oil wells, and other extensive operations are in progress to recover oil from older workings west of the city of Sullivan. A cheese factory and two factories that manufacture garments for women are located in the city of Sullivan. A small packaging company is located in Shelburn. A large electrical power plant has been built on the Wabash River west of Fairbanks.

Two railroads run through the county. Federal Highway 41 and a smaller paved road, Route 63, in the western part of the county, serve the north-south traffic. Routes 48, 154, 54, and 58 are east-west paved roads. A bridge on Route 154 crosses the Wabash River into Hutsonville, Illinois. A small ferry at Merom is the only other river crossing in the county. Bus transportation is available in most small towns. A small airport for noncommercial planes and several private landing fields are located north of Sullivan.

A sale barn in Linton, Indiana, provides a market for feeder pigs and calves. Other markets for livestock are in Vincennes, Terre Haute, and Indianapolis, Indiana.

Grain elevators are not adequate for all the wheat and soybeans at harvest time. Freight cars are used to supplement the elevators.

Literature Cited

(1) American Association of State Highway Officials.
1961. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 8, 2 v., 401 and 617 pp., illus.

(2) Baldwin, M., Kellogg, C. E., and Thorp, J.,
1938. SOIL CLASSIFICATION. U.S. Dept. Agr. Yearbook 1938: 979–1001, illus.

(3) Outdoor Recreation Resources Review Commission.
1962. OUTDOOR RECREATION FOR AMERICA. 246 pp., illus.

(4) Putnam, John A., Furnival, George M., and McKnight, J. S.
1960. MANAGEMENT AND INVENTORY OF SOUTHERN HARDWOODS. USDA Handbook No. 181, 102 pp., illus.

(5) Schnur, G. Luther.
1937. YIELD, STAND, AND VOLUME TABLES FOR EVEN-AGED UPLAND OAK FORESTS. USDA Tech. Bul. No. 560, 88 pp., illus.

(6) Simonson, Roy W.
1962. SOIL CLASSIFICATION IN THE UNITED STATES. Science, v. 137, No. 3535, pp. 1027–1034, illus.

(7) Society of American Foresters.
1955. FORESTRY HANDBOOK. Ronald Press, New York.

(8) Thorp, James, and Smith, Guy D.
1949. HIGHER CATEGORIES OF SOIL CLASSIFICATION: ORDER, SUBORDER, AND GREAT SOIL GROUPS. Soil Sci. 67: 117–126, illus.

(9) United States Department of Agriculture.
1951. MAKING LAND PRODUCE USEFUL WILDLIFE. Bulletin 2035, 22 pp., illus.

(10) ———
1951. SOIL SURVEY MANUAL. U.S. Dept. Agr. Handbook 18, 503 pp., illus.

(11) ———
1960. SOIL CLASSIFICATION, A COMPREHENSIVE SYSTEM, 7TH APPROXIMATION. 265 pp., illus. [Supplement issued in March 1967]

(12) Waterways Experiment Station, Corps of Engineers.
1953. THE UNIFIED SOIL CLASSIFICATION SYSTEM. Tech. Memo. No. 3–357, v. 1.

(13) Watkins, F. A., Jr., and Jordan, D. G.
1962. GROUND-WATER RESOURCES OF WEST-CENTRAL INDIANA. Dept. of Conservation, Div. of Geology, U.S. Geological Survey, Bul. No. 14, 345 pp., illus.

Glossary

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

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available moisture capacity. The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Catena. A sequence, or "chain," of soils on a landscape, developed from one kind of parent material but having different characteristics because of differences in relief and drainage.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

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 clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

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

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

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

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

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

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

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

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

Cemented.—Hard and brittle; little affected by moistening.

Drift (geology). Material of any sort deposited by geologic processes in one place after having been removed from another; includes drift materials deposited by glaciers and the streams and lakes associated with them.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of the following: soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Loess. A fine-grained eolian deposit consisting dominantly of silt-sized particles.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of 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 these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Parent material, soil. The disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

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

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

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

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 textural class, soil material that is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that 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.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

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

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

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."

U.S. GOVERNMENT PRINTING OFFICE: 1970