Series 1959, No. 38

Issued October 1964

SOIL SURVEY

Owen County Indiana

OUR SOIL ✶ OUR STRENGTH

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

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of Owen County, Ind., will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; aid foresters in managing woodland; and add to our knowledge of soil science.

Locating Soils

Use the index to map sheets at the back of this report to locate areas on the large map. The index is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located. When the correct sheet of the large map has been found, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they occur on the map. The symbol is inside the area if there is enough room; otherwise, it is outside the area and a pointer shows where the symbol belongs.

Finding Information

This report contains sections that will interest different groups of readers, as well as some sections that may be of interest to all.

Farmers and those who work with farmers can learn about the soils in the section "Descriptions of Soils" and then turn to the section "Use and Management of the Soils." In this way, they first identify the soils on their farm and then learn how these soils can be managed and what yields can be expected. The "Guide to Mapping Units, Capability Units, and Woodland Suitability Groups," at the back of the report will simplify use of the map and report. This guide lists each soil and land type mapped in the county, and the page where each is described. It also lists, for each soil and land type, the capability unit and woodland suitability group, and the pages where each of these are described.

Foresters and others interested in woodland can refer to the section "Woodland Uses of Soils." In that section the soils in the county are grouped according to their suitability for trees, and factors affecting the management of woodland are explained.

Engineers will want to refer to the section "Engineering Properties of Soils." Tables in that section show characteristics of the soils that affect engineering.

Scientists and others who are interested will find information about how the soils were formed and how they were classified in the section "Soil Formation and Classification."

Individuals or groups interested in learning about the wildlife resources of Owen County can refer to the section "Wildlife."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

Newcomers in Owen County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County," which gives additional information about the county.

* * * *

Fieldwork for this survey was completed in 1959. Unless otherwise indicated, all statements in the report refer to conditions in the county at that time. The soil survey of Owen County was made as part of the technical assistance furnished by the Soil Conservation Service to the Owen County Soil and Water Conservation District.

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SOIL SURVEY OF OWEN COUNTY, INDIANA

BY F. W. SANDERS, SHELBY BROWNFIELD, SAMUEL LEHMAN, AND ROBERT FIELDS, SOIL CONSERVATION SERVICE

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

OWEN COUNTY, in the southwestern part of Indiana (fig. 1) has a total area of 391 square miles. Spencer is the county seat and the largest city.

Agriculture is the leading occupation, but many people work in industries in the county or commute to Indianapolis or to other cities nearby. Approximately 71 percent of the farm income is derived from the sale of livestock and livestock products, and about 29 percent, from the sale of field crops. Cattle, hogs, and chickens are raised extensively, and corn, soybeans, and hay are the principal crops.

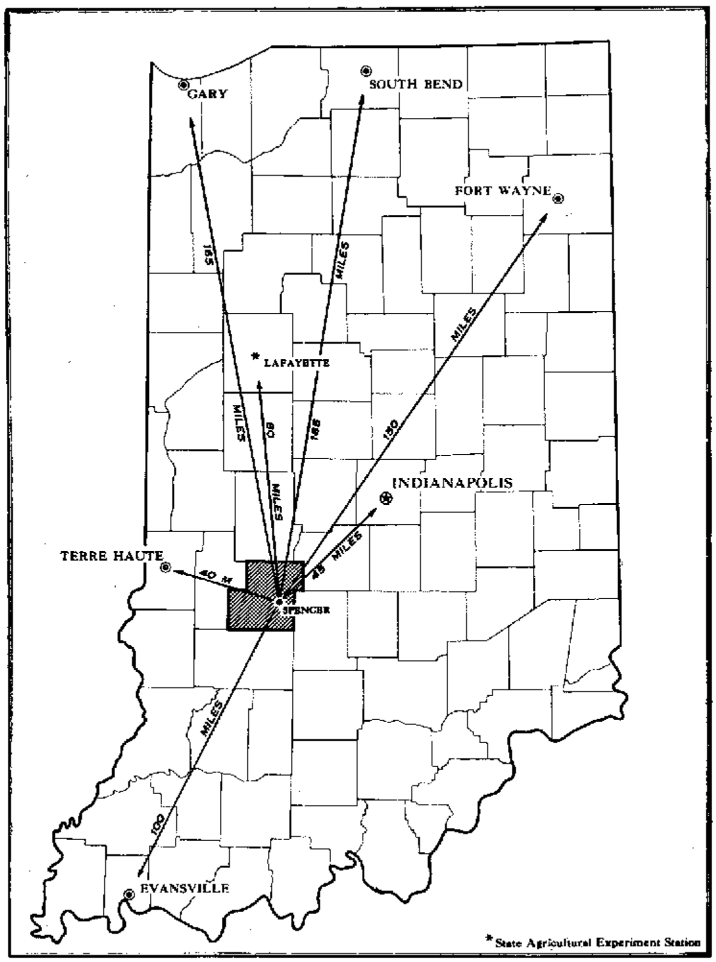

Figure 1.—Location of Owen County in Indiana.

General Nature of the County

This section of the report is provided mainly for those not familiar with Owen County. It tells about the climate and water supply, and it describes the social and industrial development. The figures used to describe the agriculture are from records of the Bureau of the Census.

The area that is now Owen County was once occupied by prehistoric people. Evidence of these people has been found in mounds throughout the county. Most of the mounds contained rude pottery and implements of polished stone and flint, but in some were large deposits of bones. These mounds are thought to be burial places. The prehistoric people were followed by the American Indians, who were of the Miami, Potawatami, Eel River, and Delaware tribes. The Indians planted corn on the rich bottom lands and hunted wild game, which was abundant on the rolling, wooded uplands.

In 1809, after white men came to this area, the Indians ceded to them most of the area that is now Owen County. The treaty that transferred this land was called the treaty of Fort Wayne. The boundary established by this treaty, known as the 10 o'clock line, runs diagonally across the northeastern part of the county. The rest of the county was later purchased from the Indians.

The first white settlement was made in 1816 just north of the present site of Spencer. Owen County was organized in 1818, and Spencer was made the county seat. The first towns established in Owen County, besides Spencer, were Freedom and Gosport. All of these towns were established on the White River so that the river could be used for travel by flatboat and steamboat.

Climate [1]

Records of climate have been kept at Spencer for only a short time. Therefore, the information about climate, given in this section, was taken from records kept at Bloomington from 1896 to the present time. Bloomington is 9 miles east of the southeastern corner of Owen County, in Monroe County. The climate at Bloomington is considered typical for Owen County.

Rainfall is adequate in most years, but in summer, when a large amount of moisture is used by plants and much is lost through evaporation, a period of low rainfall occasionally causes a reduction in crop yields. The soil stores moisture that falls during the winter and spring. As a result, damage to crops is generally prevented in sub-

[1] By L. A. SCHAAL, State climatologist, U.S. Weather Bureau.

sequent periods of little or no rainfall, especially in midsummer when the use of water is at a maximum high. In midsummer the amount of moisture used exceeds the average monthly rainfall, which is between 3.6 and 4.3 inches. The average amount of monthly precipitation is fairly uniform, but a slightly greater amount falls in spring and a slightly smaller amount falls late in winter. Figures for the average and extremes of precipitation, taken from records kept at Bloomington over a 64-year period, are given in table 1. However, these average figures that show precipitation do not adequately describe the nature of the precipitation in this county.

The amount of precipitation that falls in different months varies greatly. For 10 percent of the time in spring and summer, during the time records have been kept, there has been less than 1.6 inches of precipiation. Also for 10 percent of the time in September and again in October, 0.9 inch or less of precipitation has fallen. In contrast, precipitation exceeded 9.5 inches in 10 percent of the months of January and March. The months of April through September receive 7 inches or more. Thus, about 80 percent of the time the monthly precipitation ranges from 1.6 to 7 inches in spring and summer.

The chances that various amounts of precipitation will occur are given in table 2 for all weeks of the year. One of the wetter weeks begins April 5, when 0.40 inch or more of rain falls about 80 percent of the years. October 25 begins a fairly dry week when 0.40 inch or more of rain is expected only 44 percent of the time.

The climate of this county is midcontinental, and there are great contrasts in temperature. The average daily maximum temperature reaches 88.5°F. in July, and the average daily minimum temperature drops to 22.1°F. in January. If moisture is adequate, adapted crops are not damaged by the high temperature in midsummer. The high temperature, however, accelerates evaporation and rapidly reduces the amount of moisture available to crops. Temperatures of 20 degrees below zero have been reported in this county in winter. The freezing and thawing of the soil in winter may heave or lift some of the young plants of a forage or small-grain crop. Snow cover is welcome at such times to protect winter small grains. The average amount of snowfall in winter is about 19 inches.

Severe storms occasionally cause some damage. Nine tornadoes, most of which occurred in May, were reported in the last 44 years. The average number of days when thunderstorms occur is 48 a year. June has the most, an average of 9 days a year with thunderstorms, and August is next with 8. As a rule, not more than one thunderstorm occurs in any month in winter.

Heavy rains occasionally flood the lowlands along the West Fork of the White River. This is most frequent in spring, because at that time the soils are frozen or hold a maximum amount of water. Infiltration is limited, and runoff from brief, heavy rains cannot be adequately carried away by the streams.

Relative humidity ranges from 40 percent on a typical summer afternoon to near 100 just before dawn. In winter the most probable range in a 24-hour period is from 60 to 90 percent. Fog is a visible indication that the relative humidity is near 100 percent. Radiation fog, a phenomenon at night and early in the morning, is more prevalent near the White River than in higher areas because

TABLE 1.—*Averages and extremes*

[Based on records kept at Bloomington, Ind., from 1896 to 1959.

Month	Temperature							Average degree days [1]	Precipitation	
	Average			Extremes					Average	Greatest daily
	Daily maximum	Daily minimum	Monthly	Highest on record	Year	Lowest on record	Year			
	°F.	°F.	°F.	°F.		°F.			Inches	Inches
January	40. 2	22. 1	31. 2	78	1950	−20	1918	1, 050	3. 86	3. 38
February	39. 1	23. 2	31. 2	76	1932	−20	1899	950	2. 91	2. 61
March	53. 7	32. 3	43. 0	86	1910	−2	1943	680	4. 53	6. 56
April	64. 9	42. 4	53. 7	91	1925	17	1923	340	3. 83	2. 59
May	75. 7	52. 3	64. 0	97	1911	29	1908	120	4. 19	3. 30
June	84. 0	61. 1	72. 6	103	1913	36	1910	20	4. 30	3. 91
July	88. 5	65. 0	76. 8	110	1936	46	1911	0	3. 76	4. 25
August	86. 9	63. 3	75. 1	104	1930	41	1915	0	3. 63	3. 42
September	79. 0	56. 3	67. 7	103	1922	28	1899	70	3. 53	3. 40
October	69. 4	45. 1	57. 3	96	1954	17	1925	270	3. 04	4. 02
November	53. 8	34. 0	43. 9	84	1950	−2	1950	630	3. 26	3. 16
December	42. 0	24. 7	33. 4	73	1948	−11	1909	980	3. 29	2. 56
Year	64. 8	43. 5	54. 2	110	1936	−20	1918	5, 110	44. 13	6. 56

[1] Based on a temperature of 65° F. and computed from monthly average temperatures. These data show relative heating requirements for dwellings. Degree days for a single day are obtained by subtracting the average temperature of the day from 65°.

cold air pools in low areas, and the humidity is also higher in the bottom lands near the river.

Tender crops are sometimes lost as a result of freezes that occur unusually late in spring or early in fall. Table 3 gives the probabilities of a critical temperature in spring and fall. The average date of the last freeze in spring is April 21. The average date of the first freeze in fall is October 20.

The average number of days between the time of the last freezing temperature in spring and the first in fall, that is, the average growing season, is 182 days. In 10 percent of the years, however, the growing season is 158 days or less, and in another 10 percent it is 218 days or more. In 50 percent of the years, the growing season is 169 to 195 days long. In low depressions or basins, the growing season is shorter because on calm, clear nights cold air drains down from higher areas. Low areas do not provide a good location for crops that have a long growing season or for crops that are vulnerable to the lowest temperatures in winter.

Records kept at Indianapolis and Terre Haute indicate that the wind blows from the southwest most of the time in spring, summer, and fall. The wind is westerly or northwesterly in winter. Its velocity is highest in March and lowest in August. Extreme winds may come from intense low-pressure centers that move through or near this county or from severe local thunderstorms.

Water Supply

The sources of water vary widely over this county. Spencer gets its water from wells in outwash of Wisconsin age that are along the West Fork of the White River. This gravelly outwash furnishes an abundant supply of water. In most of the county, a well productive enough to supply water for household and farm use can be obtained. There are considerable variations in the depth at which an abundant supply of water can be obtained. In the area underlain by till, the till is generally thin enough so that the wells reach into the underlying bedrock. Getting a good well in the area underlain by limestone is usually more difficult because of the many underground crevices, cracks, and voids.

Many of the shallow wells in the uplands are dry during some seasons. The wells in the bottoms and terraces are shallow, generally about 20 feet deep. The gravelly outwash along the White River is the best source of water where a large supply is needed, such as for industry.

Springs are common throughout the county and are often developed to furnish water for household use as well as for livestock. In many places the terrain provides ideal sites for ponds and lakes. Many ponds have been constructed to supply water for livestock, and in some areas ponds are used to provide water for household use. Several lakes have been constructed for recreational uses.

Social and Industrial Development

School facilities in Owen County are presently undergoing changes for improvement. Some of the schools have been consolidated, and there are no one-room grade schools in the county. There are presently five high schools; Spencer High School is the largest. All the rural pupils are provided bus transportation to school.

of temperature and precipitation

Absence of data indicates no occurrence]

Year	Precipitation—Continued					Average number of days with—				
	Snow					Precipitation of 0.10 inch or more [4]	Temperature			
							Maximum		Minimum	
	Average [2]	Maximum monthly [2]	Year	Greatest daily [3]	Year		90° and above [5]	32° and below [5]	32° and below [5]	Zero and below [5]
	Inches	*Inches*		*Inches*			°F.	°F.	°F.	°F.
1937	5.7	30.7	1918	4.8	1951	6	0	8	25	2
1908	4.9	22.6	1910	5.0	1945	8	0	4	21	1
1913	3.0	26.0	1906	6.0	1949	8	0	1	16	(6)
1944	.4	5.0	1912	4.1	1953	8	(6)	0	4	0
1908	(7)	.2	1909	0	----------	9	1	0	(6)	0
1947	0	0	----------	0	----------	8	8	0	(6)	0
1910	0	0	----------	0	----------	7	15	0	0	0
1928	0	0	----------	0	----------	6	12	0	0	0
1931	0	0	----------	0	----------	7	6	0	(6)	
1910	0	.5	1913	.3	1950	5	2	0	3	0
1936	.9	7.3	1932	6.2	1950	6	0	2	14	(6)
1932	4.5	13.5	1942	7.0	1942	9	0	6	24	1
1913	19.4	30.7	1918	7.0	1942	87	44	21	107	4

[2] Based on a 59-year record.
[3] Based on a 19-year record.
[4] Based on a 5-year record.
[5] Based on a 34-year record.
[6] Less than one-half.
[7] Trace.

TABLE 2.—*Amounts and probability of weekly precipitation*[1]

[Based on records kept for 54 years at Bloomington, Ind.]

Week beginning—	None or a trace[2]	0.10 inch or more	0.20 inch or more	0.40 inch or more	0.60 inch or more	0.80 inch or more	1.0 inch or more	1.2 inches or more	1.6 inches or more	2.0 inches or more	2.8 inches or more	4.0 inches or more
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Jan. 3	9	83	76	64	54	46	39	33	24	17	9	3
Jan. 10	17	74	67	55	46	38	32	27	19	13	7	2
Jan. 17	7	83	75	63	54	45	39	33	24	18	10	4
Jan. 24	15	73	64	50	39	31	25	20	12	8	3	1
Jan. 31	9	80	71	54	41	32	24	18	11	6	2	0
Feb. 7	11	81	72	53	38	27	19	13	6	3	1	0
Feb. 14	11	82	75	60	48	38	30	24	14	9	3	1
Feb. 21	6	86	77	60	47	36	28	21	13	7	2	1
Mar. 1	6	88	80	63	50	38	30	23	13	7	2	0
Mar. 8	6	92	87	76	65	54	45	37	25	16	7	2
Mar. 15	9	86	81	68	56	46	37	30	19	12	5	1
Mar. 22	2	91	84	71	60	51	43	37	26	19	10	4
Mar. 29	7	85	77	64	53	44	37	30	21	14	7	2
Apr. 5	2	95	91	80	68	57	47	39	25	16	6	2
Apr. 12	11	84	78	66	55	46	38	31	21	14	6	2
Apr. 19	9	85	78	63	50	39	30	23	13	8	2	0
Apr. 26	9	85	78	65	53	43	35	28	18	11	4	1
May 3	4	89	82	68	56	46	38	31	21	14	6	2
May 10	6	88	81	68	57	48	40	33	23	16	8	3
May 17	9	87	81	68	55	45	36	28	18	11	4	1
May 24	15	81	76	65	55	46	38	32	22	15	7	2
May 31	13	81	75	64	53	45	37	31	21	14	7	2
June 7	13	82	77	65	55	46	38	32	22	15	7	2
June 14	11	81	74	62	52	44	37	31	22	15	8	3
June 21	11	84	77	65	54	44	36	29	19	13	5	1
June 28	15	77	70	57	46	37	30	24	16	10	4	1
July 5	24	71	65	54	45	37	30	25	16	11	5	1
July 12	11	81	73	60	49	41	33	27	18	12	6	2
July 19	19	71	62	48	37	29	23	18	11	7	3	1
July 26	15	75	67	52	40	31	24	19	11	7	2	1
Aug. 2	15	77	69	55	45	36	29	23	15	10	4	1
Aug. 9	11	82	76	65	56	48	41	36	27	20	11	5
Aug. 16	9	85	78	66	56	47	39	32	22	16	7	2
Aug. 23	24	67	59	47	38	31	25	20	13	9	4	1
Aug. 30	19	73	67	55	46	39	33	27	19	14	7	3
Sept. 6	17	77	70	57	45	36	29	23	14	9	3	1
Sept. 13	24	70	63	53	44	36	30	25	17	12	5	2
Sept. 20	20	70	62	49	39	32	25	20	13	8	4	1
Sept. 27	32	63	58	49	42	35	30	26	19	14	7	3
Oct. 4	24	67	60	49	41	34	28	24	17	12	6	2
Oct. 11	32	62	56	46	37	30	24	20	13	8	3	1
Oct. 18	26	65	58	48	40	34	29	25	18	13	7	3
Oct. 25	32	61	55	44	36	29	24	20	13	9	4	1
Nov. 1	19	75	68	55	45	36	30	24	16	10	4	1
Nov. 8	17	78	70	54	40	29	20	14	7	3	1	0
Nov. 15	15	77	70	58	48	40	33	28	20	14	7	2
Nov. 22	9	84	75	58	44	33	25	18	10	5	2	0
Nov. 29	19	76	69	54	41	31	23	17	9	5	1	0
Dec. 6	9	85	78	65	53	43	35	28	18	12	5	1
Dec. 13	17	74	66	53	43	36	29	18	16	11	5	2
Dec. 20	17	79	72	59	46	36	28	17	12	7	2	0
Dec. 27	13	80	73	60	49	39	32	28	17	11	4	1

[1] Calculated from records kept over a period of 54 years by G. L. BARGER, R. H. SHAW, and R. F. DALE, from "Chances of Receiving Selected Amounts of Precipitation in the North Central Region of the United States," Iowa State University, July 1959, 277 pp.

[2] A trace of precipitation is less than 0.005 inch.

For those interested in higher education, there are universities and colleges in nearby cities. Colleges within 40 miles are Indiana University at Bloomington, DePauw University at Greencastle, and Indiana State Teachers College and several small business colleges at Terre Haute.

Several churches of different denominations are located in Spencer and other towns of the county. There are many small country churches throughout the county. In areas where the population has decreased, however, some of these small churches have been abandoned.

There are several service clubs in Owen County, such as the Lions Clubs of Spencer and Gosport, the Junior Chamber of Commerce, and sororities and fraternal organizations. More closely associated with agriculture are the township and county Farm Bureaus and Home Demonstration Clubs. For the young people of the county, there are 4-H Clubs, Rural Youth, and Future Farmers of America. Conservation clubs are active in the promotion of wildlife conservation.

Each year several hundred acres of land in this county are purchased by people who live elsewhere, mostly in cities. Most of these purchases are for recreation as well as for investment. Many of the farms purchased for recreational use are in areas that are predominantly moderately steep to very steep. Most of them are protected by forest or other permanent vegetation. These areas in forest are generally protected from livestock, but considerably more attention is needed in woodland management to help prevent further soil erosion. There have been several private lakes constructed on these tracts. Locally owned private lakes are also located throughout the county. The largest are the Greybrook Lake southwest of Jordan and the Hollybrook Lake northwest of Gosport.

There are also many commercial recreational facilities. McCormicks Creek State Park, east of Spencer, was the first State park in Indiana. It has many recreational opportunities for camping, hiking, swimming, and horseback riding. It also has a year-round hotel. Cataract Falls, a privately owned park at Cataract, contains the largest waterfalls in Indiana. Cataract Lake is in the northwestern part of the county. It consists of 1,400 acres of water for fishing, swimming, boating, and other water sports. The area around the lake also offers camping and picnic facilities. Most of the land near Cataract Lake has been used for cabins, camp grounds, and other recreational uses. The Lieber State Park, on the Owen-Putnam county line, adjoins Cataract Lake.

Many of the industries in Owen County are based on natural resources. There are two strip mines in operation. The coal is mined for both local trade and for shipment by rail. There are extensive timber and lumber operations, including a large mill where staves are made for whiskey barrels, 2 crate factories, and 12 to 16 sawmills. There are two limestone quarries that produce agricultural limestone, road aggregate, and other crushed stone products. Limestone building stone is quarried near Romona. Two gravel pits located at Gosport and Spencer provide a source of material for roads and for the manufacture of concrete products. A gypsum mine is being developed in the southwestern part of the county, where several hundred acres has been purchased or leased. There are some undeveloped gas fields near Arney. Two grain elevators are located in the county.

TABLE 3.—*Probabilities of critical temperatures in spring and fall*

[Based on records kept at Bloomington, Ind., from 1921 to 1950]

Probability	Dates for given probability and temperature						
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower	36° F. or lower	40° F. or lower
Spring:							
1 year in 10 later than	March 21	March 27	April 10	April 22	May 6	May 16	May 27.
2½ years in 10 later than	March 12	March 20	April 1	April 14	April 29	May 10	May 20.
5 years in 10 later than	March 3	March 12	March 23	April 5	April 21	May 2	May 12.
7½ years in 10 later than	February 22	March 4	March 14	March 27	April 13	April 24	May 4.
9 years in 10 later than	February 13	February 25	March 5	March 19	April 6	April 18	April 27.
Fall:							
1 year in 10 earlier than	November 19	November 4	October 31	October 20	October 1	September 23	September 17.
2½ years in 10 earlier than	November 29	November 15	November 6	October 26	October 10	September 30	September 24.
5 years in 10 earlier than	December 9	November 27	November 13	November 2	October 20	October 8	October 1.
7½ years in 10 earlier than	December 19	December 9	November 20	November 9	October 30	October 16	October 8.
9 years in 10 earlier than	December 29	December 20	November 26	November 15	November 8	October 23	October 15.

Spencer has several small industries. Some of them are a manufacturing company of metal signs, a manufacturer of insulating plastics, a large distributor of corded merchandise, several printing and lithographing establishments, and a plant where canvas and tarpaulins are made.

The industries are too few to utilize all of the county's present labor force. Many people leave the county for employment, and some commute to Indianapolis, Bloomington, and other cities. Many of the commuters are farmers who need supplemental income.

The White and Eel Rivers, the first major means of transportation, were important factors in the development of this county. Three railroads cross the county; their main business is hauling coal from the coalfields in this and in the adjoining counties in southwestern Indiana.

Nearly all of the produce is transported by truck. This area is close to Indianapolis and other cities that provide quick, easily available markets for livestock and other agricultural and industrial products. Spencer, the principal trading center in the county, is serviced by several trucklines and by privately operated trucks.

The highways in Owen County suitable for motor freight are Indiana Highway Nos. 46, 67, 42, 43, 157, and 246, and U.S. Highway No. 231. Approximately 60 percent of the secondary county roads are all-weather roads, and approximately 25 percent of these are surfaced with asphalt.

Agriculture

During the settlement of Owen County, the pioneers cleared many acres of moderately steep and steep land, as well as nearly level to sloping areas. In the steeper areas productive surface soil was lost through erosion, and as a result, crop yields were reduced within a few years. These areas were abandoned to grow up to brush. Later, many acres of the gently sloping to sloping land were also abandoned because of depleted fertility and soil erosion. The farmers often moved away, leaving the areas for nature to salvage by natural reforestation. Today, many of these areas are covered by stands of timber that are good to excellent in quality. Some of the abandoned areas were later reclaimed during periods when farm prices were high. When farm prices decreased during the 1930's and when the area became more depleted, many tracts of this land were again abandoned.

The pioneers used the rough forested areas for pasture. This practice, along with burning, caused much damage to many of the forests. It has been estimated that 38,000 acres of forest are still pastured.

Many farmers lived on farms of 40 to 100 acres for years and were contented. Meanwhile, the standard of living was improving. To achieve this higher standard of living, these small farmers had to get more land or intensify their farming systems. On farms with a large amount of marginal cropland, the intensified farming caused a rapid depletion of soil fertility and a rapid increase in soil erosion. Many farmers left the farms for other employment, and some of the farms were left idle. On many other farms gradual soil erosion over the years caused the land to be left idle, and it is now covered with broomsedge and briers.

Poor farming methods and soil erosion have also caused some damage to the better, nearly level to gently sloping cropland. Recognizing the need for help with their soil erosion problems, the farmers voted in 1946 to form the Owen County Soil Conservation District. The District, with the aid of the U.S. Soil Conservation Service and other agencies, gives technical assistance to the farmers about problems of soil and water conservation.

Since the organization of the Owen County Soil Conservation District, several thousand acres have been protected from further excessive erosion. Each year, conservation practices are applied on a large additional acreage. Through the technical assistance of the District, several thousand acres of forest has been protected.

The size of the farms had increased from 60 to 80 acres in the late 1800's and then to an average size of 142.2 acres in 1959. There are some specialized farms in Owen County, but most of them are predominantly general farms. In 1959 about 57 percent of the farmers worked away from their farms for additional income.

At the time of this survey, it was estimated by a committee studying conservation needs that the use of farmland in Owen County was as follows: 94,705 acres of cropland, 19,938 acres of pasture, 100,598 acres of forest, and 25,919 acres of other land, such as idle land and homesteads. It was also estimated that 82 percent of the cropland needs some treatment to protect the soils—either erosion control or drainage. Approximately 75 percent of the pasture needs treatment, and 77 percent of the land used for forest needs some type of protection or treatment.

The number of farms in the county dropped from 1,493 in 1950 to 1,098 in 1959. The average size of farms and the average value per acre, however, have increased. During the same period, the proportionate amount of farm income derived from the sale of field crops has decreased, and that derived from the sale of livestock and livestock products has increased. The proportionate amount of farm income derived from the sale of forest products has also increased.

How Soils Are Mapped and Classified

Soil scientists made this survey to learn what kinds of soil are in Owen County, where they are located, and how they can be used. They 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 steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; 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 roots of plants.

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. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

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. Bloomfield and Martinsville, for example, are the names of two soil series. All the soils in the United States having the same series names are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soil by man.

A soil series contains soils that are alike except for the texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Martinsville loam and Martinsville silt loam are two soil types in the Martinsville series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management—in Owen County, primarily slope or degree of erosion. For example, Bloomfield loamy fine sand, 6 to 12 percent slopes, is one of several phases of Bloomfield loamy fine sand, a soil type that ranges from nearly level to steep.

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 woodland, buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The soil map in the back of this report 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 management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. 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 type or soil phase.

Occasionally it may be better to show two or more similar taxonomic units, which do not occur in regular geographic association, as one mapping unit. Such groups are called an undifferentiated mapping unit. Such mapping units are named in terms of their constitutent taxonomic units, and the names of the units are connected by the word "and." In Owen County the differences between the steep phases of some soil types of similar series were not so important that they outweighed the other soil characteristics in terms of the objective of the survey. As a specific example, Wellston silt loam, 25 to 35 percent slopes, and Muskingum stony silt loam, 25 to 35 percent slopes, are combined as one cartographic unit and called Wellston and Muskingum soils, 25 to 35 percent slopes. Also, on most soil maps, areas are shown that are so rocky, so shallow, or so frequently worked by wind and water that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Gullied land or Riverwash, and are called land types rather than soils. In this report, spot symbols are used on the soil map to designate small areas of wet, sandy, severely eroded, or gullied soils.

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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 a way that it is readily useful to different groups of readers, among them farmers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. Based on the yield and practice tables and other data, the soil scientists set up trial groups, and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists 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

After study of the soils in a locality and the way they are arranged, it is possible to make a general map that shows several main patterns of soils, called soil associations. Such a map is the colored general soil map in the back of this report. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic although not strictly uniform.

The soils within any one association are likely to differ from each other in some or in many properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general soil map shows, not the kind of soil at any particular place, but several different patterns of soils. Each pattern, furthermore, contains several kinds of soils.

Each soil association is named for the major soil series in it, but as already noted, soils of other series may also be present. The major soils of one soil association may also be present in another association, but in a different pattern.

The general map showing patterns of soils is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

1. Genesee-Eel and Stendal-Pope Associations

Nearly level, silty soils of the flood plains and terraces

These associations consist mainly of nearly level soils of first bottoms, and of minor areas of soils on stream terraces. They occupy nearly 54 square miles.

About 55 percent of the acreage consists of neutral soils of bottom lands along the Eel River, the West Fork of the White River, and other smaller streams. Well drained Genesee soils are predominant, but there are smaller areas of moderately well drained Eel soils and of imperfectly drained Shoals soils.

About 35 percent of the acreage consists of acid soils of the bottom lands. These soils are on the flood plains of Lick Creek, Fish Creek, and other small streams that drain uplands underlain by sandstone and Illinoian till. Imperfectly drained Stendal soils are dominant in those areas, but there are smaller areas of well drained Pope soils, poorly drained Atkins soils, and moderately well drained Philo soils.

On terraces along the Eel River and the West Fork of the White River in these associations are soils that have a calcareous substratum and that are underlain by stratified, calcareous sand or gravel. These soils have a loamy surface layer. They are the well-drained, brown Martinsville and Ockley soils; small areas of excessively drained, dark-brown Nineveh soils; and imperfectly drained Whitaker soils. Other soils on terraces are underlain by stratified, calcareous silty clay and clay. These are the well-drained Markland soils, the imperfectly drained McGary soils, and the poorly drained Zipp and Montgomery soils.

Still other soils on terraces along the Eel River and other small streams are acid soils that developed in stratified silt and some clay. The nearly level, imperfectly drained Bartle soils are predominant. They are mixed with small areas of poorly drained Vincennes soils.

The soils in these associations are mainly nearly level and are used primarily for cultivated crops. Even the bottom lands that are frequently flooded are used primarily for row crops, although overflow during the growing season occasionally destroys a crop. Some areas that are small and irregular and some that are extremely wet or frequently flooded are not practical to cultivate. Other small areas of flood plains that are not subject to frequent overflow are used in a cropping system that includes winter grain or hay crops. The cropping system used for the nearly level soils of stream terraces is one in which meadow crops and small grains are rotated. The major problem in managing the soils of first bottoms is flooding; that on the imperfectly drained and poorly drained soils is drainage; and that on the excessively drained soils is droughtiness.

2. Dubois-Otwell Association

Nearly level to very steep, silty soils on old lake sediments

Nearly level to very steep, acid soils underlain by lake-laid material are dominant in this soil association. The association occupies approximately 30 square miles. About 40 percent of it consists of nearly level, imperfectly drained, gray Dubois silt loams, and about 45 percent, of moderately steep to very steep, well-drained, dark grayish-brown Otwell silt loams.

Minor soils of old lakebeds are poorly drained Robinson and moderately well drained Haubstadt soils. These make up about 10 percent of the association. The rest of the association consists of soils on narrow bottom lands and of other minor soils.

The soils of this association developed in loess over lacustrine deposits of stratified silt, silty clay loam, clay, and some fine sand. The soils are generally leached free of carbonates to a depth of 10 feet or more. A pan layer at a depth of 16 to 30 inches slows the movement of water through the soil profile.

Most of the nearly level to moderately steep areas are cultivated. Drainage is the main problem in the nearly level to gently sloping areas, and erosion is the major hazard in the sloping to moderately steep areas used for crops. The soils of this association are moderately productive and are well suited to most of the crops grown in the county. Nearly all of the acreage of steep or very steep Otwell soils is in timber. The Otwell soils support trees of excellent quality and are considered among the best soils for forests.

3. Negley-Parke Association

Nearly level to very steep, silty soils on glacial outwash

This soil association is made up mainly of nearly level to very steep soils that are underlain by glacial outwash. It occupies about 35 square miles. Approximately 65 percent of the association consists of steep or very steep, excessively drained Negley soils. Gently sloping to moderately steep, well-drained Parke soils make up about 25 percent.

The rest of this association consists of nearly level to gently sloping, well-drained Pike soils; of small areas of nearly level, imperfectly drained Taggart soils; and of other minor soils. The soils on narrow bottom lands within the association are medium acid or slightly acid. They are made up of imperfectly drained Shoals, moderately well drained Eel, and well drained Genesee soils. There are also minor areas of Bloomfield and Princeton soils, which are mainly on the ridges adjacent to the White River, near Spencer.

The soils of this association formed in a mantle of loess underlain by gravelly and sandy outwash. The loess ranges from a few inches to 50 inches or more in thickness. The soils are strongly acid and are deeply leached. In most of the nearly level to steep areas, the texture of the surface layer is silt loam, but in the very steep soils it is loam.

The nearly level to moderately steep soils, which account for 20 to 30 percent of the association, are cultivated or in pasture. They are considered among the best soils for agriculture in the county. The main problem that limits their use is susceptibility to erosion. If they are not properly managed, the more rolling areas are subject to severe accelerated erosion. In some places gullies develop and cut rapidly into the fragile substratum. These nearly level to moderately steep soils are suited to all of the crops commonly grown in the county, and they are especially well suited to fruit trees and alfalfa.

Very steep soils that have not been cleared make up about 70 to 80 percent of the association. Trees of excellent quality grow on them, and the areas are considered to be among the best for forests. Several thousand acres of this association have been abandoned because of erosion, and those areas are reverting to forest.

4. Cincinnati-Vigo Association

Nearly level to very steep, silty soils on glacial till

This association consists mainly of nearly level to very steep soils on Illinoian till. It occupies approximately 130 square miles. About 60 percent of the association is made up of gently sloping to very steep, well-drained Cincinnati and Hickory soils, which are in large areas throughout the glaciated parts of the county. Nearly level to gently sloping, imperfectly drained Vigo soils make up about 15 percent. The largest area of Vigo soils is in the southwestern part of the county, but there are smaller areas throughout the till plain.

About 15 percent of the association consists of gently sloping Ava soils, which occur in small areas throughout the till plain. The rest of the association is made up largely of small areas of soils on stream terraces and on narrow flood plains. It also includes small areas of soils on sandstone and outwash.

The soils of this association developed in loess over Illinoian till. They are generally leached free of carbonates to a depth of 10 feet or more. The texture of the surface layer is silt loam.

Most of the nearly level to moderately steep soils are cultivated. The main problem in the nearly level areas is drainage. A pan at a depth of 18 to 24 inches slows the movement of water through the profile. On the gently sloping to moderately steep areas that are used for cultivated crops, erosion is the major hazard. Most of the steep or very steep soils are now producing a good growth of high-quality timber.

The larger cultivated areas in this association are mainly in the southwestern part of the county. The smaller cultivated areas in other parts of the county consist mainly of nearly level to moderately steep ridgetops that are generally adjacent to steeper areas in forest or pasture. Several thousand acres of sloping to moderately steep soils could be developed into good pasture. Several thousand acres of this association have been abandoned and are reverting to forest.

5. Zanesville-Muskingum Association

Nearly level to very steep, silty soils on sandstone and shale

In this soil association are mainly nearly level to very steep soils that were formed in material weathered from sandstone. This association occupies about 82 square miles. About 35 percent of the association consists of well-drained Zanesville soils. Shallow, well-drained Muskingum soils that are steep or very steep make up about 15 percent. In places there are numerous outcrops of bedrock and some fragments of loose rock on the surface of the Muskingum soils.

Well-drained, moderately deep Wellston soils, which are moderately steep or steep, occupy about 15 percent of the association. In some places the steep or very steep slopes are occupied by Wellston and Muskingum soils. On some of the ridgetops are nearly level to gently sloping, imperfectly drained Johnsburg and moderately well drained Tilsit soils. Other minor soils of this association are soils that developed on till in the valley fills and on isolated deposits of till, soils on terraces along streams, soils on narrow bottom lands, and soils formed on outwash.

In the southeastern part of the county are a few areas of well-drained Bewleyville silt loams that developed in material from limestone. The areas of Bewleyville soils are intermixed with those soils formed in material from sandstone. The Bewleyville soils are generally on the lower slopes, and the upper slopes are occupied by the soils formed in material from sandstone. The Bewleyville soils are generally sloping to moderately steep and have occasional sinkholes. Well-drained Princeton fine sandy loams and excessively drained Bloomfield loamy fine sands, which developed on windblown deposits, are in areas east of Freedom.

The sandstone soils of this association were formed in loess over material weathered from sandstone and a small amount of shale. The depth over bedrock ranges from less than 18 inches in the Muskingum soils to 8 to 10 feet in the Zanesville soils. The Bewleyville soils developed in 18 to 48 inches of loess over limestone residuum. Depth over bedrock is 3 to 8 feet.

Most of the soils of this association are not suited to intensive cultivation, because they are too steep and shallow. Most of the areas that are cultivated are on ridgetops or in small areas on the bottom lands of streams. Some of the narrow ridges in the steep areas, however, are impractical to cultivate. The acreage of the nearly level to gently sloping soils is small. On most of the nearly level soils, there is a drainage problem. Erosion is the major hazard on the gently sloping to moderately steep soils that are cultivated, abandoned, or used for pasture.

Nearly all of the steep and very steep areas are in forest. Several thousand acres of soils in this association have been abandoned and are reverting naturally to trees. These areas have been purchased by the State for reforestation. Also, several thousand acres of this association could be developed into good pasture.

6. Grayford Association

Nearly level to steep, silty soils on limestone

The topography of this association is mainly gently undulating to steep, and there are numerous sinkholes throughout. This association occupies about 49 square miles. About 60 percent of the association is made up of Grayford soils.

The Grayford soils are well drained and are brown to reddish brown. They are in the limestone sinkhole area in the eastern part of the county. The Grayford soils developed in loess underlain by weathered till over material weathered from limestone. Limestone bedrock is generally at a depth of 3 to 8 feet.

In the areas of valley fill and in other isolated areas where the depth of loess and till is 10 feet or more, the well drained Cincinnati, the moderately well drained Ava, and the imperfectly drained Vigo soils were developed. Some areas of Negley and Parke soils formed in outwash along the breaks of the main drainageways. The shallow Corydon soils developed in some of the steep and very steep areas. The soils of the narrow bottom lands that intersect the association are mainly medium acid.

About 60 to 70 percent of this association is used for crops and pasture, and the rest is forested. The gently rolling to rolling soils are cultivated. These soils are considered to be among the best agricultural soils in the county. They are well suited to all of the crops commonly grown in the county.

Erosion is the main hazard on these soils. The numerous sinkholes make mechanical practices to control erosion impractical, and vegetative or cultural methods are often necessary. The steep and very steep areas are in trees.

Use and Management of the Soils[2]

In the following pages the use and management of the soils are described. The system of capability classification used by the Soil Conservation Service is explained. Then, different levels of management that apply to all of the soils are discussed. After that, management of groups of soils, the capability units, is described, management of pasture and hay crops is discussed, and information about crop yields is given. This is followed by a discussion of management of the soils for woodland, for wildlife, and for engineering.

Capability Groups of Soils

The capability classification is a grouping that shows, in a general way, how suitable soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes, there can be as many as four subclasses. The subclass is indicated 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* means that water in or on the soil will interfere 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 country, indicates that the chief limitation is a climate that is too cold or too dry.

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

Within the subclasses are the capability units, groups of soils 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 identified by numbers assigned locally, for example, IIe–1 or IIIe–5.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and units in this county, are described in the list that follows.

Class I. Soils that have few limitations that restrict their use.

- Unit I–1.—Deep, nearly level, well-drained soils of the uplands and terraces.
- Unit I–2.—Deep, nearly level, well-drained soils of the bottom lands.

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

- Subclass IIe. Soils subject to moderate erosion if they are not protected.
  - Unit IIe–1.—Deep, well-drained, gently sloping soils of the uplands and terraces.
  - Unit IIe–5.—Very deep, well-drained, gently sloping, sandy soils of the uplands.
  - Unit IIe–7.—Moderately deep, moderately well drained and well drained, gently sloping soils that have a somewhat limiting layer in the subsoil.
- Subclass IIw. Soils that have moderate limitations because of excess water.
  - Unit IIw–2.—Moderately deep and deep soils of the uplands and terraces.
  - Unit IIw–7.—Deep, imperfectly drained and moderately well drained soils of the bottom lands that are subject to overflow.
  - Unit IIw–10.—Moderately deep or deep, very poorly drained organic soils.
- Subclass IIs. Soils that have moderate limitations of moisture capacity or tilth.
  - Unit IIs–1.—Moderately deep, somewhat excessively drained, nearly level soils of the terraces.
  - Unit IIs–5.—Moderately deep soils of the uplands and terraces that have a somewhat limiting layer in the subsoil.

[2] By MITCHELL HASSLER and HAROLD SCHOLL, Soil Conservation Service.

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

Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.

Unit IIIe-1.—Deep, well-drained, gently sloping or sloping soils of the uplands and terraces that are slightly to severely eroded and are underlain by limestone or outwash.

Unit IIIe-5.—Very deep, well-drained, sloping, sandy soils of the uplands.

Unit IIIe-7.—Moderately deep and deep, moderately well drained and well drained, gently sloping and sloping soils of the terraces and uplands that have a moderately developed fragipan.

Subclass IIIw. Soils that have severe limitations because of excess water.

Unit IIIw-2.—Deep, very poorly drained, dark soils in depressions.

Unit IIIw-3.—Moderately deep and deep, imperfectly drained soils of the uplands and terraces.

Unit IIIw-5.—Moderately deep, poorly drained soil of the terraces that has a somewhat impermeable layer in the subsoil.

Unit IIIw-6.—Moderately deep, imperfectly drained soils of the terraces that have a subsoil of silty clay.

Unit IIIw-7.—Moderately deep and deep soils of the uplands and terraces that have a somewhat limiting layer in the subsoil.

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

Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.

Unit IVe-1.—Deep, well-drained, sloping to moderately steep soils of the uplands and terraces that are slightly to severely eroded and are underlain by limestone or outwash.

Unit IVe-5.—Very deep, well-drained, moderately steep, sandy soils of the uplands.

Unit IVe-7.—Moderately deep, well-drained, sloping to moderately steep soils of the uplands and terraces.

Unit IVe-8.—Moderately deep, well-drained, sloping soils of the uplands that are slightly to moderately eroded and are underlain by sandstone and shale.

Unit IVe-9.—Very deep, somewhat excessively drained, sloping, loose, sandy soils of the uplands.

Class V. Soils not likely to erode that have other limitations, impractical to remove, that limit their use largely to pasture, woodland, or wildlife food and cover.

Subclass Vw. Soils too wet for cultivation; drainage or protection not feasible.

Unit Vw-1.—Poorly drained, gray soils of the bottom lands that are subject to overflow.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture, woodland, or wildlife food and cover.

Subclass VIe. Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.

Unit VIe-1.—Shallow to deep, well-drained, sloping to steep soils of the uplands and terraces.

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

Subclass VIIe. Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.

Unit VIIe-1.—Moderately steep to very steep soils of the uplands and terraces.

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

Subclass VIIIs. Rock or soil material that has little potential for production of vegetation.

Unit VIIIs-1.—Quarries, Gravel pits, and areas of Riverwash that are not suited to production of vegetation.

Management by capability units

The soils of Owen County have been placed in practical groups called capability units. Except for slight differences, the soils in one unit have essentially the same limitations, need about the same kind of management, and respond to management in about the same way.

In each unit the characteristics of the soils are described, the suitability of the soils for crops is discussed, and some suggestions are given for their management. The cropping systems and management levels mentioned are given only as examples. Other cropping systems and levels of management are suitable.

A local technician of the Soil Conservation Service or Extension Service can help select a cropping system and level of management suitable for a specific farm. The cropping system to be used will depend partly upon the principal farm enterprise. It will also depend on the combination of practices that can be used with the cropping system to protect the soils from erosion and to maintain good soil structure, the supply of plant nutrients, and the content of organic matter. The following are some of the practices used under a high and under a medium level of management.[3]

High level of management.—Under a high level of management, a cropping system should be chosen that keeps erosion to a minimum. The cropping system should also help maintain favorable soil tilth and a good supply of organic matter in the soil. Keep the pH between 6.2 and 7.0, except where deficiencies in manganese and boron indicate a need for a different pH. Maintain more than 180 pounds of available phosphate (P_2O_5) and more than 250 pounds of available potash (K_2O), per acre annually. Add nitrogen (N) in amounts indicated as the result of soil tests made at the experiment station and according to the need for a maximum yield.

Plow under crop residues, or use them as a mulch for winter cover. Keep tillage to a minimum, do not plow in fall, and plow at the proper time in spring. Do not plow when the soils are wet.

[3] SOIL CONSERVATION SERVICE and PURDUE AGRONOMY DEPARTMENT. LEVELS OF MANAGEMENT BY SOIL TYPES AFFECTING CROP YIELDS—INDIANA. 3 pp. April 16, 1957. [Mimeographed.]

Use recommended crop varieties for planting. Control weeds and insects by tilling and spraying according to recommendations of the experiment station.

Provide drainage by installing tile, open ditches, or surface drains. Growing deep-rooted legumes will help drain soils that have a fine-textured subsoil. Use irrigation where the soils have less than 3 inches of water available in the root zone.

Medium level of management.—Under a medium level of management, a recommended cropping system that helps maintain good tilth and the content of organic matter is used. The pH is kept between 5.7 and 6.2. Maintain 75 to 180 pounds of available phosphate (P_2O_5) and 150 to 250 pounds of available potash (K_2O) per acre annually. Nitrogen is added, but not in amounts needed for a maximum yield.

Under a medium level of management, part of the crop residues are removed or not used to the fullest extent for winter cover. Conventional methods of tillage are used.

The highest yielding varieties for the particular location and soil are not always used. Weeds are moderately well controlled by tillage or spraying. Spraying for insect control is not generally practical. Wet areas are sufficiently drained for cropping, but in some places yields are somewhat restricted by wetness. In addition, the soils are not irrigated.

CAPABILITY UNIT I-1

In this capability unit are deep, brown to yellowish-brown, nearly level soils of uplands and terraces. The soils are well drained and are medium textured. They are moderate in permeability and good to high in moisture-supplying capacity. There is little runoff. The soils in this unit are—

Grayford silt loam, 0 to 2 percent slopes.
Martinsville silt loam, 0 to 2 percent slopes.
Martinsville loam, 0 to 2 percent slopes.
Ockley silt loam, 0 to 2 percent slopes.
Ockley loam, 0 to 2 percent slopes.
Pike silt loam, 0 to 2 percent slopes.

These soils generally occur in fairly small areas and are managed like the adjoining soils. Some of the tracts, however, are large enough to be managed separately.

These soils are well suited to all the grains and legume-grass mixtures that are adapted to this climate, and they are generally used for those crops. A 3-year rotation of 2 years of a row crop and 1 year of a small grain and a grass-legume intercrop can be used under a medium level of management; or a rotation of 3 years of a row crop and 1 year of a small grain and a grass-legume intercrop; or row crops grown year after year can be used under a high level of management.

These soils are generally acid, low in nitrogen and phosphate, and medium in potash; however, response is very good to lime and fertilizer. The greatest need is to maintain the supply of plant nutrients and to improve the soil structure. Minimum tillage can be practiced, and cover crops are well suited.

Tiling is not needed on these soils, except as an outlet for tile mains from adjoining soils. Diversions can be constructed on the associated sloping soils to help reduce runoff that flows onto these soils. These soils are suitable for irrigation, but it may not be economically justified except for crops of high value.

If the soils are used as grassland, a mixture of alfalfa, orchardgrass, and ladino clover is good. Bromegrass or timothy can be used instead of orchardgrass. Bluegrass and tall fescue make good sod crops, too, but they need nitrogen for highest yields.

The soils of this unit are good for forest. The areas in trees generally contain good species of hardwoods, such as walnut, white oak, and poplar. Most of the larger areas have been cleared and are cultivated, but there are some areas in timber that need protection and management.

Crop residues and grassy strips provide food, cover, and nesting areas for birds and small animals.

CAPABILITY UNIT I-2

Deep, nearly level, well-drained, medium-textured, brown to yellowish-brown soils of the first bottoms make up this unit. These moderately permeable soils have a high or very high moisture-supplying capacity. They range from strongly acid to neutral. Their parent material was alluvium washed from the uplands. These soils overflow occasionally to frequently. They are easy to work, are highly productive, and can be cropped intensively. The soils in this unit are—

Genesee loam.
Genesee silt loam.
Landes fine sandy loam.
Pope loam.
Pope silt loam.

The soils of this unit are well suited to cultivated crops, and they are generally used for them. Corn and soybeans are the most important cash crops. In narrow areas along streams, these soils are probably best suited to grass or trees.

These productive soils are well suited to intensive use for row crops. In areas subject to only occasional overflow, sweetclover and ryegrass are grown once every 3 or 4 years to improve the soils. In some places rye or ryegrass is seeded when the row crop is cultivated the last time, and it serves as a cover crop or green-manure crop. It needs to be more widely used. Some winter wheat is also grown.

Generally, these soils are low in nitrogen, medium to high in phosphate, and low to medium in potash. They normally hold moisture well, and they respond well to fertilizer. The lower soil layers also hold a reserve of plant food available to deep-rooted plants. As a rule, the Genesee soils have an adequate supply of lime, but the Pope soils are low in lime.

Minimum tillage should be used on the soils of this group. It is important to establish alta fescue or other sod in overflow channels or along bare streambanks that are subject to scouring. Random tile lines are also needed in many places to drain low spots and seeps in adjoining soils. Diversions are needed in some places where water flows from higher areas.

These soils respond well to irrigation. During droughty periods the cost of irrigation can be justified in areas where crops of high value are grown. Occasional overflow, however, may present a hazard to the irrigation system.

Where the soils are used as grassland, some alfalfa is grown for hay and silage. Areas of bottom lands along the White River that are badly infested with johnsongrass are pastured. Control of johnsongrass requires intensive grazing for several years, intensive cultivation, or spot treatment with chemicals.

The kinds of trees that generally grow on these soils are cottonwood, birch, sycamore, and soft maple. Although timber grows rapidly here, clearing for cropland is generally a good practice and has been done. It is important to leave the trees along the streams and sloughs, however, to help prevent channel and bank cutting. If streamsbanks are bare, low-growing willows and cottonwood are the best trees to plant. Wildlife will benefit if a cover of woody plants or grass is kept along the streams and in the sloughs.

CAPABILITY UNIT IIe-1

In this group are deep, well-drained, gently sloping, medium-textured soils of the uplands and terraces. Their surface layer is brown to dark brown, and their subsoil is reddish brown. These soils are moderate in permeability and good to high in moisture-supplying capacity. Runoff is slow to medium. Some areas of the Grayford and Bewleyville soils contain many sinkholes, which make the topography somewhat complex. Erosion is slight to moderate. The soils in this unit are—

- Bewleyville silt loam, 2 to 6 percent slopes, moderately eroded.
- Grayford silt loam, 2 to 6 percent slopes.
- Grayford silt loam, 2 to 6 percent slopes, moderately eroded.
- Martinsville loam, 2 to 6 percent slopes, moderately eroded.
- Parke silt loam, 2 to 6 percent slopes.
- Parke silt loam, 2 to 6 percent slopes, moderately eroded.
- Pike silt loam, 2 to 6 percent slopes, moderately eroded.

These soils are well suited to all cultivated and meadow crops adapted to this climate. The intensity of cropping depends upon the combination of practices used to control erosion.

On a slope of 4 percent 150 feet long, a rotation of 1 year of a row crop, 1 year of a small grain, and 3 years of a meadow crop, with grassed waterways, will give adequate erosion control under a medium level of management. A rotation of 2 years of row crops and 1 year of a small grain and a grass-legume intercrop is a suitable cropping system if erosion is controlled by building terraces and diversions and if a high level of management is followed.

These soils need lime and nitrogen; they are generally more deficient in phosphate than in potash. Crops grown on them respond well to lime and fertilizer.

These soils are subject to splash and rill erosion. Gully erosion occurs where runoff concentrates. Grassed waterways are an important part of the water disposal system, and they need to be established before terraces or diversions are built. Farming on the contour, and constructing terraces and diversions are necessary with the more intensive rotations. In areas where there are sinkholes, contouring, terraces, and diversions generally are not practical. In those areas, therefore, practices such as growing more meadow and cover crops and using minimum tillage, need to be used.

Erosion is generally severe if end rows are cultivated up and down the hill. End rows should be replaced by vegetated turn strips (fig. 2).

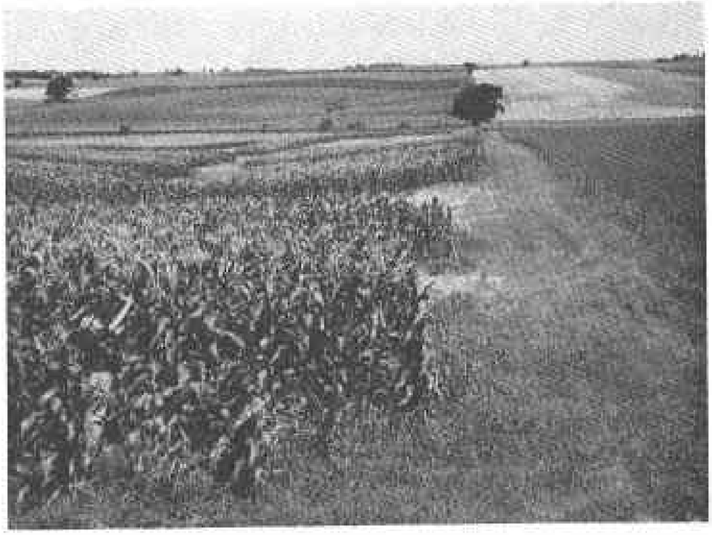

Figure 2.—**Headland in permanent sod to be used as a turn strip and for field access. This also makes a good wildlife border if it is not mowed.**

Where the soils are used as grassland, a mixture of alfalfa, orchardgrass, and ladino clover is good for pasture; alfalfa with either bromegrass, orchardgrass, or timothy makes a good hay mixture. Because their deep subsoil is more porous, Parke, Pike, and Martinsville soils are more conducive to longer lived stands of alfalfa than the other soils in the group.

These soils are good for forest and generally have good species of hardwoods on them, such as tulip-poplar, red and white oak, black walnut, ash, and cherry. Most of the acreage has already been cleared, but the smaller areas that are associated with steeper soils have not. There are practical opportunities to improve cover, travel lanes, and nesting sites for wildlife by establishing waterways, vegetation around sinkholes, and field border strips.

CAPABILITY UNIT IIe-5

Only one soil—Princeton fine sandy loam, 2 to 6 percent slopes—is in this capability unit. It is a very deep, well-drained, brown to dark-brown fine sandy loam of the uplands. The subsoil is brown to yellowish brown. This soil is moderate in permeability and good in moisture-supplying capacity. Gently rolling slopes where infiltration is good allow for slow runoff. Erosion is slight, but some measures for controlling erosion may be needed if the soil is cropped intensively.

This soil is well suited to corn, beans, alfalfa, and small grains. It is especially well suited to truck crops and orchards.

The soil is generally very low in phosphate and medium in potash. In most places there is a moderate need for lime.

The use of cover crops, crop residues, and mulch or minimum tillage helps to control wind and water erosion and provides organic matter. Grain windbreaks are needed to prevent wind erosion where specialty crops are grown. When plowing the field for specialty crops, leave the equivalent of one drill width in grain for every six plowed. Contouring is also needed where it is practical.

This soil is well suited to irrigation. Irrigation may be practical for the high-value specialty crops and orchards.

Some areas may be used as grassland. In those areas this soil is especially well suited to an alfalfa-bromegrass mixture.

This is one of the better soils for producing timber. It should be cleared for crops, however, where poor species of hardwoods grow. Where this soil is kept in timber, manage to favor the better hardwood species, such as black walnut and tulip-poplar. Windbreaks will supply cover and travel lanes for small animals.

CAPABILITY UNIT IIe-7

In this capability unit are moderately deep, gently sloping, moderately well drained and well drained, medium-textured soils of uplands and terraces. Their surface layer is brown to yellowish brown, and their subsoil is yellowish brown. The moderately well drained soils are mottled in the lower part of their subsoil. The soils of this unit are moderate to moderately slow in permeability and good to high in moisture-supplying capacity. They have a weak to moderately developed fragipan. Runoff is slow to medium. Erosion is slight to moderate. The soils in this unit are—

- Ava silt loam, 2 to 6 percent slopes.
- Ava silt loam, 2 to 6 percent slopes, moderately eroded.
- Cincinnati silt loam, 2 to 6 percent slopes.
- Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded.
- Haubstadt silt loam, 2 to 6 percent slopes.
- Haubstadt silt loam, 2 to 6 percent slopes, moderately eroded.
- Otwell silt loam, 2 to 6 percent slopes.
- Otwell silt loam, 2 to 6 percent slopes, moderately eroded.
- Tilsit silt loam, 2 to 6 percent slopes.
- Tilsit silt loam, 2 to 6 percent slopes, moderately eroded.
- Zanesville silt loam, 2 to 6 percent slopes.
- Zanesville silt loam, 2 to 6 percent slopes, moderately eroded.

These soils are well suited to most cultivated crops and meadow crops that are adapted to this climate. Alfalfa is not well suited, because the roots do not penetrate the fragipan and heaving occurs. The intensity of cropping depends upon the combination of practices used to control erosion.

On a slope of 4 percent 150 feet long, a rotation of 1 year of a row crop, 1 year of a small grain, and 3 years of meadow with waterways (fig. 3) will help to control erosion if the stand of meadow is good. Also, the soils are suitable for a rotation of 2 years of a row crop and 1 year of a small grain and a grass-legume intercrop, if erosion is controlled by terraces and diversions and if a high level of management is used.

These soils need lime and nitrogen. They are generally low in phosphate and potash. Response is very good to lime and fertilizer.

These soils are subject to splash and rill erosion, and gully erosion occurs where runoff concentrates. Grassed waterways are needed as a part of the water disposal system. They need to be established before terraces and diversions are built. Farming on the contour and using terraces (fig. 4) and diversions are necessary where the more intensive rotations are used. To prevent erosion, vegetated turn strips should be established, instead of cultivating end rows up and down the hill. Natural drainage is adequate in most places, but some areas of associated soils and drainageways may need random tile lines.

Where these soils are used as grassland, a good pasture mixture consists of orchardgrass or tall fescue and ladino clover. Red clover and orchardgrass or timothy and red clover make a good hay mixture.

Figure 3.—Mowing a grassed waterway.

These are good soils for forest. They generally have desirable kinds of hardwoods, such as tulip-poplar, red and white oak, black walnut, ash, and cherry growing on them. Most of the acreage has already been cleared; however, some small areas that are associated with steeper soils, have not been cleared. Establishing grassed waterways and field border strips improve the cover, travel lanes, and nesting sites for wildlife.

CAPABILITY UNIT IIw-2

In this unit are moderately deep and deep, nearly level, imperfectly drained, medium-textured soils of uplands and terraces. These soils have a gray to light brownish-gray surface layer and a gray, mottled subsoil. They are slowly permeable and have a high or very high moisture-supplying capacity. The major problem in managing them is excess water. The soils in this unit are—

- Ayrshire loam, 0 to 2 percent slopes.
- Bartle silt loam, 0 to 2 percent slopes.
- Taggart silt loam.
- Vincennes silt loam.
- Whitaker silt loam.

These soils are suited to corn, soybeans, small grains, and clover. Sweetclover tolerates the wetness better than alfalfa.

A rotation of 2 years of a row crop and 1 year of a small grain and a grass-legume intercrop is suitable under a medium level of management. A rotation of 3 years of a row crop and 1 year of a small grain and a grass-legume intercrop is suitable under a high level of management.

These soils are very low in nitrogen and low in phosphate and potash. Crops grown on them respond well to lime and fertilizer if drainage is improved.

These soils warm up slowly in spring. Field operations should be delayed when the soils are wet. The soils have weak structure and will puddle and run together. Therefore, it is important to avoid overcultivation and to practice minimum tillage.

Figure 4.—**Aerial view of a terrace system on Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded.**

Erosion is a problem on some of the long slopes. Contouring and rough cultivation, which hold back the water, may aggravate the wetness problem unless the land is adequately tiled. Therefore, cross-slope ditches are suitable because they control erosion and also permit good surface drainage.

Shallow surface drainage may be needed in nearly level areas. In addition, land smoothing is generally needed. It is important to cultivate so that water is directed into the shallow surface drains and into the cross-slope drains.

Tiling the bottom of the surface drains adds much to the convenience in tillage and to the maintenance of surface drains. It prevents puddling and damage from deep tracks made by implements, which are likely in wet years. A complete tile system can be installed for maximum production in extremely wet seasons, but open outlet ditches may need to be improved first. If a complete tile system is installed, the lines should be 50 to 80 feet apart (65 to 100 feet in the Vincennes soil) and at a depth of 36 to 42 inches. Where it is necessary to go 4 feet or deeper for adequate tile outlets, the underlying sand, silt, and gravel may be encountered, and special installation will be necessary. Irrigation is not generally suitable.

If these soils are used as grassland, a mixture of tall fescue and ladino clover is well suited. In undrained areas reed canarygrass is suitable.

Hardwoods such as pin oak, sweetgum, and soft maple generally grow in the wooded areas. The soils can be cleared for cropland, unless the areas are small or are associated with larger areas that are better suited to woodland. Small, odd areas can be developed and field border strips can be used to provide travel lanes and cover for wildlife.

CAPABILITY UNIT IIw-7

In this capability unit are deep, imperfectly drained and moderately well drained, medium-textured, grayish-brown to yellowish-brown soils of the first bottoms. These soils range from strongly acid to neutral. They are flooded occasionally to frequently. Flooding and a high water table are the main problems in managing them. The soils in this unit are—

Eel loam.
Eel silt loam.
Eel silty clay loam.
Philo silt loam.
Shoals loam.
Shoals silt loam.
Shoals silty clay loam.
Stendal silt loam.

These soils are generally best suited to cropland where overflow or lack of drainage is not too severe. Narrow areas along streams, however, are better suited to grass or trees.

A rotation of 2 years of a row crop, 1 year of a small grain, and 1 year of meadow is used by many farmers, but these soils are capable of more intensive use. They can be used for row crops grown year after year under a high level of management.

The Stendal and Philo soils are acid and low in phosphate and potash. The Shoals and Eel soils normally contain adequate lime. All of these soils respond more readily to fertilizer if they are drained.

It is important to establish fescue or other sod crops in overflow channels that are subject to scouring. Field operations are often delayed because of poor drainage; thus, the first need is for improved drainage. Maintain stream outlets, remove brush, and aline and straighten the channels. Use surface and tile drains. If concrete tile are used in the more acid soils of this group, they should be of special quality. Tile outlets are generally available. Tile lines should be spaced 50 to 80 feet apart and at a depth of 36 to 42 inches. Random or parallel surface drains that remove impounded water will increase the efficiency of the tile. Irrigation is not suitable, because of poor drainage and overflow. Construct diversions to keep off water from adjacent, higher areas.

Some areas may be used as grassland. In these places tall fescue and ladino clover are especially well suited.

Some good-quality hardwoods, such as birch, soft maple, ash, tulip-poplar, and walnut grow in wooded areas. Most of the large areas of bottom lands, however, are cleared and cultivated. Trees are generally not planted on these soils, but if planting is desired, see the section "Woodland Uses of Soils" for the kinds of trees to plant. The banks and berms of deep open ditches can be improved for wildlife by seeding to fescue and sericea lespedeza.

CAPABILITY UNIT IIw-10

Muck is the only soil in this capability unit. It is a moderately deep or deep, very poorly drained, black organic soil. The organic material is 12 to 42 inches thick and overlies loam to coarse clay loam mineral material. The major problem in managing this soil is excess water.

Muck is ideally suited to corn if it is well drained, and vegetable crops are well suited. Small grains are best suited as a cover crop or a green-manure crop. Ordinarily they would not be used for pasture, except where this soil has not been drained. Row crops can be grown year after year.

Muck is naturally low in phosphate and potash, and therefore, the response is good where phosphate and potash are applied. Lime is not generally needed for growing corn. Nitrogen is not needed where the organic layer is deep and the soil is well drained.

A cover should be left over winter to help prevent wind erosion. This soil needs tile or open-ditch drainage. Open ditches ought to be installed 3 to 5 years before tiling. The ditches should be spaced at 200-feet intervals at a depth of 3 feet. Tile lines run laterally should be spaced 65 to 100 feet apart at a depth of 36 to 42 inches. The tile ought to be laid in the mineral subsoil, and each should be 18 to 24 inches long. Pumping may be required where gravity outlets are not available. Controlled drainage is normally practical and worth its cost. Use diversions to keep off runoff from adjacent uplands.

CAPABILITY UNIT IIs-1

The only soil in this unit is Nineveh loam. It is dark brown and is moderately deep, somewhat excessively drained, and medium textured. It is nearly level and is on terraces. This soil is underlain by loose, calcareous gravel and sand at a depth of 24 to 42 inches. It is moderately permeable and has only fair moisture-supplying capacity. There is little runoff. The main problem in managing it is droughtiness.

Under a medium level of management, a rotation of 2 years of a row crop, 1 year of a small grain, and 1 year of meadow will maintain good soil structure and tilth. Under a high level of management, 2 years of a row crop and 1 year of a small grain and a grass-legume intercrop is adequate. Where either rotation is used, high yields may be limited by drought. It is important to regulate the amount of fertilizer for expected moderate yields because the limiting factor is the lack of moisture. High yields can be obtained by using irrigation if the soils are fertilized properly. This is an excellent soil for alfalfa. Over a period of years, higher returns may be reasonably expected from alfalfa than from row crops.

CAPABILITY UNIT IIs-5

In this capability unit are moderately deep, well drained and moderately well drained, nearly level soils of uplands and terraces. The soils are medium textured and are brown to yellowish brown. They are moderately slow in permeability and good in moisture-supplying capacity. There is little runoff. These soils have a moderately developed fragipan, which restricts somewhat the penetration of moisture and roots. The soils in this unit are—

- Ava silt loam, 0 to 2 percent slopes.
- Haubstadt silt loam, 0 to 2 percent slopes.
- Otwell silt loam, 0 to 2 percent slopes.
- Tilsit silt loam, 0 to 2 percent slopes.

These soils generally occur in fairly small areas, but some areas are large enough to be managed separately. The soils are well suited to all of the crops grown locally, except alfalfa. Alfalfa is not well suited, because of the heaving caused by the fragipan. Under a medium level of management, 2 years of row crops, 1 year of a small grain, and 1 year of meadow is suitable. Under a high level of management, 2 years of a row crop and 1 year of a small grain and a grass-legume intercrop is suitable.

Unless they have been limed, these soils are generally acid. They are low in nitrogen and phosphate and medium in potash. Crops grown on them respond to lime and fertilizer. The greatest need is the maintenance and improvement of fertility and soil structure. Minimum tillage should be practiced, and cover crops should be used. Where these soils are used as grassland, a mixture of orchardgrass and ladino clover is good, but bromegrass or timothy can be grown instead of orchardgrass.

These soils are good for forests. The wooded areas generally contain good species of hardwoods, such as walnut, white oak, and poplar. Most of the larger areas of these soils have been cleared and are cultivated; however, there are some areas in timber that need good management and protection from fire and grazing. Crop residues and grassy strips provide food, cover, and nesting areas for birds and small animals.

CAPABILITY UNIT IIIe-1

The soils in this capability unit are deep, well drained, medium textured, and gently sloping or sloping. Their surface layer is brown to dark brown, and their subsoil is reddish brown. These soils are on uplands and terraces and are underlain by limestone or outwash. They are moderate in permeability and good in moisture-supplying capacity. Runoff is medium to rapid. The relief consists of rolling complex slopes, which border the numerous sinkholes, and of some fairly smooth rolling slopes. Erosion is mostly slight to moderate, but some minor areas of gently rolling, severely eroded soils are included. The major problem in managing these soils is erosion. The soils in this unit are—

- Bewleyville silt loam, 6 to 12 percent slopes, moderately eroded.
- Grayford soils, 2 to 6 percent slopes, severely eroded.
- Grayford silt loam, 6 to 12 percent slopes.
- Grayford silt loam, 6 to 12 percent slopes, moderately eroded.
- Parke silt loam, 6 to 12 percent slopes.
- Parke silt loam, 6 to 12 percent slopes, moderately eroded.
- Parke soils, 2 to 6 percent slopes, severely eroded.

These soils are suited to cultivated crops, small grains, and meadows. They are especially good for alfalfa and orchardgrass. The intensity of cropping depends upon the combination of practices applied to control erosion.

On a slope of 8 percent, 150 feet long, a rotation of 1 year of a row crop, 1 year of a small grain, and 4 years of meadow with waterways (fig. 5) is suitable. Under a high level of management, a rotation of 2 years of a row crop, 1 year of a small grain, and 1 year of meadow with terraces is suitable.

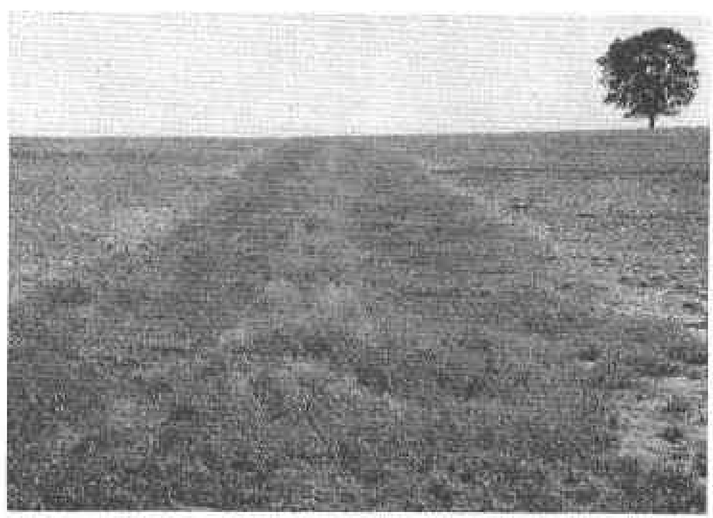

Figure 5.—**A waterway of alta fescue on Grayford silt loam. It drains 20 acres and has a slope of 3 to 6 percent.**

These soils are low in nitrogen and phosphate and medium in potash. Response is very good to lime and fertilizer. About half the acreage of the Grayford soils has many shallow, dry sinkholes, and in most places the slope is too irregular for contouring or constructing terraces to control erosion. Use practices, such as growing more meadow crops in the cropping system, growing cover crops, and using minimum tillage, to control erosion. Leave the associated sharp breaks in sod. Vegetated turn strips should replace end rows that are cultivated up and down the hill. On the rest of the soils, mechanical practices are suitable and are needed. Grassed waterways and diversions for water disposal and erosion control are needed.

Some areas are used as grassland. In these places alfalfa, clover, and such common grasses as orchardgrass, bromegrass, timothy, and tall fescue are suited to these soils.

These soils are good for forest. Good species of hardwoods, such as tulip-poplar, black walnut, and white and red oak grow in the wooded areas. If the tree cover is good enough to keep the areas wooded, improve the woodland and protect it from fire and grazing; otherwise, clear for crops or pasture. Developing grassed waterways and growing vegetation in the sinkholes and field border strips improve the cover for wildlife and provide travel lanes and nesting protection.

CAPABILITY UNIT IIIe-5

This capability unit consists of very deep, well-drained, brown to dark-brown fine sandy loams of the uplands. These soils have a brown to yellowish-brown subsoil. They are moderately permeable and have good moisture-supplying capacity. The somewhat complex, fairly short, rolling slopes allow for moderate runoff. Erosion is slight to moderate. Erosion is a moderate problem if these soils are cultivated. The soils in this unit are—

Princeton fine sandy loam, 6 to 12 percent slopes.
Princeton fine sandy loam, 6 to 12 percent slopes, moderately eroded.

These soils are well suited to corn, beans, alfalfa, and small grains. Vegetables, melons, apples, and peaches are also suitable. The use and management of these soils is similar to that of group IIe-5, but the hazard of erosion is greater on these soils and makes additional treatment necessary. These soils need fertilizer. There is a moderate need for lime, and the soils are generally very low in phosphate and medium in potash.

The use of cover crops, crop residues, and mulch or medium tillage helps control wind and water erosion and provides organic matter. Grain windbreaks, which help prevent wind erosion, are needed if specialty crops are grown. When plowing the field for specialty crops, leave the equivalent of one drill width in grain for every six plowed. Contour farming is also needed where it is practical. These soils are well suited to irrigation, which may be practical for the high-value specialty crops and orchards.

Where these soils are used as grassland, they are especially well suited to an alfalfa-bromegrass mixture. Topdress with phosphate and potash after the first cutting, using a mixture high in potash.

These are among the better soils for timber. In areas where poor-quality hardwoods grow, clear for cropland. In areas kept in timber, management should favor the better species of hardwoods, such as black walnut, tulip-poplar, and white oak. Windbreaks will provide cover and travel lanes for small animals.

CAPABILITY UNIT IIIe-7

In this capability unit are moderately deep and deep, moderately well drained and well drained, gently sloping and sloping, medium-textured soils of the uplands and terraces. The surface layer is brown to yellowish brown, and the subsoil is yellowish brown. The moderately well drained soils are mottled in the lower part of the subsoil. The soils of this unit are moderate to moderately slow in permeability and good in moisture-supplying capacity. They have a moderately developed fragipan. Runoff is medium to rapid. Most of the soils are slightly to moderately eroded, but a few are severely eroded. The major problem in managing them is erosion. The soils in this unit are—

Ava soils, 2 to 6 percent slopes, severely eroded.
Ava silt loam, 6 to 12 percent slopes.
Ava silt loam, 6 to 12 percent slopes, moderately eroded.
Cincinnati soils, 2 to 6 percent slopes, severely eroded.
Cincinnati silt loam, 6 to 12 percent slopes.
Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded.
Haubstadt soils, 2 to 6 percent slopes, severely eroded.
Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded.
Markland silt loam, 2 to 6 percent slopes, moderately eroded.
Otwell silt loam, 6 to 12 percent slopes.
Otwell silt loam, 6 to 12 percent slopes, moderately eroded.
Tilsit soils, 2 to 6 percent slopes, severely eroded.
Tilsit silt loam, 6 to 12 percent slopes, moderately eroded.
Zanesville silt loam, 6 to 12 percent slopes.
Zanesville silt loam, 6 to 12 percent slopes, moderately eroded.
Zanesville soils, 2 to 6 percent slopes, severely eroded.

If erosion is controlled, these soils are suitable for a rotation of adapted cultivated crops, small grains, and meadow. It is important to maintain good soil structure so that the soils will absorb water for plants to use and, therefore, reduce erosion.

The intensity of the cropping system depends upon the management practices used to control erosion. On a slope of 8 percent that is 150 feet long, a rotation of 1 year of a row crop, 1 year of a small grain, and 4 years of meadow, with waterways, is suitable. Under a high level of management, a rotation of 2 years of a row crop, 1 year of a small grain, and 1 year of meadow, with terraces, is suitable.

These soils are strongly acid, low in nitrogen and phosphate, and fair in potash. Crops grown on them respond well to lime and fertilizer.

The soils are subject to splash, rill, and gully erosion. Vegetative and cultural practices that control erosion are needed, and contouring, stripcropping, and using terraces and diversions should also be practiced.

Grassed waterways are an important part of the water disposal system. They need to be established before terraces or diversions are constructed. Irrigation is not normally used on these soils. Vegetated turn strips should replace end rows that are cultivated up-and-down the hill.

If these soils are used as grassland, alfalfa, orchardgrass, and ladino clover make a good mixture for pasture. Alfalfa or red clover with bromegrass, orchardgrass, or timothy makes a good mixture for hay. Because of the fragipan, alfalfa is damaged by heaving, but it can be included in the mixture.

These are generally good soils for forest, and such hardwoods as tulip-poplar, black walnut, and white and red oak grow on them. Most of the acreage has been cleared for cultivation, but small areas and areas associated with steeper, wooded soils have not been cleared. Where the cover of trees is good, use improvement practices for woodland and protect the woodland from fire and grazing. Otherwise, clear for cropland or pasture.

Developing grassed waterways and planting field border strips provide cover, travel lanes, and nesting sites for wildlife.

CAPABILITY UNIT IIIw-2

In this unit are deep, very poorly drained, moderately fine textured, very dark gray soils of depressions. The soils are slow or very slow in permeability and have good to high moisture-supplying capacity. The major problems in managing them are excess water and maintaining good tilth. The soils in this unit are—

Montgomery silty clay loam.
Zipp silty clay loam.

If they are drained, these soils are suited to corn, soybeans, clover, timothy, and tall fescue. Use a rotation of 2 years of a row crop, 1 year of a small grain, and 1 year of meadow under a medium level of management. Under a high level of management, a rotation of 3 years of a row crop, 1 year of a small grain, and 1 year of meadow can be used. Tall fescue and ladino clover are suitable for pasture.

These soils are generally low in potash. Crops grown on them respond more readily to fertilizer if the soils are drained.

Plowing in fall is suitable if there is no danger from overwash and scouring. Use minimum tillage. To protect the soil structure, avoid working the soil and trampling by livestock when it is wet. These soils warm up slowly in spring, and field operations may need to be delayed because of wetness.

A well-designed system of surface drainage is needed on these soils. Land smoothing will improve the drainage. If the surface drainage system needs to be supplemented by tile, the tile should be spaced 45 to 65 feet apart, in a system of laterals, and at a depth of 36 to 42 inches. There should be a minimum grade of 0.1 percent for all sizes of tile. Special blinding or a filter of porous material is needed over the tile. Irrigation is not generally suitable for these soils.

The natural woodland vegetation was pin oak, sweetgum, and soft maple. Most of the acreage has been cleared for cultivation. Banks and berms of deep open ditches seeded to fescue and sericea lespedeza provide food and cover for wildlife.

CAPABILITY UNIT IIIw-3

The soils in this management group are moderately deep and deep, imperfectly drained, gently rolling, and medium textured. They are on uplands and terraces. They have a gray to light brownish-gray surface layer and a gray, mottled subsoil. Permeability is slow or very slow, and moisture-supplying capacity is medium to high. The major problems in managing these soils are excess water and erosion. The soils in this unit are—

Dubois silt loam, 2 to 6 percent slopes.
Dubois silt loam, 2 to 6 percent slopes, moderately eroded.
Johnsburg silt loam, 2 to 6 percent slopes.
Johnsburg silt loam, 2 to 6 percent slopes, moderately eroded.
Vigo silt loam, 2 to 6 percent slopes.
Vigo silt loam, 2 to 6 percent slopes, moderately eroded.

These soils are suited to cultivated crops, small grains, clover, and grasses. Alfalfa is not well suited. Sweetclover tolerates the wetness better than alfalfa if the soils are adequately limed.

The intensity of the cropping system depends upon the combination of other practices used to control erosion and to improve drainage. On a slope of 3 percent that is 200 feet long, a rotation of 1 year of a row crop, 1 year of a small grain, and 2 years of meadow will help to control erosion. Under a high level of management, a rotation of 2 years of a row crop and 1 year of a small grain and a grass-legume intercrop is suitable if ditches are constructed across the slope to control erosion.

These soils are generally strongly acid, very low in nitrogen, and low in phosphate and potash. If the soils are drained, crops grown on them respond well to lime and fertilizer.

These soils warm up slowly in the spring; field operations should be delayed if the soils are wet. These soils have weak structure and tend to puddle and run together. Therefore, avoid overcultivation and use minimum tillage.

A well-designed water disposal system is important on these soils. The system may include shallow surface drains, cross-slope drains, diversions, and waterways.

Land smoothing or grading is generally needed. It is important to cultivate so that the water is directed into the shallow surface drains and into the cross-slope drains. Tile in the bottom of the surface drains will add much to the convenience and to the maintenance of the drains by preventing puddling and damage from deep tracks caused by implements, which are likely in wet years. A complete tile system can be installed for maximum production in extremely wet seasons, but open outlet ditches may need to be improved first. If a complete tile system is installed, the laterals should run across the slope at a grade of not more than 0.75 percent, unless special precautions are taken to obtain the closest fit possible. On a grade of more than 2 percent, sealed bell joints, tongue-and-groove joints, or continuous ridge pipe should be used. The laterals are generally 50 to 65 feet apart (50 to 80 feet for the Johnsburg soils) and at a depth of 36 to 42 inches. The minimum grade should be 0.25 percent for 4- and 5-inch tile, 0.20 percent for 6-inch tile, and 0.15 percent for 8-inch tile. Special blinding or a filter of porous material is needed over the tile in these soils. Irrigation is not generally suitable.

If the soils are used as grassland, a mixture of tall fescue and ladino clover is well suited. On undrained areas reed canarygrass is suitable.

Harwoods, such as pin oak, sweetgum, and soft maple, grow in the wooded areas. These areas can be cleared for crops or pasture, unless they are small or are associated with larger areas of other soils that are better suited to trees. Developing small, odd areas and field border strips provides cover, travel lanes, and nesting sites for wildlife.

CAPABILITY UNIT IIIw-5

The only soil in this unit—Robinson silt loam—is moderately deep, poorly drained, nearly level, and medium textured. It is on terraces. It has a light-gray to gray surface layer and a light-gray to gray, mottled subsoil. Permeability is very slow, and moisture-supplying capacity is high. There is a somewhat impermeable layer in the subsoil.

This soil is suited to corn, soybeans, small grains, and clover. Sweetclover tolerates the wetness better than alfalfa. This soil is closely associated with the Dubois soils, and therefore its management is similar to that of the Dubois soils. The drainage problem on this soil, however, is more severe.

A rotation of 2 years of a row crop, 1 year of a small grain, and 1 year of meadow is suitable under a medium level of management. Under a high level of management, a rotation of 2 years of a row crop and 1 year of a small grain and a grass-legume intercrop is suitable.

Robinson silt loam is very low in nitrogen and low in phosphate and potash. There is a good response to lime and fertilizer if drainage is improved.

This soil warms up slowly in spring. Field operations should be delayed if the soil is wet. This soil has weak structure and tends to puddle and run together; therefore, it is important to avoid overcultivation and to practice minimum tillage.

Shallow surface drainage may be needed in nearly level areas. Land smoothing or grading is also generally needed, and it is important to cultivate so that water is directed into the shallow surface drains and into the cross-slope drains. Tile in the bottom of the surface drains will add much to the convenience and to the maintenance of the surface drains by preventing puddling and deep tracks caused by implements, which are likely in wet years. A complete tile system can be installed for maximum production in extremely wet seasons, but open outlet ditches may need to be improved first. If the surface drainage system is supplemented by tile, the tile should be spaced 45 to 65 feet apart, in a system of laterals and at a depth of 36 to 42 inches. There should be a minimum grade of 0.1 percent for all sizes of tile. Special blinding or a filter of porous material is needed over the tile. Irrigation is not generally suitable.

Where this soil is used as grassland, a mixture of tall fescue and ladino clover is well suited. In undrained areas reed canarygrass is suitable.

Hardwoods, such as pin oak, sweetgum, and soft maple, grow in the wooded areas. Clear these areas for crops or pasture, unless they are small or are associated with larger areas of other soils that are better suited to trees. Small odd areas and field border strips provide travel lanes and cover for wildlife.

CAPABILITY UNIT IIIw-6

In this unit are moderately deep, imperfectly drained, nearly level to gently sloping, medium-textured soils of terraces. These soils have a gray surface layer and a mottled, gray subsoil of silty clay. They are very slow in permeability and fair in moisture-supplying capacity. The major problem in managing them is excess water. The soils in this unit are—

McGary silt loam, 0 to 2 percent slopes.
McGary silt loam, 2 to 6 percent slopes, moderately eroded.

These soils are suited to corn, soybeans, small grains, and clover. Sweetclover tolerates the wetness better than alfalfa.

The intensity of the cropping system depends upon the combination of other practices used to improve drainage and to control erosion. A rotation of 2 years of a row crop, 1 year of a small grain, and 1 year of meadow is suitable under a medium level of management. Under a high level of management, a rotation of 3 years of a row crop, 1 year of a small grain, and 1 year of meadow is suitable.

The soils in this unit are very low in nitrogen and low in phosphate and potash. There is good response to lime and fertilizer if drainage is improved.

These soils warm up slowly in spring; field operations should be delayed if the soils are wet. These soils have weak structure and tend to puddle and run together; therefore, it is important to avoid overworking and to practice minimum tillage.

Shallow surface drains may be needed in nearly level areas. Land smoothing or grading is also generally needed, and it is important to cultivate so that water is directed into the shallow surface drains and into the cross-slope drains. Tile in the bottom of the surface drains add much to the convenience and to the maintenance of the surface drains by preventing puddling and deep tracks caused by implements, which are likely in wet years. A complete tile system can be installed for maximum production in extremely wet seasons, but open outlet ditches may need to be improved first. A well-designed system of surface drainage is needed on these soils. Land smoothing improves the drainage. If the surface drainage system needs to be supplemented by tile, the tile should be spaced 45 to 65 feet apart, in a system of laterals, and at a depth of 36 to 42 inches, with a minimum grade of 0.1 percent for all sizes of tile. Special blinding or a filter of porous material is needed over the tile in these soils. Irrigation is not generally suitable.

If these soils are used as grassland, a mixture of tall fescue and ladino clover is well suited. In undrained areas reed canarygrass is suitable.

Hardwoods, such as pin oak, sweetgum, and soft maple grow in the wooded areas. Clear these areas for crops or pasture unless they are small or are associated with larger areas of other soils that are better suited to trees. Small, odd areas and field border strips provide cover, travel lanes, and nesting sites for wildlife.

CAPABILITY UNIT IIIw-7

In this unit are moderately deep and deep, imperfectly drained, nearly level, medium-textured soils of uplands and terraces. These soils have a gray to light brownish-gray surface layer and a gray, mottled subsoil. A pan limits somewhat the penetration of roots and the infiltration of moisture. It is at a depth of about 20 inches in the subsoil and extends to a depth of about 40 inches. Permeability is very slow. Wetness is the major problem in managing these soils. The soils in this unit are—

Dubois silt loam, 0 to 2 percent slopes.
Johnsburg silt loam, 0 to 2 percent slopes.
Vigo silt loam, 0 to 2 percent slopes.

These soils are suited to corn, soybeans, small grains, and clover. Sweetclover tolerates the wetness better than alfalfa.

A rotation of 2 years of a row crop, 1 year of a small grain, and 1 year of meadow is suitable under a medium level of management. A rotation of 2 years of a row crop and 1 year of a small grain and a grass-legume intercrop is suitable under a high level of management.

These soils are very low in nitrogen and low in phosphate and potash. Response is good to lime and fertilizer if drainage is improved.

These soils warm up slowly in spring; field operations should be delayed if the soils are wet. These soils have weak structure and tend to puddle and run together; therefore, it is important to avoid overcultivation and to use minimum tillage.

Erosion is a problem on some of the long slopes. Contouring and rough cultivation that hold back the water may aggravate the problem of wetness, unless the soils are adequately tiled. Therefore, cross-slope ditches are well suited because they help to control erosion and also permit good surface drainage.

Shallow surface drainage may be needed in nearly level areas. Land smoothing or grading is also generally needed, and it is important to cultivate so that water is directed into the shallow surface drains and into the cross-slope drains. Tile in the bottom of the surface drains add much to the convenience in tillage and to the maintenance of surface drains by preventing deep tracks from implements and puddling, which are likely in wet years. A complete tile system can be installed for maximum production in extremely wet seasons, but open outlet ditches may need to be improved first. If a complete tile system is installed, the lines are generally run 50 to 65 feet apart (50 to 80 feet for the Johnsburg soils), and at a depth of 36 to 42 inches. The minimum grade should be 0.25 percent for 4- and 5-inch tile, 0.20 percent for 6-inch tile, and 0.15 percent for 8-inch tile. Special blinding or a filter of porous material may be needed over the tile. Irrigation is not generally suitable.

If the soils are used as grassland, a mixture of tall fescue and ladino clover is well suited. In undrained areas reed canarygrass is suitable.

Hardwoods, such as pin oak, sweetgum, and soft maple grow in the wooded areas. Clear those areas for crops unless they are small or are associated with larger areas of other soils that are better suited to woodland. Small, odd areas and field border strips provide travel lanes and cover for wildlife.

CAPABILITY UNIT IVe–1

The soils in this unit are deep, well drained, medium textured, and sloping to moderately steep. They have a brown to yellowish-brown surface layer and a yellowish-brown to reddish-brown subsoil. They are on uplands and terraces and are underlain by limestone or outwash. Permeability is moderate, and moisture-supplying capacity is fair to good. Runoff is rapid or very rapid. These soils are slightly to severely eroded. The major problem in cultivating them is erosion. The soils in this unit are—

Bewleyville silt loam, 12 to 18 percent slopes, moderately eroded.
Bewleyville soils, 6 to 12 percent slopes, severely eroded.
Grayford silt loam, 12 to 18 percent slopes.
Grayford silt loam, 12 to 18 percent slopes, moderately eroded.
Grayford soils, 6 to 12 percent slopes, severely eroded.
Markland silt loam, 6 to 12 percent slopes, moderately eroded.
Parke silt loam, 12 to 18 percent slopes.
Parke silt loam, 12 to 18 percent slopes, moderately eroded.
Parke soils, 6 to 12 percent slopes, severely eroded.

These soils are suited to small grains, hay, and pasture. Row crops can be grown occasionally if erosion is controlled. If row crops are grown, interseeded grasses or a small grain should be grown for a winter cover crop to help control erosion. These soils need lime, nitrogen, phosphate, and potash, and the response to these plant nutrients is good.

Maintain a cover of plants or plant residues on the soils to help control erosion. The trash mulch method can be used for reseeding hay or pasture. Keep waterways and sharp breaks in continuous sod. All cultural operations should be done on the contour. Diversions help to control runoff, especially on the longer slopes.

If these soils are used as grassland, alfalfa, clover, orchardgrass, and tall fescue are well suited. These are good soils for forest, and in most places good species of timber, such as tulip-poplar, black walnut, red and white oak, cherry, and ash grow on them. Slopes of more than 12 percent that are in good-quality timber should be left in forest. Where areas are to be planted to trees, plant red, white, or shortleaf pine. Poor-quality timber can be cleared if economically feasible; otherwise, protect such timber and manage it properly.

CAPABILITY UNIT IVe–5

Only one soil, Princeton fine sandy loam, 12 to 18 percent slopes, moderately eroded, is in this unit. It is a very deep, well-drained, moderately steep soil of the uplands. Its surface layer is brown to dark-brown fine sandy loam, and its subsoil is brown to yellowish brown. This soil is moderately permeable and has fair moisture-supplying capacity. There is moderate runoff because of the complex, hilly relief. Erosion is moderate and is the chief problem in cultivating this soil.

This soil is well suited to small grains and hay crops. Alfalfa is especially well suited because the roots can grow deep. Vegetables, melons, apples, and peaches are also suitable.

Using cover crops, crop residues, mulch, and minimum tillage will help control wind and water erosion. Proper kinds and amounts of fertilizer, as well as lime, are needed for high yields. The soils are generally lower in phosphate than in potash.

If special crops are grown, grain windbreaks are useful to help control wind erosion. When plowing the field for specialty crops, leave the equivalent of one drill width in grain for every six plowed. Where practical, all cultural operations should be done on the contour.

This soil is well suited to overhead irrigation. Overhead irrigation is practical for the high-value specialty crops and orchards.

This is one of the better soils for producing timber. Areas kept in timber should be managed to favor the better hardwoods, such as black walnut, tulip-poplar, and white oak.

CAPABILITY UNIT IVe–7

The soils in this unit are moderately deep, well drained and moderately well drained, sloping to moderately steep, and medium textured. They are on uplands and terraces. Their surface layer is brown to yellowish brown, and their subsoil is yellowish brown to reddish brown. These soils are moderate to moderately slow in permeability and fair to good in moisture-supplying capacity. Runoff is rapid or very rapid. The soils have been slightly to severely eroded. The major problem in cultivating them is erosion. The soils in this unit are—

Ava soils, 6 to 12 percent slopes, severely eroded.
Cincinnati soils, 6 to 12 percent slopes, severely eroded.
Cincinnati silt loam, 12 to 18 percent slopes.
Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded.
Haubstadt soils, 6 to 12 percent slopes, severely eroded.
Otwell soils, 6 to 12 percent slopes, severely eroded.
Otwell silt loam, 12 to 18 percent slopes.
Otwell silt loam, 12 to 18 percent slopes, moderately eroded.
Zanesville soils, 6 to 12 percent slopes, severely eroded.
Zanesville silt loam, 12 to 18 percent slopes.
Zanesville silt loam, 12 to 18 percent slopes, moderately eroded.

Suitable uses are small grain, hay, and pasture. Row crops can be grown occasionally if erosion is controlled. If row crops are grown, interseeded grasses or a small grain should be used for winter cover. Otherwise, maintain a good cover of grass most of the time.

These soils need lime, nitrogen, phosphate, and potash, and the response to them is good. The soils are generally lower in phosphate than in potash.

Maintain a cover of plants or plant residues on the soils to help control erosion. The trash mulch method can be used for reseeding hay or pasture. Keep waterways and sharp breaks in continuous sod. All cultural operations should be done on the contour. Diversions help to control runoff, especially on the longer slopes.

If the soils are used as grassland, clover, orchardgrass, and tall fescue are well suited (fig. 6). It is important to supply water for livestock so that the forage can be improved and used for grazing (fig. 7). Ponds and developed springs are suitable.

These are good soils for forest, and generally good species of timber, such as tulip-poplar, black walnut, red and white oak, cherry, and ash, grow on them. Slopes of more than 12 percent that are in good timber should remain in timber. In areas to be planted to trees, plant red, white, or shortleaf pine. Poor timber can be cleared if economically feasible; otherwise, protect the timber and manage it properly. If these soils are abandoned after improper cropping, they will revert to woodland naturally.

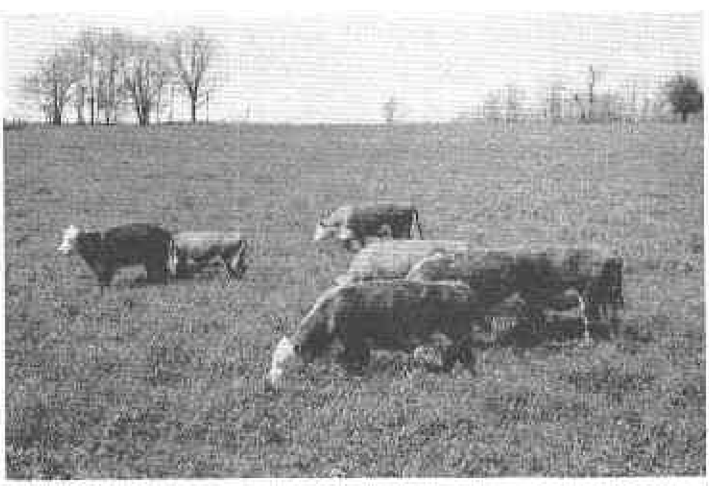

Figure 6.—**Hereford cattle grazing on excellent fescue-alfalfa pasture. This soil lost nearly all of its surface layer as a result of intensive cropping, but it is now well protected and is productive as grassland.**

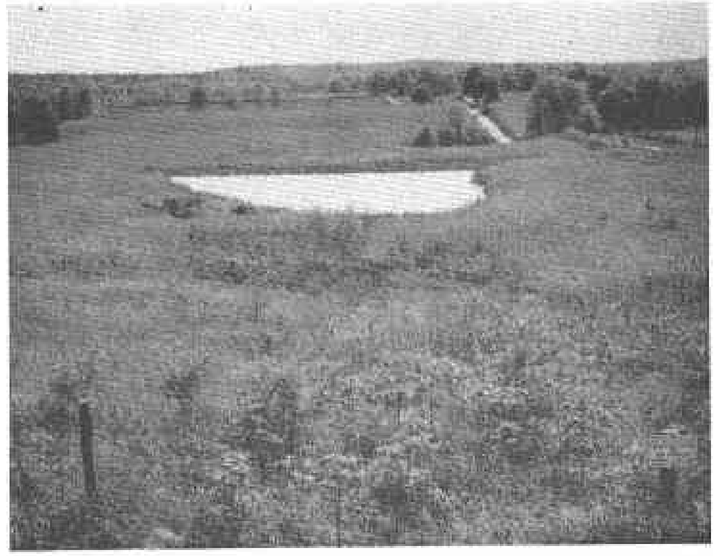

Figure 7.—**Pond constructed to provide water for livestock. The protected area around the pond provides an excellent area for wildlife.**

Constructing ponds, developing springs, and locating food patches properly will benefit the distribution of wildlife.

CAPABILITY UNIT IVe–8

In this unit are moderately deep, well-drained, medium-textured, sloping soils of the uplands. These soils have a brown to yellowish-brown surface layer and a brown subsoil. They are underlain by sandstone and shale. Permeability is moderate, and moisture-supplying capacity is fair to good. Runoff is rapid or very rapid. These soils have been slightly to moderately eroded. The major problem in cultivating them is erosion. The soils in this unit are—

Wellston silt loam, 6 to 12 percent slopes.
Wellston silt loam, 6 to 12 percent slopes, moderately eroded.

Suitable uses are small grains, hay, and pasture. Row crops can be grown occasionally if erosion is controlled. If row crops are grown, interseeded grasses or a small grain should be used for winter cover.

Crops grown on these soils respond well to a complete fertilizer and lime. Keep a cover of plants or plant residues on the soils to help control erosion. The trash mulch method can be used for reseeding hay or pasture. Keep waterways and sharp breaks in continuous sod. All tillage should be done on the contour. Diversions help control runoff, especially on the longer slopes.

Alfalfa, clover, orchardgrass, and tall fescue are well suited. Ponds are not suitable, because the soils are shallow over bedrock. These are good soils for forest. Good species of timber grow in most of the wooded areas.

CAPABILITY UNIT IVe–9

This unit consists of very deep, somewhat excessively drained, sloping, dark-brown loamy fine sands of the uplands. Their subsoil is brown to yellowish-brown fine sand and fine sandy loam. Permeability is rapid, and moisture-supplying capacity is low. Very little runoff occurs on these rolling, loose, sandy soils. The soils are droughty, and when they are dry, they are subject to wind erosion. The soils in this unit are—

Bloomfield loamy find sand, 6 to 12 percent slopes.
Bloomfield loamy fine sand, 12 to 18 percent slopes.

These soils are well suited to melons and orchard crops. If cultivated crops are grown, plant cover crops to reduce wind erosion and to provide additional organic matter. A mixture of alfalfa and grass for meadow grows well if these soils are adequately fertilized. Because these sandy soils are porous, plant nutrients leach out rapidly. Therefore, it is necessary to add nutrients annually. Generally, however, the soils are low in plant nutrients, and any buildup in the level of nutrients is impractical, because of the rapid leaching.

CAPABILITY UNIT Vw-1

Atkins silt loam is the only soil in this unit. It is poorly drained, gray, and very strongly acid. This soil is on first bottoms and is subject to frequent flooding. Most of the acreage is in marsh or swamp.

This soil is not generally practical for cultivation. If it is wooded, leave it in timber and use good management. Pin oak and soft maple grow on most areas.

If this soil is used as grassland, it may be profitable to install shallow surface drains to remove standing water, and diversions to cut off water from adjoining steeper soils. Ladino clover, alsike clover, and alta fescue could then be established. Applications of lime, phosphate, potash, and nitrogen, particularly nitrogen, will increase yields. If drainage is not improved, seed to reed canarygrass and add fertilizer.

CAPABILITY UNIT VIe-1

In this unit are shallow to deep, well-drained, sloping to steep soils of the uplands and terraces. Their surface layer is brown to yellowish brown, and their subsoil is yellowish brown to reddish brown. These soils are moderate in permeability and fair in moisture-supplying capacity. Runoff is rapid or very rapid. The major problem in cultivating these soils is erosion. The soils in this unit are—

Bewleyville soils, 12 to 18 percent slopes, severely eroded.
Bewleyville silt loam, 18 to 25 percent slopes.
Cincinnati soils, 12 to 18 percent slopes, severely eroded.
Cincinnati and Hickory silt loams, 18 to 25 percent slopes.
Cincinnati and Hickory silt loams, 18 to 25 percent slopes, moderately eroded.
Corydon stony silt loam, 12 to 18 percent slopes.
Grayford soils, 12 to 18 percent slopes, severely eroded.
Grayford silt loam, 18 to 25 percent slopes.
Grayford silt loam, 18 to 25 percent slopes, moderately eroded.
Grayford soils, 18 to 25 percent slopes, severely eroded.
Grayford silt loam, 25 to 35 percent slopes.
Hickory silt loam, 25 to 35 percent slopes.
Hickory silt loam, 25 to 35 percent slopes, moderately eroded.
Markland soils, 6 to 12 percent slopes, severely eroded.
Markland silt loam, 12 to 18 percent slopes, moderately eroded.
Muskingum stony silt loam, 12 to 18 percent slopes.
Negley loam, 18 to 25 percent slopes.
Negley loam, 25 to 35 percent slopes.
Negley silt loam, 18 to 25 percent slopes.
Negley silt loam, 18 to 25 percent slopes, moderately eroded.
Otwell soils, 12 to 18 percent slopes, severely eroded.
Otwell silt loam, 18 to 25 percent slopes.
Otwell silt loam, 18 to 25 percent slopes, moderately eroded.
Otwell silt loam, calcareous substratum, 25 to 35 percent slopes.
Parke soils, 12 to 18 percent slopes, severely eroded.
Princeton fine sandy loam, 18 to 25 percent slopes, moderately eroded.
Wellston silt loam, 12 to 18 percent slopes.
Wellston silt loam, 12 to 18 percent slopes, moderately eroded.
Wellston silt loam, 18 to 25 percent slopes.
Wellston silt loam, 18 to 25 percent slopes, moderately eroded.
Wellston soils, 6 to 12 percent slopes, severely eroded.
Zanesville soils, 12 to 18 percent slopes, severely eroded.
Zanesville silt loam, 18 to 25 percent slopes.
Zanesville silt loam, 18 to 25 percent slopes, moderately eroded.

These soils are probably best suited to pasture or trees. The response to lime, nitrogen, phosphate, and potash is good. The soils are generally lower in phosphate than in potash.

Pasture renovation should be done in narrow strips and on the contour, if practical. Use mulch tillage. Maintain a good cover of grass by controlling grazing and by liming, fertilizing, and reseeding.

If these soils are used as grassland; alfalfa, clover, orchardgrass, and tall fescue are suitable. Many areas of these soils are partly wooded and are used for pasture. The yield of forage is poor, however, and the growing timber is damaged by livestock. Areas that are better suited to pasture should be fenced and treated to improve the capacity and quality of grazing. The wooded areas should be protected from livestock. Clearing slopes of more than 12 percent for pasture is not generally a good practice, because of the hazard of erosion. Also, the cost would likely be too high and the return too low.

These soils are good for forest. Good species of timber, such as tulip-poplar, black walnut, and red and white oak, grow in most areas. Where the soils have not already been cleared, protect the timber from fire and grazing, and manage for timber production. Where the areas are to be planted to trees, plant red, white, or shortleaf pine. In severely eroded areas plant Virginia or Jack pine in place of the red or white pine. Add Scotch pine if interested in producing Christmas trees. If these soils are abandoned because of improper cropping, they will eventually revert to woodland naturally. A large acreage of woodland in the county is used by city dwellers for cabin homesites and for recreational areas.

CAPABILITY UNIT VIIe-1

Moderately steep to very steep, slightly to severely eroded soils of uplands and terraces make up this unit. Most of the very steep soils are in forest. The severely eroded soils are mainly idle or have a new growth of timber and brush. These soils should be managed for timber. The soils in this unit are—

Bloomfield loamy fine sand, 18 to 35 percent slopes.
Corydon stony silt loam, 35 to 70 percent slopes.
Gullied land, glacial drift.
Gullied land, residuum.
Hickory soils, 18 to 25 percent slopes, severely eroded.
Hickory silt loam, 35 to 70 percent slopes.
Markland silt loam, 18 to 25 percent slopes, moderately eroded.
Muskingum stony silt loam, 18 to 25 percent slopes.
Muskingum stony silt loam, 25 to 35 percent slopes.
Muskingum stony silt loam, 35 to 70 percent slopes.
Negley soils, 18 to 25 percent slopes, severely eroded.
Negley loam, 35 to 70 percent slopes.
Otwell soils, 18 to 25 percent slopes, severely eroded.

Otwell silt loam, calcareous substratum, 35 to 70 percent slopes.
Strip mines.
Wellston soils, 12 to 18 percent slopes, severely eroded.
Wellston soils, 18 to 25 percent slopes, severely eroded.
Wellston and Muskingum soils, 25 to 35 percent slopes.
Wellston and Muskingum soils, 25 to 35 percent slopes, moderately eroded.
Wellston and Muskingum soils, 35 to 70 percent slopes.

These soils are probably best suited to trees and wildlife. Some areas could be cleared and improved for pasture, but the cost would likely be too high and the return too low. In most places pastures on these soils are not dependable in dry seasons; they supply little grazing during the hot summer months. A large acreage of woodland in the county is used by city dwellers for cabin homesites and for recreational areas (fig. 8).

On well-managed woodland, good species of hardwoods, such as tulip-poplar, black walnut, red and white oak, and ash, predominate. To control gullies, plant black locust and white, red, and shortleaf pine. Virginia or Jack pine should replace red and white pine where erosion is severe or where the site is hot and dry. Add Scotch pine if you want to produce Christmas trees. All areas in woodland should be protected from grazing by livestock.

The soils of this unit are well suited to wildlife development on open, gullied areas. Establish ground cover with sericea, Korean, or Japonica lespedeza to control erosion and to provide food for wildlife. In many places wildlife would benefit if waterholes were established. Pine should be planted in clumps to provide shelter. Multiflora rose is excellent for food and shelter for wildlife. It can be planted if there is no objection to its spreading to other idle or unmanaged areas, as those areas will eventually become dominated by hardwoods.

CAPABILITY UNIT VIIIs-1

Odd areas of Gravel pits, Riverwash, and Quarries have some use as areas for wildlife. They are not suitable for the production of vegetation. Refer to the section "Wildlife" for a discussion of management for wildlife.

Figure 8.—A building used by a city resident as a recreational weekend dwelling. The tract on which it stands contains 80 acres of class IV and class VII land that is now in forest.

Management of Soils Used for Pasture and Hay

Most of the sloping soils of Owen County produce good yields of forage, and many of them are more profitable for forage than for grain crops. On the soils in capability classes I through IV, pastures are normally grazed from 1 to 4 years in the cropping system. The soils in capability classes VI and VII, which are not suited to cultivated crops, are generally kept in permanent pasture and renovated, as needed, to maintain good yields of forage.

Methods and rates of seeding and fertilizing, and suggestions for other aspects of establishing and managing pastures can be obtained from current bulletins of the Purdue Agricultural Extension Service and from the Purdue Agronomy Handbook.[4]

Some general management practices that are used to maintain and improve soils that are used primarily for producing forage are described in the following paragraphs.

Improving pasture by reseeding.—Test the soil to determine its need for lime and fertilizer. Apply lime 6 months before seeding. Where feasible, remove stones, stumps, brush, and other obstructions that interfere with the use of farm equipment. Prepare a good seedbed. To do this, shallow plow the nearly level to gently sloping soils on the contour. Work the steeper soils so as to leave a mulch on the surface, but do not plow them. Start preparing the seedbed several weeks or months before seeding by eradicating the weeds through cultivating, spraying, or both.

To reseed, use legumes and grasses that are best suited to the soils and that will be productive at the time when pasture is needed. Inoculate the legumes. Seed the pasture mixture in a companion crop that will control erosion, but use no more than 1 bushel of oats per acre. Cover the seed lightly. Use a cultipacker or a similar implement that puts the seed at the proper depth. If the seed is broadcast, a cultipacker will help cover the seed and also firm the seedbed. Apply phosphate and potash at the time of seeding. If the fertilizer is broadcast, work it into the soil before seeding. Drilling the fertilizer in a band 1 inch below the seed helps establish the stand of pasture plants. Pasture the companion crop when it is about 8 inches high to keep it from competing too strongly with the young forage plants.

Improving and maintaining pasture by controlling grazing.—Avoid overgrazing at all times, and do not allow the plants to be grazed closer than 4 to 6 inches. Delay grazing in spring until the ground is firm and growth is well started. Do not allow grazing for 1 month before the first hard frost in fall, which is normally some time between September 1 and September 30. Divide the pasture into three or more parts, and rotate the grazing. This gives the plants a chance to recover and prolongs their life.

Improving and maintaining pasture by controlling weeds and brush.—Mow weeds before they have a chance to seed. Except where the grazing is rotated daily, do the

[4] PURDUE UNIVERSITY AGRICULTURAL EXTENSION SERVICE. THE AGRONOMY HANDBOOK. 104 pp. illus. 1961.

mowing before the livestock are removed from the pasture. Cattle will eat wilted weeds and vegetation from urine spots after the vegetation has been mowed. Spray weeds and brush in areas where spraying is more economical and effective than mowing.

Improving and maintaining pasture by topdressing with lime and fertilizer.—Apply lime to acid soils to encourage white clover or similar legumes that furnish nitrogen for the grasses in the pasture mixture. Apply phosphate and potash in amounts indicated by the results of soil tests. Apply nitrogen to grass in spring if earlier grazing is desired. If enough moisture is available, nitrogen increases the total yields of grass and improves its content of protein. Repeated applications of nitrogen, however, encourage grasses to force legumes out of the pasture mixture.

Estimated Yields

Estimated average yields of principal crops under two levels of management are listed for the soils of the county in table 4. In columns A are yields to be expected under an average or medium level of management, and in columns B are yields to be expected under an improved or high level of management. Practices used under a medium level of management and those used under a high level are discussed in the section "Management by Capability Units."

The yields are estimated averages for a 5- to 10-year period. The yields are based on information from farmers, the county agent, members of the staff of the Purdue Agricultural Experiment Station, and others familiar with the agriculture of the county. They are also based on farm records and on direct observation of members of the soil survey party. Considered in making the estimates were the prevailing climate, characteristics of the soils, and the influence of different kinds of management on the soils.

It should be understood that these yield data may not apply directly to specific tracts of land for any particular year, because the soils vary somewhat from place to place, because management practices differ slightly from farm to farm, and because weather conditions vary from year to year. Nevertheless, these estimates appear to be as accurate a guide as can be obtained without further detailed and lengthy investigations. They are useful in showing the relative productivity of the soils and how soils respond to improved management.

TABLE 4.—*Estimated average acre yields of principal crops under two levels of management*

[In columns A are yields to be expected under average management, and in columns B are yields to be expected under improved management. Absence of data indicates that the crop ordinarily is not grown or the soil is not suitable for it]

Soil	Corn		Soybeans		Wheat		Oats		Alfalfa or alfalfa-grass mixture		Other mixed hay (red clover, orchardgrass, or timothy)[1]	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Atkins silt loam												
Ava silt loam, 0 to 2 percent slopes	57	87	25	36	27	38	47	67	3	4	2.0	3.0
Ava silt loam, 2 to 6 percent slopes	55	85	23	33	26	36	45	65	3	4	2.0	3.0
Ava silt loam, 2 to 6 percent slopes, moderately eroded	50	80	23	33	25	35	45	65	3	4	2.0	3.0
Ava soils, 2 to 6 percent slopes, severely eroded	42	64	18	26	20	30	33	48	2.5	3.5	1.8	2.7
Ava silt loam, 6 to 12 percent slopes	50	80	23	33	25	35	45	65	2.7	3.7	1.8	2.7
Ava silt loam, 6 to 12 percent slopes, moderately eroded	48	75	20	30	23	33	40	60	2.7	3.7	1.8	2.7
Ava soils, 6 to 12 percent slopes, severely eroded	33	51	13	22	18	28	30	45	2.5	3.5	1.3	2.5
Ayrshire loam, 0 to 2 percent slopes	55	85	23	33	26	36	45	65			2.0	3.0
Bartle silt loam, 0 to 2 percent slopes	55	85	23	33	26	36	45	65			2.0	3.0
Bewleyville silt loam, 2 to 6 percent slopes, moderately eroded	55	85	25	35	26	36	50	70	3	4	2.0	3.0
Bewleyville silt loam, 6 to 12 percent slopes, moderately eroded	48	75	20	30	23	33	40	60	2.7	3.7	1.8	2.7
Bewleyville soils, 6 to 12 percent slopes, severely eroded	33	51	13	22	18	28	30	45	2.5	3.5	1.3	2.5
Bewleyville silt loam, 12 to 18 percent slopes, moderately eroded	36	55	15	25	23	32	36	55	2.7	3.7	1.3	2.5
Bewleyville soils, 12 to 18 percent slopes, severely eroded												
Bewleyville silt loam, 18 to 25 percent slopes												
Bloomfield loamy fine sand, 6 to 12 percent slopes	40	55	15	25	20	30	35	45	2.5	3		
Bloomfield loamy fine sand, 12 to 18 percent slopes									2.5	3		
Bloomfield loamy fine sand, 18 to 35 percent slopes												
Cincinnati silt loam, 2 to 6 percent slopes	55	85	23	33	26	36	45	65	3	4	2.0	3.0
Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded	50	80	23	33	25	35	45	65	3	4	2.0	3.0
Cincinnati soils, 2 to 6 percent slopes, severely eroded	42	64	18	26	20	30	33	48	2.5	3.5	1.8	2.7
Cincinnati silt loam, 6 to 12 percent slopes	50	80	23	33	25	35	45	65	2.7	3.7	1.8	2.7
Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded	48	75	20	30	23	33	40	60	2.7	3.7	1.8	2.7

TABLE 4.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Corn		Soybeans		Wheat		Oats		Alfalfa or alfalfa-grass mixture		Other mixed hay (red clover, orchardgrass, or timothy) [1]	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Cincinnati soils, 6 to 12 percent slopes, severely eroded	33	51	13	22	18	28	30	45	2.5	3.5	1.3	2.5
Cincinnati silt loam, 12 to 18 percent slopes	40	60	17	27	25	35	40	60	2.7	3.7	1.3	2.5
Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded	36	55	15	25	23	32	36	55	2.7	3.7	1.3	2.5
Cincinnati soils, 12 to 18 percent slopes, severely eroded												
Cincinnati and Hickory silt loams, 18 to 25 percent slopes												
Cincinnati and Hickory silt loams, 18 to 25 percent slopes, moderately eroded												
Corydon stony silt loam, 12 to 18 percent slopes												
Corydon stony silt loam, 35 to 70 percent slopes												
Dubois silt loam, 0 to 2 percent slopes	55	85	23	33	26	36	45	65			2	3
Dubois silt loam, 2 to 6 percent slopes	55	85	23	33	26	36	45	65			2	3
Dubois silt loam, 2 to 6 percent slopes, moderately eroded	50	75	21	30	24	33	40	60			2	3
Eel silt loam	50	75	23	33								
Eel loam	50	75	23	33								
Eel silty clay loam	50	75	23	33								
Genesee silt loam	60	85	25	35					3.5	4		
Genesee loam	60	85	25	35					3.5	4		
Grayford silt loam, 0 to 2 percent slopes	60	90	27	40	28	40	50	70	3	4	2.0	3.0
Grayford silt loam, 2 to 6 percent slopes	57	87	23	33	28	38	45	65	3	4	2.0	3.0
Grayford silt loam, 2 to 6 percent slopes, moderately eroded	55	85	23	33	26	36	45	65	3	4	2.0	3.0
Grayford soils, 2 to 6 percent slopes, severely eroded	42	64	18	26	20	30	33	48	2.5	3.5	1.8	2.7
Grayford silt loam, 6 to 12 percent slopes	50	80	23	33	25	35	45	65	2.7	3.7	1.8	2.7
Grayford silt loam, 6 to 12 percent slopes, moderately eroded	48	75	20	30	23	33	40	60	2.7	3.7	1.8	2.7
Grayford soils, 6 to 12 percent slopes, severely eroded	33	51	15	25	18	28	30	45	2.5	3.5	1.3	2.5
Grayford silt loam, 12 to 18 percent slopes	42	63	17	27	25	35	40	60	2.7	3.7	1.3	2.5
Grayford silt loam, 12 to 18 percent slopes, moderately eroded	36	55	15	25	23	32	36	55	2.7	3.7	1.3	2.5
Grayford soils, 12 to 18 percent slopes, severely eroded												
Grayford silt loam, 18 to 25 percent slopes												
Grayford silt loam, 18 to 25 percent slopes, moderately eroded												
Grayford soils, 18 to 25 percent slopes, severely eroded												
Grayford silt loam, 25 to 35 percent slopes												
Gullied land, glacial drift												
Gullied land, residuum												
Haubstadt silt loam, 0 to 2 percent slopes	57	87	25	36	27	38	47	67	3	4	2.0	3.0
Haubstadt silt loam, 2 to 6 percent slopes	55	85	23	33	26	36	45	65	3	4	2.0	3.0
Haubstadt silt loam, 2 to 6 percent slopes, moderately eroded	50	80	23	33	25	35	45	65	3	4	2.0	3.0
Haubstadt soils, 2 to 6 percent slopes, severely eroded	42	64	18	26	20	30	33	48	2.5	3.5	1.8	2.7
Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded	48	75	20	30	23	33	40	60	2.7	3.7	1.8	2.7
Haubstadt soils, 6 to 12 percent slopes, severely eroded	33	51	13	22	18	28	30	45	2.5	3.5	1.3	2.5
Hickory soils, 18 to 25 percent slopes, severely eroded												
Hickory silt loam, 25 to 35 percent slopes												
Hickory silt loam, 25 to 35 percent slopes, moderately eroded												
Hickory silt loam, 35 to 70 percent slopes												
Johnsburg silt loam, 0 to 2 percent slopes	47	78	22	30	25	35	45	65	2.5	3.5	2.0	3.0
Johnsburg silt loam, 2 to 6 percent slopes	47	78	22	30	25	35	45	65	2.5	3.5	2.0	3.0
Johnsburg silt loam, 2 to 6 percent slopes, moderately eroded	44	67	20	27	23	32	36	54	2.5	3.5	2.0	3.0
Landes fine sandy loam	50	70	23	33								
Markland silt loam, 2 to 6 percent slopes, moderately eroded	50	80	23	33	25	35	45	65	3.0	4.0	2.0	3.0
Markland silt loam, 6 to 12 percent slopes, moderately eroded	36	55	15	25	23	32	36	55	2.7	3.7	1.8	2.7
Markland soils, 6 to 12 percent slopes, severely eroded												
Markland silt loam, 12 to 18 percent slopes, moderately eroded												
Markland silt loam, 18 to 25 percent slopes, moderately eroded												

TABLE 4.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Corn		Soybeans		Wheat		Oats		Alfalfa or alfalfa-grass mixture		Other mixed hay (red clover, orchardgrass, or timothy)[1]	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Martinsville loam, 0 to 2 percent slopes	60	90	27	40	28	40	50	70	3.0	4.0	2.0	3.0
Martinsville silt loam, 0 to 2 percent slopes	60	90	27	40	28	40	50	70	3.0	4.0	2.0	3.0
Martinsville loam, 2 to 6 percent slopes, moderately eroded	55	85	25	35	26	36	50	70	3.0	4.0	2.0	3.0
McGary silt loam, 0 to 2 percent slopes	46	68	20	27	23	33	35	58	---	---	2.0	3.0
McGary silt loam, 2 to 6 percent slopes, moderately eroded	46	68	20	27	23	33	35	58	---	---	2.0	3.0
Montgomery silty clay loam	50	75	23	33	26	36	35	52	---	---	2.0	3.0
Muck	40	60	---	---	---	---	---	---	---	---	---	---
Muskingum stony silt loam, 12 to 18 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---
Muskingum stony silt loam, 18 to 25 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---
Muskingum stony silt loam, 25 to 35 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---
Muskingum stony silt loam, 35 to 70 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---
Negley loam, 18 to 25 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---
Negley soils, 18 to 25 percent slopes, severely eroded	---	---	---	---	---	---	---	---	---	---	---	---
Negley loam, 25 to 35 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---
Negley loam, 35 to 70 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---
Negley silt loam, 18 to 25 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---
Negley silt loam, 18 to 25 percent slopes, moderately eroded	---	---	---	---	---	---	---	---	---	---	---	---
Nineveh loam	40	55	13	22	18	25	40	60	2.5	3.5	1.8	2.7
Ockley loam, 0 to 2 percent slopes	60	90	27	40	28	40	50	70	3	4	2.0	3.0
Ockley silt loam, 0 to 2 percent slopes	60	90	27	40	28	40	50	70	3	4	2.0	3.0
Otwell silt loam, 0 to 2 percent slopes	57	87	23	33	28	38	45	65	3	4	2.0	3.0
Otwell silt loam, 2 to 6 percent slopes	55	85	23	33	26	36	45	65	3	4	2.0	3.0
Otwell silt loam, 2 to 6 percent slopes, moderately eroded	50	80	23	33	25	35	45	65	3	4	2.0	3.0
Otwell silt loam, 6 to 12 percent slopes	50	80	23	33	25	35	45	65	2.7	3.7	1.8	2.7
Otwell silt loam, 6 to 12 percent slopes, moderately eroded	48	75	20	30	23	33	40	60	2.7	3.7	1.8	2.7
Otwell soils, 6 to 12 percent slopes, severely eroded	33	51	13	22	18	28	30	45	2.5	3.5	1.3	2.5
Otwell silt loam, 12 to 18 percent slopes	40	60	17	27	25	35	40	60	2.7	3.7	1.3	2.5
Otwell silt loam, 12 to 18 percent slopes, moderately eroded	36	55	15	25	23	32	36	55	2.7	3.7	1.3	2.5
Otwell soils, 12 to 18 percent slopes, severely eroded	---	---	---	---	---	---	---	---	---	---	---	---
Otwell silt loam, 18 to 25 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---
Otwell silt loam, 18 to 25 percent slopes, moderately eroded	---	---	---	---	---	---	---	---	---	---	---	---
Otwell soils, 18 to 25 percent slopes, severely eroded	---	---	---	---	---	---	---	---	---	---	---	---
Otwell silt loam, calcareous substratum, 35 to 70 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---
Otwell silt loam, calcareous substratum, 25 to 35 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---
Parke silt loam, 2 to 6 percent slopes	58	87	23	33	28	38	45	65	3	4	2.0	3.0
Parke silt loam, 2 to 6 percent slopes, moderately eroded	55	85	23	33	26	36	45	65	3	4	2.0	3.0
Parke soils, 2 to 6 percent slopes, severely eroded	42	64	18	26	20	30	33	48	2.5	3.5	1.8	2.7
Parke silt loam, 6 to 12 percent slopes	50	80	23	33	25	35	45	65	2.7	3.7	1.8	2.7
Parke silt loam, 6 to 12 percent slopes, moderately eroded	48	75	20	30	23	33	40	60	2.7	3.7	1.8	2.7
Parke soils, 6 to 12 percent slopes, severely eroded	33	51	13	22	18	28	30	45	2.5	3.5	1.3	2.5
Parke silt loam, 12 to 18 percent slopes	40	60	17	27	25	35	40	60	2.7	3.7	1.3	2.5
Parke silt loam, 12 to 18 percent slopes, moderately eroded	36	55	15	25	23	32	36	55	2.7	3.7	1.3	2.5
Parke soils, 12 to 18 percent slopes, severely eroded	---	---	---	---	---	---	---	---	---	---	---	---
Philo silt loam	50	70	23	33	---	---	---	---	---	---	---	---
Pike silt loam, 0 to 2 percent slopes	60	90	27	40	28	40	50	70	3	4	2.0	3.0
Pike silt loam, 2 to 6 percent slopes, moderately eroded	55	85	23	33	26	36	45	65	3	4	2.0	3.0
Pope silt loam	50	70	23	33	---	---	---	---	---	---	---	---
Pope loam	50	70	23	33	---	---	---	---	---	---	---	---
Princeton fine sandy loam, 2 to 6 percent slopes	57	87	23	33	28	38	45	65	3.0	4.0	2.0	3.0
Princeton fine sandy loam, 6 to 12 percent slopes	50	80	23	33	25	35	45	65	3.0	4.0	1.8	2.7
Princeton fine sandy loam, 6 to 12 percent slopes, moderately eroded	50	80	23	33	25	35	45	65	3.0	4.0	1.8	2.7
Princeton fine sandy loam, 12 to 18 percent slopes, moderately eroded	42	63	17	27	25	35	40	60	2.7	3.7	1.3	2.5

TABLE 4.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Corn		Soybeans		Wheat		Oats		Alfalfa or alfalfa-grass mixture		Other mixed hay (red clover, orchardgrass, or timothy) [1]	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Princeton fine sandy loam, 18 to 25 percent slopes, moderately eroded												
Riverwash												
Robinson silt loam	40	60	18	28	20	29	35	52			1.7	2.5
Shoals loam	45	60	20	28								
Shoals silt loam	45	60	20	28								
Shoals silty clay loam	45	60	20	28								
Stendal silt loam	45	60	20	28								
Strip mines												
Taggart silt loam	55	85	23	33	26	36	45	65			2.0	3.0
Tilsit silt loam, 0 to 2 percent slopes	50	78	22	30	25	35	45	65	2.5	3.5	2.0	3.0
Tilsit silt loam, 2 to 6 percent slopes	48	75	21	29	25	35	40	60	2.5	3.5	2.0	3.0
Tilsit silt loam, 2 to 6 percent slopes, moderately eroded	44	67	20	27	23	32	36	54	2.5	3.5	2.0	3.0
Tilsit soils, 2 to 6 percent slopes, severely eroded	37	56	16	24	20	29	32	47	2.3	3.3	1.8	2.7
Tilsit silt loam, 6 to 12 percent slopes, moderately eroded	37	56	16	24	20	29	32	47	2.3	3.3	1.8	2.7
Vigo silt loam, 0 to 2 percent slopes	55	85	23	33	26	36	45	65			2.0	3.0
Vigo silt loam, 2 to 6 percent slopes	55	85	23	33	26	36	45	65			2.0	3.0
Vigo silt loam, 2 to 6 percent slopes, moderately eroded	50	75	21	30	24	33	40	60			2.0	3.0
Vincennes silt loam	55	85	23	33	26	36	45	65			2.0	3.0
Wellston silt loam, 6 to 12 percent slopes	37	56	16	24	20	29	32	47	2.3	3.3	1.8	2.7
Wellston silt loam, 6 to 12 percent slopes, moderately eroded	30	48	13	20	17	25	27	40	2.0	3.0	1.8	2.7
Wellston soils, 6 to 12 percent slopes, severely eroded												
Wellston silt loam, 12 to 18 percent slopes	30	48	13	20	17	25	27	40	2.0	3.0	1.3	2.5
Wellston silt loam, 12 to 18 percent slopes, moderately eroded												
Wellston soils, 12 to 18 percent slopes, severely eroded												
Wellston silt loam, 18 to 25 percent slopes												
Wellston silt loam, 18 to 25 percent slopes, moderately eroded												
Wellston soils, 18 to 25 percent slopes, severely eroded												
Wellston and Muskingum soils, 25 to 35 percent slopes												
Wellston and Muskingum soils, 25 to 35 percent slopes, moderately eroded												
Wellston and Muskingum soils, 35 to 70 percent slopes												
Whitaker silt loam	55	85	23	33	26	36	45	65			2.0	3.0
Zanesville silt loam, 2 to 6 percent slopes	48	75	21	29	25	35	40	60	2.5	3.5	2.0	3.0
Zanesville silt loam, 2 to 6 percent slopes, moderately eroded	44	67	20	27	23	32	36	54	2.5	3.5	2.0	3.0
Zanesville soils, 2 to 6 percent slopes, severely eroded	42	60	18	25	21	30	33	50	2.5	3.5	2.0	3.0
Zanesville silt loam, 6 to 12 percent slopes	44	67	20	27	23	32	36	54	2.5	3.5	1.8	2.7
Zanesville silt loam, 6 to 12 percent slopes, moderately eroded	37	56	16	24	20	29	32	47	2.3	3.3	1.8	2.7
Zanesville soils, 6 to 12 percent slopes, severely eroded	30	45	12	20	16	25	27	40	2.0	3.0	1.3	2.5
Zanesville silt loam, 12 to 18 percent slopes	35	53	15	23	19	28	30	45	2.3	3.3	1.3	2.5
Zanesville silt loam, 12 to 18 percent slopes, moderately eroded	30	48	13	20	17	25	27	40	2.0	3.0	1.3	2.5
Zanesville soils, 12 to 18 percent slopes, severely eroded												
Zanesville silt loam, 18 to 25 percent slopes												
Zanesville silt loam, 18 to 25 percent slopes, moderately eroded												
Zipp silty clay loam	30	40	14	20	20	25	25	40				

[1] Fescue is not included in mixed hay. Figures for small grains on bottom-land soils are for areas of these soils that are partly protected by levees or that are flooded infrequently. Yields for corn and soybeans on bottom-land soils are for years when crops are not damaged by overflow.

Woodland Uses of Soils[5]

The kinds of trees or forest cover types (woodcrops) and the growth of the trees are influenced by the characteristics of the soils on which the stand grows. Likewise, the rate at which woodcrops grow is related directly to the characteristics of the soils. Therefore, management is generally dictated by the kinds of soils and by the growth of the trees. If the relationship between the kind of soil and the growth, management, and yield of different kinds of woodcrops are known, a more efficient wood-producing enterprise can be planned. In addition, the benefits of woodland, such as the esthetic and recreational values and the uses of wildlife and watersheds, can be encouraged.

[5] JOHN HOLWAGER, woodland conservationist, Soil Conservation Service, assisted in the preparation of this section.

Woodland suitability groups

To determine the relationship between the different kinds of soils and the growth, management, and yield of different kinds of trees, soils that have similar capabilities for growing trees have been grouped into woodland suitability groups. Each different kind of soil in the county has been studied. For those soils on which the production of woodcrops is considered important, ratings have been made of potential soil productivity, equipment limitations, seedling mortality, and the hazards of windthrow and erosion. Criteria for determining these ratings were devised so that each soil was grouped with other soils suited to about the same kind of woodland use.

Table 5 shows the woodland suitability groups in this county. It shows the potential soil productivity by giving the average site index for upland oak and tulip-poplar for each group. It also gives names of trees

TABLE 5.—*Woodland*

[Absence of information

Woodland suitability group	Site index [1]		Preferred species for plantings—	
	Upland oak	Tulip-poplar	In existing woodlands	On north- and east-facing sites— Uneroded to moderately eroded
Group 1: Moderately deep and deep, well-drained, medium-textured to moderately coarse textured soils that are moderate to rapid in permeability (BvB2, BvC2, BvD2, BwC3, BwD3, CcB, CcB2, CfB3, CcC, CcC2, CfC3, CcD, CcD2, CfD3, GrA, GrB, GrB2, GsB3, GrC, GrC2, GsC3, GrD, GrD2, GsD3, MaB2, MaC2, MaD2, MdC3, MfA, MeA, MeB2, Nv, OkA, OcA, OmA, OmB, OmB2, OmC, OmC2, OwC3, OmD, OmD2, OwD3, PaB, PaB2, PcB3, PaC, PaC2, PcC3, PaD, PaD2, PcD3, PkA, PkB2, PrB, PrC, PrC2, PrD2).	87–97	90–100	Tulip-poplar, red oak, white oak.	Black locust,[2] white pine, red pine, shortleaf pine, tulip tree,[3] black walnut,[3] white ash.[3]
Group 2: Deep well-drained, medium-textured soils that are moderate in permeability (ChE, ChE2, HcF, HcF2, HkE3, MaE2, NmE, NmE2, NgE, NgF, NsE3, OmE, OmE2, OwE3, OtF, PrE2).	85–95	95–105	Tulip-poplar, red oak, white oak.	Black locust,[2] white pine, red pine, shortleaf pine, tulip tree,[3] black walnut,[3] white ash.[3]
Group 3: Deep, well-drained, medium-textured soil material that is moderate to moderately rapid in permeability (Gt).	--------	--------	--------	Black locust,[2] white pine red pine, shortleaf pine, tulip tree,[3] black walnut,[3] white ash.[3]
Group 4: Deep, well-drained, medium-textured soils that are moderate in permeability (HcG, NgG, OtG).	80–90	90–100	Tulip-poplar, red oak, white oak.	Black locust,[2] white pine, red pine, shortleaf pine, tulip tree,[3] black walnut,[3] white ash.[3]
Group 5: Moderately deep and deep, imperfectly drained, medium-textured soils that are slow or very slow in permeability (AyA, BaA, DbA, DbB, DbB2, JoA, JoB, JoB2, MgA, MgB2, Ta, VgA, VgB, VgB2, Wt).	80–92	90–100	Sweetgum, soft maple, tulip-poplar.	White pine, red pine, shortleaf pine, Scotch pine,[4] tulip tree,[3] white ash.[3]

See footnotes at end of table.

that are dominant in the existing woodland, the preferred species for planting on different sites, and the limitations and hazards for each group.

The site index [6] is the average height, at 50 years of age, of the tallest trees in a naturally occurring, well-stocked stand. Site-index curves are used to determine the site index from height and age measurements of trees in any qualifying stand, regardless of their age.

The names of the trees given as preferred species for planting can be used as a guide where trees are to be planted. Numerous open areas, not suited to annual crops but suitable primarily for woodland, should be planted to trees, where they have not reseeded naturally. Nearly all of these sites are seriously eroded, have been grazed intensively, or have been damaged by fire. The exposure and the present structure of the soils make these sites unsuitable for the production of good-quality hardwoods. Therefore, in most places pines should be planted to reestablish conditions needed for again producing good hardwoods.

Equipment limitations refers to the effects of soil characteristics and relief that influence the movement of equipment commonly used in tending or harvesting trees. Limitations are *slight* if the kind of equipment or time of use is not restricted; *moderate* if one or more unfavorable factors are present; and *severe* if the restrictions are extreme in the choice of equipment, time of its use, or requirements for safety. For excessively wet soils, for soils where the slope is 50 percent or more, and for severely gullied land, a rating of *severe* is given.

[6] Site-index data for upland oak were developed from site-index curves according to USDA Tech. Bul. 560. Those for yellow-poplar are from curves constructed by W. T. DOOLITTLE, U.S. Forest Serv., in October 1957, and curves for sweetgum are from Forest Handb., Soc. Amer. Forest, published in 1955.

suitability grouping of soils

indicates data are not available]

Preferred species for plantings—Continued			Equipment limitations	Seedling mortality	Windthrow hazard	Erosion hazard
On north- and east-facing sites—Continued	On south- and west-facing sites					
Severely eroded	Uneroded to moderately eroded	Severely eroded				
Red pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Black locust,[2] white pine, red pine, shortleaf pine, Virginia pine, tulip tree,[3] white ash.[3]	Virginia pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Slight to moderate.	Slight to moderate.	Slight	Slight to moderate.
Red pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Black locust,[2] white pine, red pine, shortleaf pine, Virginia pine, tulip tree,[3] white ash.[3]	Virginia pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Moderate	Slight to moderate.	Slight	Moderate.
Red pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Black locust,[2] white pine, red pine, shortleaf pine, Virginia pine, tulip tree,[3] white ash.[3]	Virginia pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Severe	Moderate	Slight	Severe.
Red pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Black locust,[2] white pine, red pine, shortleaf pine, Virginia pine, tulip trees,[3] white ash.[3]	Virginia pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Severe	Slight	Slight	Severe.
Shortleaf pine, white pine, Virginia pine, Scotch pine.[4]	White pine, shortleaf pine, Virginia pine, Scotch pine.[4]	Virginia pine, shortleaf pine, Scotch pine,[4] Austrian pine.[4]	Moderate	Slight	Moderate	Slight.

TABLE 5.—*Woodland*

[Absence of information

Woodland suitability group	Site index [1]		Preferred species for plantings—	
	Upland oak	Tulip-poplar	In existing woodlands	On north- and east-facing sites— Uneroded to moderately eroded
Group 6: Deep, well-drained, medium-textured soils underlain by limestone, generally at a depth of 4 to 5 feet (BvE, GrE, GrE2, GsE3, GrF).	--------	75–85	Tulip-poplar, red oak, black walnut.	Black locust,[2] white pine, red pine, shortleaf pine, tulip tree,[3] black walnut,[3] white ash.[3]
Group 7: Somewhat droughty, medium-textured soils underlain by limestone bedrock at a depth of 6 to 18 inches (CoD, CoG).	70–75	80–90	White oak, ash, black oak.	White pine, red pine, shortleaf pine, Scotch pine,[4] Austrian pine.[4]
Group 8: Deep, moderately well drained and well drained, medium-textured soils that are moderately slow to moderate in permeability and formed in alluvium (Em, Es, Et, Gm, Gg, La, Ph, Pp, Po).	--------	95–105	Tulip-poplar, white ash, red oak, black walnut.	Black locust,[2] white pine, red pine, shortleaf pine, tulip tree,[3] black walnut,[3] white ash.[3]
Group 9: Moderately deep and deep, moderately well drained and well drained, medium-textured soils that have a fragipan (GnA, GnB, GnB2, GoB3, GnC, GnC2, GoC3, HaA, HaB, HaB2, HbB3, HaC2, HbC3, TsA, TsB, TsB2, TtB3, TsC2, ZaB, ZaB2, ZaC, ZaC2, ZaD, ZaD2, ZaE, ZaE2, ZnB3, ZnC3, ZnD3).	75–85	80–90	White oak, black oak, ash.	White pine, red pine, shortleaf pine, tulip tree,[3] white ash.[3]
Group 10: Well-drained, medium-textured soils that have a permeable subsoil and are shallow to moderately deep over consolidated sandstone or shale (MmD, MmE, WmC, WmC2, WnC3, WmD, WmD2, WnD3, WmE, WmE2, WnE3, WoF, WoF2).	75–85	90–100	White oak, black oak.	White pine, red pine, shortleaf pine, tulip tree,[3] white ash.[3]
Group 11: Moderately deep and deep, poorly drained or very poorly drained soils that are slow or very slow in permeability (At, Mh, Ro, Vn, Zp).	--------	90–100	Soft maple, sweetgum, pin oak.	White pine, loblolly pine, sweetgum, sycamore, soft maple, cottonwood, cypress.
Group 12: Somewhat droughty, medum-textured soils underlain by sandstone at a depth of 36 inches or less (MmF, MmG, WoG).	80–90	80–90	Black oak, white oak.	White pine, red pine, shortleaf pine, Scotch pine [4], Austrian pine [4].
Group 13: Deep, imperfectly drained, medium-textured and moderately fine textured, gray, mottled soils that formed in alluvium (Sm, Sh, Sn, So).	--------	--------	Soft maple, sweetgum, pin oak.	White pine, red pine, shortleaf pine, Scotch pine, [4] tulip tree, [3] white ash [3].
Group 14: Moderately deep or deep, moderately well drained or well drained, medium-textured soil material underlain by limestone, sandstone, or shale at a depth of 4 to 6 feet (Gu).	--------	--------	--------	Black locust,[2] white pine, red pine, shortleaf pine, tulip tree,[3] black walnut,[3] white ash.[3]
Group 15: Very deep, somewhat excessively drained, coarse-textured soils that are rapid in permeability (ByC, ByD, ByE).	80–85	75–85	Black oak, scarlet oak, white oak.	White pine, red pine, shortleaf pine, Scotch pine,[4] Austrian pine.[4]
Group 16: Strip mines (St)	--------	--------	Cottonwood, soft maple, green ash, white ash.	White pine, red pine, shortleaf pine, Scotch pine,[4] Austrian pine [4].

[1] Site index at 50 years. Schnur curves (SCHNUR, G. LUTHER. YIELD, STAND, AND VOLUME TABLES FOR EVEN-AGED UPLAND OAK FORESTS. USDA Tech. Bul. 560. 1937.) were used for upland oak. Doolittle curves (USFS 1957) were used for tulip-poplar.

suitability grouping of soils—Continued

indicates data are not available]

Preferred species for plantings—Continued			Equipment limitations	Seeding mortality	Windthrow hazard	Erosion hazard
On north- and east-facing sites—Continued	On south- and west-facing sites					
Severely eroded	Uneroded to moderately eroded	Severely eroded				
Red pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Black locust,[2] white pine, red pine, shortleaf pine, Virginia pine, tulip tree,[3] white ash.[3]	Virginia pine, white, pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Moderate	Slight to moderate.	Slight	Moderate.
Shortleaf pine, Virginia pine, white pine, Scotch pine,[4] Austrian pine.[4]	Red pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] Virginia pine.	Shortleaf pine, Virginia pine, Scotch pine,[4] pitch pine.	Moderate to severe.	Moderate	Severe	Severe.
Red pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Black locust,[2] white pine, red pine, shortleaf pine, Virginia pine, tulip tree,[3] white ash.[3]	Virginia pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Slight	Slight	Slight	Slight.
Shortleaf pine, Virginia pine, white pine, Scotch pine,[4] Austrian pine,[4] pitch pine.	Red pine, white pine, shortleaf pine, Virginia pine, Scotch pine,[4] Austrian pine.[4]	Virginia pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] pitch pine.	Slight to moderate.	Slight to moderate.	Moderate	Slight to moderate.
Shortleaf pine, Virginia pine, white pine, Scotch pine,[4] Austrian pine,[4] pitch pine.	Red pine, white pine, shortleaf pine, Virginia pine, Scotch pine,[4] Austrian pine.[4]	Virginia pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] pitch pine.	Slight to moderate.	Slight to moderate.	Slight to moderate.	Slight to moderate.
White pine, loblolly pine, sweetgum, sycamore, soft maple, cottonwood, cypress.[5]	White pine, loblolly pine, sweetgum, sycamore, soft maple, cottonwood, cypress.[5]	White pine, loblolly pine, sweetgum, sycamore, soft maple, cotton wood, cypress.[5]	Moderate to severe.	Slight to to modrate.	Moderate to severe.	Slight.
Shortleaf pine, Virginia pine, white pine, Scotch pine,[4] Austrian pine.[4]	Red pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] Virginia pine.	Shortleaf pine, Virginia pine, Scotch pine,[4] pitch pine.	Moderate to severe.	Moderate	Moderate	Slight to moderate.
Shortleaf pine, white pine, Virginia pine, Scotch pine.[4]	White pine, shortleaf pine, Virginia pine, Scotch pine.[4]	Virginia pine, shortleaf pine, Scotch pine,[4] Austrian pine.[4]	Slight	Slight	Moderate	Slight.
Red pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Black locust,[2] white pine, red pine, shortleaf pine, Virginia pine, tulip tree,[3] white ash.[3]	Virginia pine, white pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] black locust.[2]	Severe	Moderate	Moderate	Severe.
Shortleaf pine, Virginia pine, white pine, Scotch pine,[4] Austrian pine.[4]	Red pine, shortleaf pine, Scotch pine,[4] Austrian pine,[4] Virginia pine.	Shortleaf pine, Virginia pine, Scotch pine,[4] pitch pine.	Slight to moderate.	Moderate to severe.	Slight	Slight to moderate.
Shortleaf pine, Virginia pine, white pine, Scotch pine,[4] Austrian pine.[4]	Red pine, shortleaf pine, Scotch pine[4], Austrian pine,[4] Virginia pine.	Shortleaf pine, Virginia pine, Scotch pine,[4] pitch pine.	Severe	Moderate to severe.	Slight	Severe.

[2] For production of fence posts only.
[3] For spot planting in woodland openings.
[4] For Christmas trees only.
[5] Natural regeneration generally better than planting.

Seedling mortality, the regeneration potential, refers to the expected degree of mortality of naturally occurring or planted tree seedlings. The ratings are based on the assumption that there is an adequate supply of seed for naturally occurring seedlings, good stock and proper planting for plantations, and normal environmental factors. A rating of *slight* indicates that ordinary losses are not more than 25 percent of the planted stock. A rating of *moderate* indicates that the losses are between 25 and 50 percent of the planted stock, and of *severe*, that more than half of the planted stock is likely to die.

The hazard of windthrow is an evaluation of the soil characteristics that control the development of tree roots, which affect windfirmness. A high water table and a shallow soil over a restrictive layer are examples of features that contribute to the hazard of windthrow. A rating of *slight* indicates that individual trees will withstand normal winds, even when released on all sides; of *moderate*, that trees will remain standing unless the wind is of high velocity or the soil is excessively wet; and of *severe*, that the soil does not allow adequate rooting for stability.

The hazard of erosion refers to the potential risk of erosion when the area is managed according to acceptable standards of woodland use. Factors that influence these risks are steepness and length of slope and soil profile characteristics. Building and maintaining roads, skid trails, and fire lanes may create problems of erosion on some soils. Gullies and washed-out roads can be prevented by recognizing the haazrds of erosion. The ratings *slight*, *moderate*, and *severe* are based on the increasing risk of erosion.

WOODLAND SUITABILITY GROUP 1

This group consists of moderately deep and deep, well-drained, medium textured to moderately coarse textured soils that have moderate to rapid permeability. The underlying material is variable. These soils are nearly level to moderately steep and are slightly to severely eroded. The soils in this group are—

Bewleyville silt loam, 2 to 6 percent slopes, moderately eroded.
Bewleyville silt loam, 6 to 12 percent slopes, moderately eroded.
Bewleyville soils, 6 to 12 percent slopes, severely eroded.
Bewleyville silt loam, 12 to 18 percent slopes, moderately eroded.
Bewleyville soils, 12 to 18 percent slopes, severely eroded.
Cincinnati silt loam, 2 to 6 percent slopes.
Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded.
Cincinnati soils, 2 to 6 percent slopes, severely eroded.
Cincinnati silt loam, 6 to 12 percent slopes.
Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded.
Cincinnati soils, 6 to 12 percent slopes, severely eroded.
Cincinnati silt loam, 12 to 18 percent slopes.
Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded.
Cincinnati soils, 12 to 18 percent slopes, severely eroded.
Grayford silt loam, 0 to 2 percent slopes.
Grayford silt loam, 2 to 6 percent slopes.
Grayford silt loam, 2 to 6 percent slopes, moderately eroded.
Grayford soils, 2 to 6 percent slopes, severely eroded.
Grayford silt loam, 6 to 12 percent slopes.
Grayford silt loam, 6 to 12 percent slopes, moderately eroded.
Grayford soils, 6 to 12 percent slopes, severely eroded.
Grayford silt loam, 12 to 18 percent slopes.
Grayford silt loam, 12 to 18 percent slopes, moderately eroded.
Grayford soils, 12 to 18 percent slopes, severely eroded.
Markland silt loam, 2 to 6 percent slopes, moderately eroded.
Markland silt loam, 6 to 12 percent slopes, moderately eroded.
Markland silt loam, 12 to 18 percent slopes, moderately eroded.
Markland soils, 6 to 12 percent slopes, severely eroded.
Martinsville silt loam, 0 to 2 percent slopes.
Martinsville loam, 0 to 2 percent slopes.
Martinsville loam, 2 to 6 percent slopes, moderately eroded.
Nineveh loam.
Ockley silt loam, 0 to 2 percent slopes.
Ockley loam, 0 to 2 percent slopes.
Otwell silt loam, 0 to 2 percent slopes.
Otwell silt loam, 2 to 6 percent slopes.
Otwell silt loam, 2 to 6 percent slopes, moderately eroded.
Otwell silt loam, 6 to 12 percent slopes.
Otwell silt loam, 6 to 12 percent slopes, moderately eroded.
Otwell soils, 6 to 12 percent slopes, severely eroded.
Otwell silt loam, 12 to 18 percent slopes.
Otwell silt loam, 12 to 18 percent slopes, moderately eroded.
Otwell soils, 12 to 18 percent slopes, severely eroded.
Parke silt loam, 2 to 6 percent slopes.
Parke silt loam, 2 to 6 percent slopes, moderately eroded.
Parke soils, 2 to 6 percent slopes, severely eroded.
Parke silt loam, 6 to 12 percent slopes.
Parke silt loam, 6 to 12 percent slopes, moderately eroded.
Parke soils, 6 to 12 percent slopes, severely eroded.
Parke silt loam, 12 to 18 percent slopes.
Parke silt loam, 12 to 18 percent slopes, moderately eroded.
Parke soils, 12 to 18 percent slopes, severely eroded.
Pike silt loam, 0 to 2 percent slopes.
Pike silt loam, 2 to 6 percent slopes, moderately eroded.
Princeton fine sandy loam, 2 to 6 percent slopes.
Princeton fine sandy loam, 6 to 12 percent slopes.
Princeton fine sandy loam, 6 to 12 percent slopes, moderately eroded.
Princeton fine sandy loam, 12 to 18 percent slopes, moderately eroded.

This group contains some of the best soils for timber in the county, and the most valuable kinds of trees grown in Indiana are suited to them. The soils can be managed so that high-quality logs for lumber and for veneer are obtained. The texture and depth of the soils make conditions favorable for good growth of trees. Trees can develop roots freely because there are no obstructions, such as rocks or a fragipan. Site-index data for this group of soils range from 90 to 100 for tulip-poplar and from 87 to 97 for upland oak.

Seedling mortality is moderate, particularly on the severely eroded phases of the Parke, Cincinnati, Markland, and Otwell soils. Eroded areas of these soils should be planted to trees because natural regeneration cannot be expected to control the active erosion, especially on the slopes that face south and southwest. The hazard of windthrow is slight for all the soils of this group because the trees root deeply. There is a moderate hazard of erosion on all the soils in this group that have slopes of 12 to 18 percent. Where logging is on slopes of 12 percent or steeper, skid trails should be located in such a way that new gullies will not form and old gullies will not reactivate.

WOODLAND SUITABILITY GROUP 2

This group consists of deep, well-drained, medium-textured soils that have moderate permeability. The substratum consists of friable till or stratified sand, silt, and gravelly material, or of silt and clay. These soils are steep or very steep and are slightly to severely eroded. The soils in this group are—

Cincinnati and Hickory silt loams, 18 to 25 percent slopes.
Cincinnati and Hickory silt loams, 18 to 25 percent slopes, moderately eroded.
Hickory silt loam, 25 to 35 percent slopes.
Hickory silt loam, 25 to 35 percent slopes, moderately eroded.
Hickory soils, 18 to 25 percent slopes, severely eroded.

Markland silt loam, 18 to 25 percent slopes, moderately eroded.
Negley silt loam, 18 to 25 percent slopes.
Negley silt loam, 18 to 25 percent slopes, moderately eroded.
Negley loam, 18 to 25 percent slopes.
Negley loam, 25 to 35 percent slopes.
Negley soils, 18 to 25 percent slopes, severely eroded.
Otwell silt loam, 18 to 25 percent slopes.
Otwell silt loam, 18 to 25 percent slopes, moderately eroded.
Otwell soils, 18 to 25 percent slopes, severely eroded.
Otwell silt loam, calcareous substratum, 25 to 35 percent slopes.
Princeton fine sandy loam, 18 to 25 percent slopes, moderately eroded.

The site-index data indicate that the soils in this group are among the better ones for timber in this county. On the Cincinnati and Negley soils where severe erosion has occurred, the hazard of drought makes the soils better suited to oak and hickory than to tulip-poplar, walnut, beech, and maple.

Because of the fairly steep slopes of 18 to 35 percent, using logging equipment may be moderately difficult. Seedling mortality ranges from slight on the less eroded areas to moderate on the severely eroded, more droughty areas where slopes face south or west.

Figure 9.—An excellent stand of different kinds of oak on Negley loam, 35 to 70 percent slopes.

WOODLAND SUITABILITY GROUP 3

The only mapping unit in this group is Gullied land, glacial drift. It consists of deep, well-drained, medium-textured soil material that is moderate to moderately rapid in permeability. The substratum is variable; it ranges from loamy till to stratified silt, clay, and sandy material. Erosion is severe or very severe; gullies are numerous, and in many places they extend into the underlying substratum. Slopes range from 0 to more than 35 percent.

The underlying material of Gullied land, glacial drift, is favorable for the growth of fair- to good-quality trees. The production potential, however, is fairly low because of the severe erosion and the root zone that is less favorable than in uneroded areas.

Natural reseeding on this land type is only partly successful, and in some eroded areas planting trees will be necessary to get good cover. The hazard of erosion is severe, even in places where temporary cover has checked erosion. Special care should be taken in operating equipment and in locating logging trails so that gullies will not be reactivated. The steep slopes, many gullies, and exposure of the underlying material make equipment limitations severe.

WOODLAND SUITABILITY GROUP 4

This group consists of deep, well-drained, medium-textured soils that are moderate in permeability. The underlying material consists of friable till or stratified silt and clay, or sand and gravel. Little erosion has occurred on these extremely steep soils. The soils in this group are—

Hickory silt loam, 35 to 70 percent slopes.
Negley loam, 35 to 70 percent slopes.
Otwell silt loam, calcareous substratum, 35 to 70 percent slopes.

Because of their steep slopes, the soils in this group have remained in forest cover. Some damage to the timber has occurred through burning and grazing, but there is little erosion. The site-index figures indicate an excellent potential for timber production (fig. 9). Deep soils that are only slightly eroded, even though they are very steep, generally have a good potential for timber.

The equipment limitations are severe because of the exceptionally steep slopes. The main logging trails should be located along the ridgetops or along the narrow bottoms. Where skid trails need to be up and down the slope, cutoff ditches should be made so that large gullies will not form. To help prevent erosion, the logging trails ought to be seeded immediately after logging operations are completed.

The hazard of erosion for this group of soils is severe. Their steep slopes make the soils easily eroded.

WOODLAND SUITABILITY GROUP 5

This group consists of moderately deep and deep, imperfectly drained, medium-textured soils that are slow or very slow in permeability. The underlying material is variable. These soils are nearly level or gently sloping and are uneroded to moderately eroded. The soils in this group are—

Ayrshire loam, 0 to 2 percent slopes.
Bartle silt loam, 0 to 2 percent slopes.
Dubois silt loam, 0 to 2 percent slopes.
Dubois silt loam, 2 to 6 percent slopes.
Dubois silt loam, 2 to 6 percent slopes, moderately eroded.
Johnsburg silt loam, 0 to 2 percent slopes.
Johnsburg silt loam, 2 to 6 percent slopes.
Johnsburg silt loam, 2 to 6 percent slopes, moderately eroded.
McGary silt loam, 0 to 2 percent slopes.
McGary silt loam, 2 to 6 percent slopes, moderately eroded.
Taggart silt loam.
Vigo silt loam, 0 to 2 percent slopes.
Vigo silt loam, 2 to 6 percent slopes.
Vigo silt loam, 2 to 6 percent slopes, moderately eroded.
Whitaker silt loam.

Because of the extreme wetness and poor aeration of these soils, the production potential is only moderate.

There is a moderate hazard for logging because of the extreme wetness during part of the year. Logging early in spring should be avoided. Logging when the soils are wet causes compaction, damages the soil structure, and injures the shallow-rooted trees.

Seedling mortality is generally slight. In exceptionally wet years the soils may be too wet for satisfactory natural reseeding. A system of management is needed that assures good coppice or sprout growth to supplement natural reseeding.

These imperfectly drained soils discourage deep root development, and therefore the trees are subject to windthrow. All the soils in this group have a moderate windthrow hazard, which prevents leaving widely scattered seed trees in a logging area.

WOODLAND SUITABILITY GROUP 6

In this group are deep, well-drained, medium-textured soils underlain by limestone bedrock, generally at a depth of 4 to 5 feet. These soils are steep or very steep, and they are slightly to severely eroded. The soils in this group are—

Bewleyville silt loam, 18 to 25 percent slopes.
Grayford silt loam, 18 to 25 percent slopes.
Grayford silt loam, 18 to 25 percent slopes, moderately eroded.
Grayford soils, 18 to 25 percent slopes, severely eroded.
Grayford silt loam, 25 to 35 percent slopes.

Because these soils are shallow over bedrock and because the growth of roots is restricted, the site index is low. On the steep, eroded Grayford soils, conifers should be planted for erosion control because natural reseeding gives inadequate cover. The production potential for these soils is very good. The direction of the slope is important, however, because slopes facing south and southwest are fairly droughty.

Because of the steep slopes, and in a few places, exposed limestone rocks or ledges, the equipment limitations are moderate. The hazard of erosion is also moderate. The soils in this group are very erodible, however, and gullies form quickly if the surface is disturbed. Additional soil losses after logging greatly reduce the quality and quantity of future timber crops.

WOODLAND SUITABILITY GROUP 7

This group consists of shallow, somewhat droughty, medium-textured soils where limestone bedrock is at a depth of 6 to 18 inches. There are numerous outcrops and escarpments of bedrock. These soils are moderately steep to extremely steep and are generally slightly eroded. The soils in this group are—

Corydon stony silt loam, 12 to 18 percent slopes.
Corydon stony silt loam, 35 to 70 percent slopes.

The soils in this group are among the poorest in the county for forestry. Fortunately they occupy only a little less than 1,000 acres.

Data collected on upland oaks growing on soils of this group show an average site index of 72 feet. All trees measured for this group were on either east- or northeast-facing slopes. It is reasonable to expect a site index of 70 or less for the warmer, less favorable south- and southwest-facing slopes.

Equipment limitations range from moderate to severe, depending upon the steepness of slope and the amount of rock on the surface. Seedling mortality is moderate because the soils are droughty. Spot planting or reinforcement plantings are needed in many places to obtain a good stand of trees.

The hazard of windthrow is severe because of the very shallow root zone. In some places on steeper slopes, the weight of the treetops will cause uprooting. The hazard of erosion is severe. Any type of logging that tends to leave the surface bare starts severe erosion. Gullies generally do not form, but the soil material washes out from between the stones. This type of erosion leaves even poorer growing conditions for future stands than does the formation of gullies.

WOODLAND SUITABILITY GROUP 8

This group consists of deep, moderately well drained and well drained, medium-textured soils formed in alluvium. Permeability is moderately slow to moderate. The substratum consists of stratified silt and some sand. These soils are on nearly level bottoms along streams and are subject to occasional to frequent overflow. The soils in this group are—

Eel loam.
Eel silt loam.
Eel silty clay loam.
Genesee silt loam.
Genesee loam.
Landes fine sandy loam.
Philo silt loam.
Pope silt loam.
Pope loam.

Most of the timber on these soils is in fairly narrow strips that border the major streams of the county.

The fertile soils and favorable supply of moisture are ideal for the good growth of trees. The site index is as high as 95 to 105 for tulip-poplar. The estimated production potential is as high as 650 board feet per acre per year for all the soils in this group.

WOODLAND SUITABILITY GROUP 9

In this group are moderately deep and deep, moderately well drained and well drained, medium-textured soils that have a fragipan. The soils are underlain by consolidated sandstone, shale, or both, within a depth of 5 to 6 feet, or by medium-textured glacial drift. They are nearly level to steep; some of the steeper areas are severely eroded. The soils in this group are—

Ava silt loam, 0 to 2 percent slopes.
Ava silt loam, 2 to 6 percent slopes.
Ava silt loam, 2 to 6 percent slopes, moderately eroded.
Ava soils, 2 to 6 percent slopes, severely eroded.
Ava silt loam, 6 to 12 percent slopes.
Ava silt loam, 6 to 12 percent slopes, moderately eroded.
Ava soils, 6 to 12 percent slopes, severely eroded.
Haubstadt silt loam, 0 to 2 percent slopes.
Haubstadt silt loam, 2 to 6 percent slopes.
Haubstadt silt loam, 2 to 6 percent slopes, moderately eroded.
Haubstadt soils, 2 to 6 percent slopes, severely eroded.
Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded.
Haubstadt soils, 6 to 12 percent slopes, severely eroded.
Tilsit silt loam, 0 to 2 percent slopes.
Tilsit silt loam, 2 to 6 percent slopes.
Tilsit silt loam, 2 to 6 percent slopes, moderately eroded.
Tilsit soils, 2 to 6 percent slopes, severely eroded.
Tilsit silt loam, 6 to 12 percent slopes, moderately eroded.
Zanesville silt loam, 2 to 6 percent slopes.
Zanesville silt loam, 2 to 6 percent slopes, moderately eroded.
Zanesville soils, 2 to 6 percent slopes, severely eroded.
Zanesville silt loam, 6 to 12 percent slopes.
Zanesville silt loam, 6 to 12 percent slopes, moderately eroded.
Zanesville soils, 6 to 12 percent slopes, severely eroded.
Zanesville silt loam, 12 to 18 percent slopes.
Zanesville silt loam, 12 to 18 percent slopes, moderately eroded.
Zanesville soils, 12 to 18 percent slopes, severely eroded.
Zanesville silt loam, 18 to 25 percent slopes.
Zanesville silt loam, 18 to 25 percent slopes, moderately eroded.

The production potential ranges from 150 to 250 board feet per acre per year. Steepness and the direction of slope are very important on these soils. The trees on south-facing slopes grow slowly and are poorly formed. Because of their fragipan, these soils are not suited to certain species, such as black walnut and red oak.

The site index is low because of the restriction of root growth caused by the fragipan. The fragipan also restricts the movement of capillary water to the roots, which makes the soils droughty. Because of the shallow rooting, there is a moderate hazard of windthrow.

WOODLAND SUITABILITY GROUP 10

This group consists of shallow to moderately deep, well-drained, medium-textured soils that have a permeable subsoil. The underlying strata of consolidated sandstone or shale is generally at a depth of 6 to 36 inches. These soils are steep or very steep, and they are generally slightly to moderately eroded. Included in the mapping of these soils are small areas of soils where bedrock is near the surface or where outcrops of sandstone or shale occur. The soils in this group are—

Muskingum stony silt loam, 12 to 18 percent slopes.
Muskingum stony silt loam, 18 to 25 percent slopes.
Wellston silt loam, 6 to 12 percent slopes.
Wellston silt loam, 6 to 12 percent slopes, moderately eroded.
Wellston soils, 6 to 12 percent slopes, severely eroded.
Wellston silt loam, 12 to 18 percent slopes.
Wellston silt loam, 12 to 18 percent slopes, moderately eroded.
Wellston soils, 12 to 18 percent slopes, severely eroded.
Wellston silt loam, 18 to 25 percent slopes.
Wellston silt loam, 18 to 25 percent slopes, moderately eroded.
Wellston soils, 18 to 25 percent slopes, severely eroded.
Wellston and Muskingum soils, 25 to 35 percent slopes.
Wellston and Muskingum soils, 25 to 35 percent slopes, moderately eroded.

These soils are important for timber production because they are suited only to trees. The site index was taken for tulip-poplar on a Wellston soil where the slope faces north or east and is between 12 and 18 percent. This site index is above the average for all the other soils. The site index for upland oak was taken on a number of plots on various sites and represents a true average for the soils of this group.

Equipment limitations range from slight to moderate, depending on the slope. Difficult and hazardous logging is encountered on the soils where the slope is more than 25 percent. Seedling mortality is slight on practically all the soils, except for those that are severely eroded where the slope is more than 18 percent. Because the soils of this group are rocky and are shallow over bedrock, the development of roots is fairly poor. Some damage from windthrow can be expected on the steeper slopes. As a rule, the better quality timber is produced on the north- and east-facing slopes, where the temperature is cooler. There is a moderate hazard of erosion on all the soils, particularly on the steeper ones. The included soils are erodible, and the soil material washes from between the rocks rapidly if the soils are exposed to logging.

WOODLAND SUITABILITY GROUP 11

This group consists of moderately deep and deep, poorly drained or very poorly drained soils that are slow or very slow in permeability. These soils are nearly level or in depressions. The underlying material consists of till or stratified material of silt and clay or silt and fine sand. The soils in this group are—

Atkins silt loam.
Montgomery silty clay loam.
Robinson silt loam.
Vincennes silt loam.
Zipp silty clay loam.

Because of excessive moisture and poor aeration, the potential for timber production on these soils is low. The equipment limitations are severe on all of the soils but Robinson silt loam, for which it is moderate. The extreme wetness of these soils, often for a period longer than 3 months of the year, makes logging difficult.

Seedling mortality ranges from slight on Robinson silt loam to moderate on all the other soils. The soils in this group are often too wet for good natural regeneration. They also present a very difficult problem for planting trees, because they are nearly always too wet for planting in spring, when trees should be planted.

The hazard of windthrow is severe. The abundance of moisture causes the trees to develop very shallow roots. This must be considered in managing the stands because leaving occasional trees would bring about a serious problem of windthrow. The hazard of erosion is practically nonexistent, because the woodland areas are flat.

WOODLAND SUITABILITY GROUP 12

This group consists of shallow to moderately deep, somewhat droughty, medium-textured soils over sandstone bedrock that is at a depth of 36 inches or less. These soils are steep or very steep, and erosion is slight to moderate. Outcrops of sandstone are common in some of the steeper areas. The soils in this group are—

Muskingum stony silt loam, 25 to 35 percent slopes.
Muskingum stony silt loam, 35 to 70 percent slopes.
Wellston and Muskingum soils, 35 to 70 percent slopes.

On these soils some of the poorest quality timber in the State is growing. Because the soils are stony and shallow over bedrock, their production potential is very low.

The poplars measured for site index on these soils were in a stand on a north-facing slope. In general, except where poplar is grown on cooler slopes with deeper soil material, the soils in this group are better suited to oak and hickory than to poplar.

Equipment limitations are moderate to severe. Slopes steeper than 35 percent where rocks outcrop make logging costly and hazardous. Seedling mortality is moderate because the soils are shallow over bedrock and are somewhat droughty. On the slopes that face south and southwest, some loss from natural reseeding or planting can be expected. The windthrow hazard is moderate because of the very shallow root zone and steep slopes. On some of these slopes, a tree of any size will be uprooted by its top weight.

The soils of this group erode easily if they are not protected by vegetation. In logging these steep soils, enough forest cover should be left to protect the soils from erosion. Logging trails should be located so that gullies will not form.

WOODLAND SUITABILITY GROUP 13

In this group are deep, imperfectly drained, medium-textured and moderately fine textured, gray, mottled soils that formed in alluvium. The underlying material consists of stratified silt and fine sand. These soils are on nearly level bottoms along streams. The soils in this group are—

Shoals silt loam.
Shoals loam.
Shoals silty clay loam.
Stendal silt loam.

The equipment limitations, seedling mortality, and hazard of erosion are all slight on this group of soils. The drainage is good enough that logging operations can be performed throughout most of the year. The windthrow hazard is moderate because of a high water table, which causes the roots of trees to be near the surface. Good yields of timber can be expected on these soils because the natural fertility is high and the moisture supply is abundant.

WOODLAND SUITABILITY GROUP 14

Gullied land, residuum, is the only mapping unit in this group. It consists of moderately deep or deep, moderately well drained or well drained, medium-textured soil material underlain by limestone, sandstone, or shale at a depth of 4 to 6 feet. This land type is severely gullied, and the underlying bedrock is exposed in many places. Gullied land, residuum, is sloping to moderately steep.

The production potential is very low because of the exposure of rock and damage from erosion. This land type is better suited to cover for wildlife than to timber. Retaining any complete cover can be valuable for protecting the soils below this land type.

All logging limitations are severe because of the numerous gullies, exposed bedrock, and in general, very rough topography. Planting trees is important because natural seeding cannot be expected to cover the bare, eroded areas.

Seedling mortality is moderate because the slopes are steep, and in many places the original surface layer has been lost. The most drastic failure of seedlings occurs on the slopes that face south and southwest. The hazard of windthrow is moderate. Because bedrock and stones are near the surface, roots do not produce a very firm structure. Care should be taken in logging so as not to leave the slopes that face south and southwest exposed to wind.

The hazard of erosion is severe. This land type is very badly gullied, and erosion can be aggravated fairly easily. Logging roads ought to be located in such a way that old gullies will not become active or new ones will form up and down the slope. Skid trails need to be located properly, and bare areas should be seeded or planted after logging.

WOODLAND SUITABILITY GROUP 15

In this group are very deep, somewhat excessively drained, coarse-textured soils that are rapid in permeability. The parent material is windblown, calcareous fine sand on the uplands adjacent to the river valley. These soils are rolling to steep, and the relief resembles dunes. The soils in this group are—

Bloomfield loamy fine sand, 6 to 12 percent slopes.
Bloomfield loamy fine sand, 12 to 18 percent slopes.
Bloomfield loamy fine sand, 18 to 35 percent slopes.

On the steep soil the equipment limitations are moderate because of the lack of traction. Seedling mortality is moderate to severe because the soils are droughty and lack readily available plant nutrients. Wind erosion sometimes is a factor in causing seedling mortality, as the blowing sand cuts off the seedlings, covers them, and exposes their roots to heat and drought.

WOODLAND SUITABILITY GROUP 16

In this group is the land type, Strip mines. It is a mixture of soil and rock overburden made up of glacial till and material from shale, sandstone, and siltstone. The material ranges from calcareous to strongly acid. The relief is very irregular; it ranges from nearly level to steep, and the slopes are generally short.

Because of the steep, irregular slopes, equipment limitations are severe. Seedling mortality is moderate to severe because of the heterogeneous mixture of soil material and the southern and western exposures. The hazard of erosion is severe because of the very steep, broken slope and the varied reaction of the soil surface to the action of water.

Planting trees is important in these areas because of the lack of seed trees nearby to supply natural seeding. In addition, planting should be selective because of the variable soil conditions. Woody and shrubby plants, to furnish wildlife cover and food, may have as great or greater value than plantings for timber production.

Yield Information

The approximate average yearly growth per acre of upland oak and yellow-poplar growing in Owen County is shown in table 6. The measurements were taken from well-stocked, unthinned, naturally occurring stands and are given in board feet and in cords. No information was available for bottom-land hardwoods.

TABLE 6.—*Approximate average yearly growth per acre for well-stocked, unthinned, naturally occurring stands of upland oak and yellow-poplar*

[Absence of data indicates that these species are not generally grown on these soils]

Woodland suitability group	Upland oak[1]		Yellow-poplar[2]	
	Bd. Ft.[3]	*Cords*[4]	*Bd. Ft.*[3]	*Cords*[4]
1, 2, and 4	450	0.82	488	1.05
5	300	.64	450	1.00
6	450	.82	352	.84
7	232	.50		
8			643	1.25
9	232	.50	228	.63
10	310	.66	643	1.25
12	240	.55	228	.63

[1] Adapted from USDA Technical Bulletin 560.
[2] Adapted from USDA Technical Bulletin 356 by E. F. McCarthy.
[3] Trees 60 years of age measured according to International ¼-inch rule.
[4] Trees 30 years of age; yield measured in rough cords (85 cu. ft. of solid wood).

Wildlife

The present trend of agriculture in various parts of the county affects the balance between food, cover, and water for wildlife. On the western side of the county, which is composed mainly of nearly level to moderately steep Illinoian till soils that have a medium-textured mantle of loess, about 40 percent of the acreage is in cultivated crops and pasture. The principal kinds of wildlife in this area are quail, songbirds, and rabbits, squirrels, and other small mammals. There is a reasonably good balance between amounts of food and cover, but quality and distribution need to be improved. Food is rarely a limiting factor, but on some farms where cash-grain farming is practiced or where the entire crop is removed from the field, it is important to provide additional patches of food for wildlife.

Where large areas are under cultivation, there is a need to provide more year-round cover. On farms where small grains and forage crops are grown, mowing for weed control should be delayed until the nesting period of birds is over. In the uplands permanent open water near food and cover is important to wildlife during periods of drought. Planting such linear cover as hedgerows to provide travel lanes so that small animals can reach available food and water, and also to provide protection from predators, will help the distribution of wildlife. Where food is scarce, planting patches of food, such as sorghum and lespedeza, makes the population of animals and birds more stable.

Sod waterways, border strips, protected areas around farm ponds, and grassy fence rows provide cover for escape and for nesting. In the western part of the county, for a large part of the year, water is available in open ditches and intermittent streams. During summer droughts, however, additional sources of water are often needed. Building a farm pond helps to provide a year-round supply of water so that the animals and birds can stay in their native habitat. The areas around ponds also provide nesting sites and feeding grounds for waterfowl, which are becoming more numerous. In some places year-round water is supplied from pits where strip mining has taken place. Growing vegetation on the spoil banks of Strip mines also encourages a heavy concentration of upland game, particularly deer.

In the central part of the county, the soils are medium textured and are strongly sloping to very steep. They developed mainly from glacial outwash and from weathered sandstone and shale on which there is a thin mantle of loess. The rough slopes, which are characteristic of the area, make the retention of woodland cover important in a large part of the acreage. About two-thirds of the area is now in timber. Protecting woodland from fire and grazing, and planting trees on open, idle, and eroded areas create more dense woodland areas.

The topography and the type of vegetation make this part of the county important to such wildlife as deer, quail, songbirds, and squirrels, raccoons, rabbits, and other small mammals. Also, the number of deer in Owen County is increasing. Large areas of timber in which there are many small openings accommodate a population of ruffed grouse in other parts of Indiana and may increase the number of ruffed grouse in this county.

Low-growing cover, food patches, and year-round water supply are often in demand in the central part of the county to assure a continuous and well-distributed population of wildlife. Establishing food patches or leaving crop residues adjacent to areas of woody cover is very helpful to wildlife. Cagles Mill Lake at the northern end of this area and the White River, which cuts across the southeastern corner of the county, provide a year-round supply of water. Constructing farm ponds and small lakes in other parts of the area will benefit wildlife and tend to stabilize the population of game. The areas of year-round water have a noticeable influence on migratory waterfowl. Increasing numbers stop off at water areas in this county for rest and food. This area, with its variety of soils and vegetation, may become very important for hunting because of its suitability for many types of wildlife.

The area on the eastern side of the county consists of gently sloping to steep, medium-textured soils developed from weathered limestone and drift. This area is generally broken up by more diversified vegetation. About 75 percent of it is in crops and pasture, interspersed with scattered woodland. McCormicks Creek State Park, in this area, contains 1,225 acres of protected woodland. This park has a definite influence on the types and amounts of wildlife in the eastern corner of the county. In general, there is a good balance of food and cover. In a few places, food patches need to be established adjacent to useful cover to stabilize the population of wildlife. Supplying water is an important problem in the eastern part of the county because it is difficult to construct farm ponds on soils underlain by limestone. In a few places, the sinkholes have silted to a point that they now hold water throughout the year. These waterholes are important to wildlife, and protection or development of the surrounding land for food and cover would enhance the area for wildlife.

About half of the land adjoining the White River and its tributaries is in crops, and nearly 40 percent is in woodland. The woodland is in narrow strips along the streams and sloughs that are too wet to crop regularly. Such places provide a good balance of food, cover, and water for all types of wildlife. Improvement in nesting cover for birds through the use of more grasses and legumes is desirable. This can be done by establishing border strips along the wooded areas, developing waterways to lead hill water to the main channels, and seeding some of the sloughs to a permanent cover of grass. Developing such nesting cover will not only improve conditions for local wildlife, but will greatly enhance the value of the area for migratory waterfowl.

A moderate amount of fishing is afforded by the White River and its tributaries. Most of this is trotline and hook-and-line fishing for game fish. Since the 1,400-acre Cataract Lake adjoining Lieber State Park was opened in 1956 for fishing, boating, and other outdoor recreation, large numbers of people from central and southern Indiana use the facilities. Nearly 100,000 paid admissions are registered each year. Because it is near Indianapolis, Terre Haute, Bloomington, and other large centers of population, the county also has potential for the development of commercial hunting areas.

Engineering Properties of Soils [7]

Soil properties are of special interest to the engineer because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal systems. The properties most important to the engineer are permeability to water, shear strength, compaction charactertistics, soil drainage, skrink-swell characteristics, grain size, plasticity, and reaction. Relief and depth to the water table and to bedrock are also important.

This section records the properties of soils important to engineering. It contains information that engineers can use to—

1. Make soil and land use studies that will aid in the selection and development of industrial, business, residential, and recreational sites.
2. Estimate charactertistics of runoff and erosion for use in planning dams and other structures for conserving soil and water; in planning drainage structures, underground conduits and cables, and sewage disposal fields; and in determining the stability of embankments and road cuts.
3. Make reconnaissance surveys of soil and ground conditions that will aid in selecting locations for highways and airports and in planning detailed soil surveys for the intended locations.
4. Locate sand and gravel for use in construction of concrete buildings and structures and as a base for both flexible and rigid pavements.
5. Correlate pavement performance with types of soil and thus develop information that is useful in designing and maintaining the pavements.
6. Supplement information obtained from other published maps, reports, and aerial photographs for the purpose of making soil maps and reports that can be used readily by engineers.
7. Become aware of the hazards or useful properties of various soils used for highway and earth construction when definite laboratory data are lacking or are not available.

It is not intended that this report eliminate the need for on-site sampling and testing of sites for design and construction of specific engineering works and uses. The mapping and description of the soils are somewhat generalized, and the report therefore should be used only as a preliminary to more detailed field surveys to determine the in-place condition of the soil material at the site proposed for engineering construction.

Detailed information about the properties of all the soils in the county are given in the section "Descriptions of Soils." Some additional information useful to engineers can be obtained from the soil map and from other sections of the report, particularly, "General Soil Map" and "Soil Formation and Classification."

Some terms used in this report are used primarily by soil scientists, and some are used primarily by engineers. Definitions of selected terms are given in the Glossary at the back of this report.

Engineering tests and estimates

Information about engineering properties of soils and their interpretations are presented in tables 7 and 8. Table 7 lists the soils and gives a brief description of their estimated physical and chemical properties. Table 8 sets forth engineering interpretations of the soils of the county. Specific features or characteristics that may affect the selection, design, or application of treatment measures are listed, and suitability ratings for specific purposes are given. The listing of features and ratings is based on information in table 9, or actual test data, and on field experience.

Table 9 gives laboratory test data for 15 soil types that are extensive in the county and indicates their parent material and depth. It gives the results of tests for moisture density, mechanical analysis, liquid limit, and plasticity index. It also gives the classifications of the samples according to the system of the American Association of State Highway Officials and according to the Unified classification system, Corps of Engineers.

Engineering classification systems

The U.S. Department of Agriculture (USDA) system of classifying soil texture is used by agricultural scientists. In this system, classes of soil texture are based on different combinations of sand (2.0 millimeters to 0.05 millimeter in diameter), silt (0.05 to 0.002 millimeter in diameter), and clay (less than 0.002 millimeter in diameter). The classes in order of increasing proportions 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. Those with the term "sand" in the name are modified for very fine, fine, coarse, or very coarse sand. Gravelly refers to soils that contain gravel up to 3 inches in diameter, and stony, to soils that contain stones more than 10 inches in diameter.

In the Unified soil classification system,[8] which was developed by the U.S. Army Corps of Engineers, soil materials are identified as coarse grained (eight classes), fine grained (six classes), and highly organic. An approximate classification of soils by this system can be made in the field.

The American Association of State Highway Officials (AASHO) has developed a classification based on the field performance of soil materials.[9] In this system soil materials are placed in seven principal groups. The

[7] RICHARD AUSTIN, State conservation engineer, Soil Conservation Service, in consultation with Prof. R. D. Miles and P. T. Yeh, Joint Highway Research Project, School of Civil Engineering, Purdue University, assisted in preparing this section. The work performed by Purdue University was under a cooperative agreement with the Indiana State Highway Commission and the U.S. Department of Commerce, Bureau of Public Roads.

[8] WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS. THE UNIFIED SOIL CLASSIFICATION SYSTEM. v. 1, 30 pp., illus. 1953.

[9] AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 8, pt. 1, pp. 45–51, illus. Washington, D.C. 1961.

groups range from A–1, which consists of gravelly soils of high bearing capacity, to A–7, which consists of clay soils having low strength when wet. Within each group, the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. The group index number is shown in parentheses following the soil group symbol.

Engineering descriptions of the soils

Table 7 gives a brief description of the soils mapped in Owen County and their estimated physical and chemical properties. In this table the description of the soil properties is based on a typical profile for each soil mapped. The profile is divided into layers significant to engineering, according to depth, in inches, from the surface. The table also shows depth to the seasonally high water table and depth to bedrock. It gives the textural classification of the U.S. Department of Agriculture, of the Unified system, and of the American Association of State Highway Officials. In addition, the grain size, permeability, available water capacity, reaction, frost potential, and shrink-swell potential are estimated. A more complete description of each profile is given in the section "Descriptions of Soils."

In the column indicating depth to the seasonal water table, the highest annual level of the water table is given. Permeability is the rate, expressed in inches per hour, that water passes through a layer of undisturbed soil. The data are estimated from information from the Purdue University Agricultural Experiment Station, from estimated data previously assembled on the soils of Indiana, and from the observations and experience of soil scientists.

The available water capacity, expressed in inches per inch of soil depth, is the approximate amount of capillary water held in the soil when wet to field capacity. This amount of water will wet air-dry soil to a depth of 1 inch without deeper percolation. Because available water capacity is determined by horizons, the capacity of a particular horizon to deliver water to plant roots is dependent on whether the roots can reach that horizon. In soils with a fragipan or claypan, the roots of plants cannot pentrate the pan layer without some difficulty. Therefore, the horizons below the pan layer do not contribute to plants all of the water they can hold. This factor needs to be considered in figuring the total available water that can be held by a soil for the use of plants. The available water is determined from undisturbed soil cores. It was estimated from data furnished by the Purdue University Agricultural Experiment Station, from data published in the Indiana Drainage Guide, from test data made in the laboratories of the U.S. Department of Agriculture, and from the observations of soil scientists.

The column showing reaction gives the degree of acidity or alkalinity, expressed in pH values, of the different layers in the profile. Neutral soils have a pH value of 6.6 to 7.3. Values below 6.6 indicate an acid soil, and those above 7.3 indicate an alkaline soil.

The potential frost action is indicated by numbers from 1 to 5. If the potential is nonexistent or very slight, the rating is 1, and if it is very high, the rating is 5. In general, the silts and fine silty sands are the most susceptible to frost action. Coarse-grained material that contains little or no fines is affected only slightly, if at all. Clays (CL and CH) are subject to frost action, but the loss of strength of such material may not be so great as for silty soils. Fines with a low plasticity index are generally more susceptible than those with a high index.

The shrink-swell potential is an indication of the volume change to be expected of the soil material with a change in moisture content. It is determined primarily by the amount and type of clay. Soils with a high content of montmorillonite clay have the highest shrink-swell potential. Soils that have a high shrink-swell potential tend to crack when they are dry and heave when they are wet. In general, soils classified as CH and A–7 have a high shrink-swell potential. Sands and gravels having a small amount of slightly plastic fines, as well as most other nonplastic to slightly plastic soil material, have a low shrink-swell potential.

Engineering properties are not described for Gullied land, glacial drift; Gullied land, residuum; Muck; Riverwash; and Strip mines, because of the variability of their soil material.

Engineering interpretations

Table 8 rates the soils according to their suitability for use in the construction of highways and for general engineering purposes. It also gives features of the soils that affect their use for engineering practices that are effective in controlling erosion and runoff. Additional information about the relief of the county, the association of soils with other soils, the parent material, and the underlying rock material can be found in the section "Descriptions of Soils."

In the columns that show the suitability of the soil material as a source of topsoil, sand and gravel, and road fill, the ratings are expressed as *poor*, *fair*, or *good*. The suitability of the soil material for road fill depends largely on the texture of the soil material and its natural water content. Highly plastic soil materials with high natural water content are rated "poor." Highly erodible soils (silts and fine sands) are difficult to compact and require moderately gentle slopes and fast vegetation coverage. Therefore, they are rated "poor to fair."

Table 8 also gives the suitability of soils for certain agricultural and engineering structures and the features of the soils that affect those structures. A special engineering problem is encountered in the construction of water storage reservoirs. Sites for reservoirs where there is less than 5 feet of soil cover over gravel, a porous, sandy subsoil, or a cavernous or seamy substratum of limestone or shale should be avoided. Measures to correct these features are depositing and compacting a sealed layer of impervious material over the reservoir floor and up the face of the dam. The impervious material should be at least 12 inches thick, with an additional 1 inch per foot of water depth. Sites where springs, sinkholes, or seepage are common should be avoided or carefully investigated.

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TABLE 7.—*Brief description of the soils of Owen County,*

Map symbol	Soil name	Description of soil and site	Depth to seasonal water table	Depth to bedrock	Depth from surface
			Feet	*Feet*	*Inches*
At	Atkins silt loam.	Poorly drained soil formed in alluvium and subject to frequent overflow. About 30 inches or more of silty material underlain by stratified fine sand and silt; in some places layers of coarse sand and gravel are at a depth of 48 inches or more.	At surface to 1 foot below.	15 or more.	0–34 34–48 48–60+
GnA GnB GnB2 GnC GnC2 GoB3 GoC3	Ava silt loam, 0 to 2 percent slopes. Ava silt loam, 2 to 6 percent slopes. Ava silt loam, 2 to 6 percent slopes, moderately eroded. Ava silt loam, 6 to 12 percent slopes. Ava silt loam, 6 to 12 percent slopes, moderately eroded. Ava soils, 2 to 6 percent slopes, severely eroded. Ava soils, 6 to 12 percent slopes, severely eroded.	Soils developed in 10 to 48 inches of loess overlying material weathered from loam to clay loam till; 1½ to 2 feet of silt loam over a dense pan layer of mottled gray and brown silty clay loam; underlain by loam to clay loam till, which is calcareous at a depth of 10 to 12 feet.	Very deep.	20 to 50 or more; a few areas less than 10.	0–24 24–46 46–140+
AyA	Ayrshire loam, 0 to 2 percent slopes.	Imperfectly drained soil consisting of 1½ to 2 feet of loam underlain by 2 to 2½ feet of silty clay loam to clay loam; over calcareous, windblown coarse silt, fine sand, and fine sandy loam that extend to a depth of 8 feet or more.	2 or less.	15 or more.	0–21 21–52 52–80
BaA	Bartle silt loam, 0 to 2 percent slopes.	Imperfectly drained soil developed in old alluvial fans and subject to occasional overflow; 1 to 2 feet of silt loam over 2 to 3 feet of light silty clay loam; underlain by stratified silty clay loam, silt, and fine sand that extend to a depth of 8 feet or more.	2 or less.	15 or more.	0–36 36–50 50–70+
BvB2 BvC2 BvD2 BvE BwC3 BwD3	Bewleyville silt loam, 2 to 6 percent slopes, moderately eroded. Bewleyville silt loam, 6 to 12 percent slopes, moderately eroded. Bewleyville silt loam, 12 to 18 percent slopes, moderately eroded. Bewleyville silt loam, 18 to 25 percent slopes. Bewleyville soils, 6 to 12 percent slopes, severely eroded. Bewleyville soils, 12 to 18 percent slopes, severely eroded.	Well-drained soils developed in 18 to 48 inches of loess overlying material weathered from limestone. About 1 foot of brown silt loam underlain by 3 feet of dark-brown silty clay loam, which overlies very sticky and plastic, reddish cherty clay.	No water table.	4 to 8.	0–12 12–48 48–54
ByC ByD ByE	Bloomfield loamy fine sand, 6 to 12 percent slopes. Bloomfield loamy fine sand, 12 to 18 percent slopes. Bloomfield loamy fine sand, 18 to 35 percent slopes.	Excessively drained soils developed in windblown, calcareous fine sand; 2 to 3 feet of very permeable, nonplastic loamy fine sand over 2 to 4 feet of fine sand with thin bands ½ to 2 inches thick of sandy clay loam to fine sandy loam; underlain by calcareous fine sand.	Very deep.	20 or more.	0–30 30–78 78–100+

See footnotes at end of table.

Ind., and their estimated physical and chemical properties

Classification			Percentage passing sieve—			Permeability	Available water capacity	Reaction	Potential frost action	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4	No. 10	No. 200					
						Inches per hour	*Inches per inch of soil*	*pH value*		
Silt loam	CL or ML	A–4	100	99	74	0. 05–0. 2	0. 21	5. 6–6. 0	5	Low.
Silt loam, fine sandy loam.	CL or ML	A–4	100	98	78	0. 2–0. 8	. 20	5. 1–5. 5	4–5	Low.
Loam, silt loam, sand, gravel.	CL or ML	A–4	100	98	78	0. 8–2. 5	. 17	5. 6–6. 0	4–5	Low.
Silt loam to light silty clay loam.	OL or CL	A–4	96	94	75	0. 8–2. 5	. 20	5. 1–5. 5	3–5	Low to moderate.
Silty clay loam	CL	A–7	100	100	95	0. 2–0. 8	. 14	4. 5–5. 0	3–4	Moderate.
Loam to clay loam	CL	A–6	99	97	64	0. 8–2. 5	. 20	4. 5–5. 5	3–4	Moderate.
Loam	ML	A–4	100	98	74	0. 8–2. 5	. 16	5. 5–6. 6	3–5	Low.
Silty clay loam to clay loam.	CL	A–4	100	100	90	0. 05–0. 2	. 19	5. 6–6. 0	3–4	Moderate.
Silt, fine sandy loam, fine sand.	SM	A–2	100	95	28	0. 8–2. 5	. 16	6. 1–7. 4+	4	Low.
Silt loam	CL or ML	A–4	100	99	74	0. 05–0. 2	. 20	5. 1–5. 5	3–5	Low.
Silty clay loam	CL	A–4	100	100	90	0. 05–0. 2	. 19	4. 5–5. 0	3–4	Moderate.
Thin layers of silty clay loam, silt, and fine sand.	CL or ML	A–4	100	100	80	0. 2–0. 8	. 16	5. 6–6. 0	3–5	Moderate.
Silt loam	CL	A–4, A–6.	100	100	90	0. 8–2. 5	. 18	5. 6–6. 0	3–4	Moderate.
Silty clay loam	CH	A–7	100	99	88	0. 2–0. 8	. 17	5. 1–5. 5	3	High.
Clay	CH	A–7	100	99	87	0. 05–0. 2	. 17	5. 6–6. 0	3	High.
Loamy fine sand	SP	A–3	100	100	10	5. 0–10. 0	. 07	6. 1–6. 5	1	Low.
Fine sand to sandy clay loam.	SP or SM	A–2, A–3.	100	100	11	2. 5– 5. 0	. 08	5. 6–6. 0	1 or 4	Low.
Fine sand	SP or SM	A–3	100	100	10	10+	. 05	([1])	1	Low.

TABLE 7.—*Brief description of the soils of Owen County, Ind.,*

Map symbol	Soil name	Description of soil and site	Depth to seasonal water table	Depth to bedrock	Depth from surface
			Feet	*Feet*	*Inches*
CcB CcB2 CcC CcC2 CcD CcD2 CfB3 CfC3 CfD3 ChE ChE2	Cincinnati silt loam, 2 to 6 percent slopes. Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded. Cincinnati silt loam, 6 to 12 percent slopes. Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded. Cincinnati silt loam, 12 to 18 percent slopes. Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded. Cincinnati soils, 2 to 6 percent slopes, severely eroded. Cincinnati soils, 6 to 12 percent slopes, severely eroded. Cincinnati soils, 12 to 18 percent slopes, severely eroded. Cincinnati and Hickory silt loams, 18 to 25 percent slopes. Cincinnati and Hickory silt loams, 18 to 25 percent slopes, moderately eroded.	Well-drained soils developed in 10 to 48 inches of loess overlying material weathered from till. About 1 foot of brown silt loam underlain by about 2 feet of light silty clay loam, which overlies a somewhat dense, gray, streaked, silty layer that is about 2 feet thick; the underlying material consists of friable loam to clay loam till, which is calcareous at a depth of about 10 feet.	Very deep.	20–50 or more; small areas less than 10.	0–11 11–27 27–52 52–132+
CoD CoG	Corydon stony silt loam, 12 to 18 percent slopes. Corydon stony silt loam, 35 to 70 percent slopes.	Shallow soils developed in thin loess and material weathered from high-grade limestone; many outcrops of limestone throughout the area.	No water table.	Generally less than 1½.	0–9 9–15
DbA DbB DbB2	Dubois silt loam, 0 to 2 percent slopes. Dubois silt loam, 2 to 6 percent slopes. Dubois silt loam, 2 to 6 percent slopes, moderately eroded.	Imperfectly drained soils developed in 10 to 60 inches of loess and medium- to fine-textured material weathered from lacustrine material; 1½ to 2 feet of silt loam overlying 2 to 2½ feet of a very slowly permeable dense pan layer of silty clay loam; underlain by stratified layers of silty clay loam, silt loam, and fine sandy loam extending to a depth of 10 feet or more; seldom overflows, but generally wet until late in spring.	Perched water table at a depth of 3 feet or less.	20 to 50 or more.	0–20 20–42 42–120+
Es Em Et	Eel silt loam. Eel loam. Eel silty clay loam.	Moderately well drained bottom-land soils formed in alluvium consisting of 3 to 4 feet of loam or silt loam; underlain by stratified layers of sandy loam, loam, and silt loam, which is subject to occasional or frequent flooding. The entire profile is neutral to calcareous. The silty clay loam type is finer textured than the other types to a depth of about 2 feet.	More than 3.	15 or more; some small areas less than 5.	0–40 40–60+
Gm Gg	Genesee silt loam. Genesee loam.	Well-drained bottom-land soils formed in alluvium and subject to occasional overflow; 3 to 4 feet of loam or silt loam underlain by stratified layers that range from silt loam to fine sand; entire profile is neutral to calcareous.	More than 3½.	15 or more; some small areas less than 5.	0–42 42–63+
GrA	Grayford silt loam, 0 to 2 percent slopes.	Well-drained soils developed in 10 to 50 inches of loess over thin weathered	No water table.	3 to 8.	0–15 15–50

See footnotes at end of table.

and their estimated physical and chemical properties—Continued

Classification			Percentage passing sieve—			Permeability	Available water capacity	Reaction	Potential frost action	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4	No. 10	No. 200					
						Inches per hour	*Inches per inch of soil*	*pH value*		
Silt loam	OL or CL	A-4	96	94	65	0. 8-2. 5	0. 20	5. 6-6. 0	3-4	Low.
Silty clay loam	CL	A-7	98	97	74	0. 8-2. 5	. 15	5. 1-5. 5	3-4	Moderate.
Silt loam	CL	A-7	98	94	74	0. 05-0. 2	. 14	5. 1-5. 5	3-4	Moderate.
Loam to clay loam	CL	A-6	99	97	64	0. 8-2. 5	. 20	[2] 5. 6-6. 0	3-4	Moderate.
Silt loam	CL	A-6	100	99	90	0. 8- 2. 5	. 18	6. 6-7. 3	4	Moderate.
Silty clay loam	CL	A-6	100	100	92	0. 3- 0. 8	. 15	6. 6-7. 3+	3-4	Moderate.
Silt loam	CL or ML	A-4	100	85	85	0. 05- 0. 2	. 23	4. 5-5. 0	3-5	Low to moderate.
Silty clay loam	CL	A-7	100	100	95	<. 05	. 16	4. 5-5. 0	3-4	Moderate.
Silty clay loam, silt loam, fine sandy loam.	CL	A-6	99	98	71	0. 2- 0. 8	. 17	[3] 4. 5-5. 0	3-4	Moderate.
Silt loam to loam	CL or ML	A-4	100	99	74	0. 8- 2. 5	. 20	6. 6-7. 3	3-5	Low to moderate.
Silt loam, loam, sandy loam.	CL or ML	A-4	100	98	78	0. 8- 2. 5	. 20	6. 6-7. 3	3-5	Low to moderate.
Loam to silt loam	CL or ML	A-4	100	99	74	0. 8- 2. 5	. 20	6. 6-7. 3	3-5	Low to moderate.
Silt loam, fine sand, fine sandy loam.	CL or ML	A-4	100	98	78	0. 8- 2. 5	. 20	6. 6-7. 3	3-5	Low to moderate.
Silt loam	CL	A-4	96	89	60	0. 8- 2. 5	. 18	5. 6-6. 1	4	Moderate.
Silty clay loam	CL	A-6	100	98	84	0. 8- 2. 5	. 18	4. 5-5. 0	3-4	Moderate.

TABLE 7.—*Brief description of the soils of Owen County, Ind.,*

Map symbol	Soil name	Description of soil and site	Depth to seasonal water table	Depth to bedrock	Depth from surface
			Feet	*Feet*	*Inches*
GrB	Grayford silt loam, 2 to 6 percent slopes.	till, underlain by material weathered from limestone; 1 to 1½ feet of dark-brown silt loam overlying about 3 feet of dark-brown silty clay loam; underlain by a foot or more of reddish clay to silty clay; plastic and sticky.			50–60
GrB2	Grayford silt loam, 2 to 6 percent slopes, moderately eroded.				
GrC	Grayford silt loam, 6 to 12 percent slopes.				
GrC2	Grayford silt loam, 6 to 12 percent slopes, moderately eroded.				
GrD	Grayford silt loam, 12 to 18 percent slopes.				
GrD2	Grayford silt loam, 12 to 18 percent slopes, moderately eroded.				
GrE	Grayford silt loam, 18 to 25 percent slopes.				
GrE2	Grayford silt loam, 18 to 25 percent slopes, moderately eroded.				
GrF	Grayford silt loam, 25 to 35 percent slopes.				
GsB3	Grayford soils, 2 to 6 percent slopes, severely eroded.				
GsC3	Grayford soils, 6 to 12 percent slopes, severely eroded.				
GsD3	Grayford soils, 12 to 18 percent slopes, severely eroded.				
GsE3	Grayford soils, 18 to 25 percent slopes, severely eroded.				
HaA	Haubstadt silt loam, 0 to 2 percent slopes.	Moderately well drained soils developed in thin loess over material weathered from medium-textured lacustrine deposits. About 2 feet of friable, yellowish-brown silt loam overlying a slowly permeable, somewhat dense silt loam pan that is about 2 feet thick; beneath this layer is 1½ feet of slowly permeable silty clay loam; the underlying layers consist mainly of silty clay loam, clay loam, and silt, but there are a few layers of fine sand; generally calcareous at a depth of about 10 feet.	Very deep.	20 to 50 or more.	0–22
HaB	Haubstadt silt loam, 2 to 6 percent slopes.				22–36 36–53 53–83+
HaB2	Haubstadt silt loam, 2 to 6 percent slopes, moderately eroded.				
HaC2	Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded.				
HbB3	Haubstadt soils, 2 to 6 percent slopes, severely eroded.				
HbC3	Haubstadt soils, 6 to 12 percent slopes, severely eroded.				
HcF	Hickory silt loam, 25 to 35 percent slopes.	Well-drained soils developed in thin loess over loam to clay loam till. About 1 foot of brown, friable silt loam to loam overlying about 3 feet of yellowish-brown silty clay loam; underlain by loam to clay loam till; calcareous at a depth of 70 inches or less.	Very deep.	Predominantly more than 20; some areas more than 50; a few areas less than 6.	0–12 12–50 50–70+
HcF2	Hickory silt loam, 25 to 35 percent slopes, moderately eroded.				
HcG	Hickory silt loam, 35 to 70 percent slopes.				
HkE3	Hickory soils, 18 to 25 percent slopes, severely eroded.				
JoA	Johnsburg silt loam, 0 to 2 percent slopes.	Imperfectly drained soils developed in 30 to 48 inches of loess over material weathered from sandstone and shale. About 1½ to 2 feet of friable silt loam overlying about 3 feet of very slowly permeable silty clay loam or heavy silt loam; friable loam to sandy loam occurs between bedrock and the layers above; internal drainage is impeded by the fragipan.	Perched water table at a depth of 2 feet or less.	4 to 6.	0–19
JoB	Johnsburg silt loam, 2 to 6 percent slopes.				19–56
JoB2	Johnsburg silt loam, 2 to 6 percent slopes, moderately eroded.				56–62

See footnotes at end of table.

and their estimated physical and chemical properties—Continued

Classification			Percentage passing sieve—			Permeability	Available water capacity	Reaction	Potential frost action	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4	No. 10	No. 200					
						Inches per hour	*Inches per inch of soil*	*pH value*		
Clay to silty clay	CH	A-7	94	91	77	0. 05- 0. 2	0. 16	5. 6-6. 0	3	High.
Silt loam	CL or ML	A-4	100	100	95	0. 8- 2. 5	. 23	5. 1-5. 5	4	Low to moderate.
Silt loam	CL	A-6	100	100	87	0. 2- 0. 8	. 20	4. 5-5. 0	3-4	Moderate.
Silty clay loam	ML	A-7	100	100	94	0. 2- 0. 8	. 20	4. 5-5. 0	3-5	Moderate.
Clay loam, silty clay loam, and silt.	CL	A-6	100	100	78	0. 2- 0. 8	. 17	[2] 4. 5-5. 0	3-4	Moderate.
Silt loam	CL	A-4	96	89	09	0. 8- 2. 5	. 20	4. 5-5. 0	3-4	Moderate.
Silty clay loam	CL	A-7	100	100	95	0. 8- 2. 5	. 18	4. 5-5. 0	3-4	Moderate.
Loam to clay loam	CL	A-6	97	90	64	0. 8- 2. 5	. 17	[5] 5. 6-6. 0	3-4	Moderate.
Silt loam	CL	A-4	98	98	88	0. 8- 2. 5	. 22	5. 1-5. 5	4	Low to moderate.
Silty clay loam to silt loam.	CL	A-6	100	100	95	0. 05- 0. 2	. 14	4. 5-5. 0	3-4	Moderate.
Silt loam to sandy loam.	CL or ML	A-4	94	90	68	0. 8- 2. 5	. 16	4. 5-5. 0	3-5	Low to moderate.

TABLE 7.—*Brief description of the soils of Owen County Ind.,*

Map symbol	Soil name	Description of soil and site	Depth to seasonal water table	Depth to bedrock	Depth from surface
			Feet	*Feet*	*Inches*
La	Landes fine sandy loam.	Well-drained soils formed in alluvium and subject to overflow. About 1 foot of friable fine sandy loam underlain by layers of loam, loamy fine sand, and fine sandy loam to a depth of 4 feet or more; sand increases at a depth of about 4 feet; loose sand and gravel are at a depth of 4 feet in many places.	3½ or more.	15 or more.	0–12 12–48 48–55+
MaB2 MaC2 MaD2 MaE2 MdC3	Markland silt loam, 2 to 6 percent slopes, moderately eroded. Markland silt loam, 6 to 12 percent slopes, moderately eroded. Markland silt loam, 12 to 18 percent slopes, moderately eroded. Markland silt loam, 18 to 25 percent slopes, moderately eroded. Markland soils, 6 to 12 percent slopes, severely eroded.	Well-drained soils developed in fine-textured lacustrine clay that has a thin cap of loess. About 9 inches of friable silt loam overlying about 2 feet of slowly permeable silty clay; the underlying layers are calcareous silty clay with minor layers of silt and fine sand.	Very deep.	20 or more.	0–9 9–41 41–70+
MeA MeB2 MfA	Martinsville loam, 0 to 2 percent slopes. Martinsville loam, 2 to 6 percent slopes, moderately eroded. Martinsville silt loam, 0 to 2 percent slopes.	Well-drained soils developed in medium-textured outwash on terraces. About 1½ feet of friable silt loam to loam overlying about 3 feet of moderately permeable silty clay loam to sandy clay loam; underlain by stratified loamy sand, coarse sand, silt and fine gravel; calcareous at a depth of 3½ to 6½ feet.	4 or more.	Predominantly more than 20.	0–19 19–51 51–80 80+
MgA MgB2	McGary silt loam, 0 to 2 percent slopes. McGary silt loam, 2 to 6 percent slopes, moderately eroded.	Imperfectly drained soils developed in fine-textured lacustrine clay that has a thin cap of loess; 10 inches of gray, friable silt loam underlain by sticky, plastic silty clay to silty clay loam to a depth of about 3 feet; the underlying material consists of calcareous, stratified silty clay and some silt; does not overflow but has a high water table in spring.	2 or less.	Predominantly more than 20.	0–10 10–32 32+
Mh	Montgomery silty clay loam.	Very poorly drained, black, depressional soil formed in lacustrine lakebeds. About 1 foot of sticky, plastic silty clay loam underlain by about 4 feet of sticky, very plastic, gray silty clay; the underlying layers consist of silty clay, clay, and minor layers of silt and fine sand; often ponded.	Ponded.	Predominantly more than 20.	0–13 13–66 66+
MmD MmE MmF MmG	Muskingum stony silt loam, 12 to 18 percent slopes. Muskingum stony silt loam, 18 to 25 percent slopes. Muskingum stony silt loam, 25 to 35 percent slopes. Muskingum stony silt loam, 35 to 70 percent slopes.	Shallow soils developed in thin loess and material weathered from sandstone, siltstone, and shale; bedrock generally is at a depth of 1 to 1½ feet; outcrops of sandstone are common.	No water table.	Less than 2.	0–15 15+
NgE NgF NgG	Negley loam, 18 to 25 percent slopes. Negley loam, 25 to 35 percent slopes. Negley loam, 35 to 70 percent slopes.	Well-drained soils developed in sandy and gravelly outwash. About 4 feet of friable, permeable loam to fine sandy loam underlain by leached loamy fine sand and coarses and to a depth of about 10 feet; the under-	Very deep.	20 to 100 or more.	0–11 11–50 50–120

See footnotes at end of table.

and their estimated physical and chemical properties—Continued

Classification			Percentage passing sieve—			Permeability	Available water capacity	Reaction	Potential frost action	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4	No. 10	No. 200					
						Inches per hour	*Inches per inch of soil*	*pH value*		
Fine sandy loam	SM	A-2	95	80	28	2. 5- 5. 0	0. 13	6. 6-7. 3	4	Low.
Loam to fine sandy loam.	SM	A-2	95	80	28	0. 8- 2. 5	. 15	6. 6-7. 3	4	Low.
Loamy fine sand and fine sandy loam.	SW or SM	A-3	100	100	8	2. 5- 5. 0	. 13	(1)	1 or 4	Low.
Silt loam	CL	A-7	100	100	71	0. 8- 2. 5	. 20	4. 5-5. 0	4	Moderate.
Silty clay	CH or CL	A-7	100	100	94	0. 2- 0. 8	. 14	4. 5-5. 0	3-4	High.
Silty clay and silt loam	CL	A-6	100	99	95	0. 2- 0. 8	. 15	(1)	3-4	Moderate.
Silt loam to loam	CL or ML	A-4	100	100	90	0. 8- 2. 5	. 20	5. 6-6. 0	3-5	Low to moderate.
Silty clay loam to sandy clay loam.	CL	A-6	100	100	92	0. 8- 2. 5	. 18	5. 6-6. 0	3-4	Moderate.
Loamy sand and sandy clay loam.	SC or ML	A-6	100	100	50	0. 8- 2. 5	. 10	5. 6-6. 0	4-5	Low to moderate.
Sand, fine gravel, and silt.	SM or SC	A-2	100	100	29	2. 5- 5. 0	. 05	(1)	4	Low.
Silt loam	CL	A-7	100	100	71	0. 8- 2. 5	. 20	6. 6-7. 3	3-4	Moderate.
Silty clay to silty clay loam.	CH or CL	A-7	100	100	94	<0. 05	. 14	5. 6-6. 0	3-4	Moderate to high.
Silty clay and silt	CL	A-7	100	99	98	0. 05- 0. 2	. 15	(1)	3-4	Moderate.
Silty clay loam	OL, CH or CL	A-7	100	100	94	0. 05- 0. 2	. 15	6. 6-7. 3	3-4	High.
Silty clay	CH	A-7	100	100	79	<0. 5	. 14	6. 6-7. 3	3	High.
Silty clay to clay	CH	A-7	100	100	79	<0. 5	. 14	(1)	3	High.
Stony silt loam to loam.	CL	A-4	98	98	88	0. 8- 2. 5	. 20	5. 1-5. 6	4	Low to moderate.
Sandstone and shale bedrock.	------	------	------	------	------	------	------	------	------	
Loam	ML or CL	A-4	100	100	74	0. 8-2. 5	. 17	4. 5-5. 0	3-5	Low to moderate.
Fine sandy loam to sandy loam.	SM	A-2	100	90	28	0. 8-2. 5	. 13	4. 5-5. 0	4	Low.
Loamy fine sand and coarse sand.	SW or SM	A-3	100	100	6	5. 0-10. 0	. 05	4. 5-5. 0	1 or 4	Low.

TABLE 7.—*Brief description of the soils of Owen County, Ind.,*

Map symbol	Soil name	Description of soil and site	Depth to seasonal water table	Depth to bedrock	Depth from surface
			Feet	*Feet*	*Inches*
NmE NmE2 NsE3	Negley silt loam, 18 to 25 percent slopes. Negley silt loam, 18 to 25 percent slopes, moderately eroded. Negley soils, 18 to 25 percent slopes, severely eroded.	lying strata consist of calcareous coarse sand and fine gravel.			120+
Nv	Nineveh loam.	Well-drained soil developed in medium-textured outwash underlain by loose, calcareous gravel and sand at a depth of 42 inches or less. About 1 foot of friable loam underlain by about 2 feet of clay loam to gravelly clay loam; the underlying strata consist of loose, calcareous sand and gravel.	4 or more.	20 or more.	0–8 8–34 34+
OcA OkA	Ockley loam, 0 to 2 percent slopes. Ockley silt loam, 0 to 2 percent slopes.	Well-drained soils developed in medium-textured outwash underlain by loose, calcareous gravel and sand at a depth of 3½ to 6 feet. The upper layer consists of 1 to 2 feet of friable, permeable loam to silt loam underlain by 3 to 4 feet of clay loam; the underlying strata consist of loose, calcareous gravel and sand.	5 or more.	20 or more.	0–28 28–62 62+
OmA OmB OmB2 OmC OmC2 OmD OmD2 OmE OmE2 OtF OtG OwC3 OwD3 OwE3	Otwell silt loam 0 to 2 percent slopes. Otwell silt loam, 2 to 6 percent slopes. Otwell silt loam, 2 to 6 percent slopes, moderately eroded. Otwell silt loam, 6 to 12 percent slopes. Otwell silt loam, 6 to 12 percent slopes, moderately eroded. Otwell silt loam, 12 to 18 percent slopes. Otwell silt loam, 12 to 18 percent slopes, moderately eroded. Otwell silt loam, 18 to 25 percent slopes. Otwell silt loam, 18 to 25 percent slopes, moderately eroded. Otwell silt loam, calcareous substratum, 25 to 35 percent slopes. Otwell silt loam, calcareous substratum, 35 to 70 percent slopes. Otwell soils, 6 to 12 percent slopes, severely eroded. Otwell soils, 12 to 18 percent slopes, severely eroded. Otwell soils, 18 to 25 percent slopes, severely eroded.	Well-drained soils developed in thin loessal deposits overlying material weathered from medium-textured lacustrine deposits. About 1½ feet of friable silt loam overlying 2 to 3 feet of silty clay that has moderately slow permeability; the underlying strata consist of stratified silty clay loam, clay loam, and silt with minor lenses of fine sand. The calcareous substratum phase has a moderately permeable profile and is calcareous at a depth of 2½ to 4 feet.	Very deep.	20 to 100 or more; a few areas less than 10.	0–15 15–42 42–160
PaB PaB2 PaC PaC2 PaD	Parke silt loam, 2 to 6 percent slopes. Parke silt loam, 2 to 6 percent slopes, moderately eroded. Parke silt loam, 6 to 12 percent slopes. Parke silt loam, 6 to 12 percent slopes, moderately eroded. Parke silt loam, 12 to 18 percent slopes.	Well-drained soils developed in thin loessal deposits overlying material weathered from medium-textured outwash. About 1½ feet of friable silt loam over firm to friable silty clay loam to sandy clay loam that is 4 to 6 feet thick; the underlying material is stratified sand and gravel that is generally calcareous at a depth of about 10 feet.	Very deep.	20 to 100 or more.	0–18 18–80 80–120+

See footnotes at end of table.

and their estimated physical and chemical properties—Continued

Classification			Percentage passing sieve—			Permeability	Available water capacity	Reaction	Potential frost action	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4	No. 10	No. 200					
						Inches per hour	*Inches per inch of soil*	*pH value*		
Fine gravel and coarse sand.	SW or SM	A-3	50	50	6	10+	0.04	(1)	1	Low.
Loam	ML or CL	A-4	100	100	74	0.8-2.5	.17	6.6-7.3	3-5	Low.
Clay loam to gravelly clay loam.	SC	A-6	90	90	38	0.8-2.5	.12	6.6-7.3	4	Moderate.
Sand and gravel	SW	A-1	50	50	5	------------	.04	(1)	1	Low.
Loam to silt loam	ML or CL	A-4	100	100	74	0.8-2.5	.17	5.6-6.0	3-5	Low to moderate.
Clay loam	SC	A-6	100	90	38	0.8-2.5	.15	5.6-6.0	4	Moderate.
Gravel and coarse sand	GP	A-1	50	50	5	10+	.04	(1)	1	Low.
Silt loam	CL or ML	A-4	100	100	95	0.8-2.5	.23	4.5-5.0	3-5	Low to moderate.
Silty clay loam	ML	A-7	100	100	87	0.2-0.8	.20	4.5-5.0	3-5	Moderate.
Clay loam, silty clay loam, and silt.	CL	A-6	100	100	78	0.2-0.8	.17	[2] 4.5-5.0	3-4	Moderate.
Silt loam	CL or ML	A-4	100	100	90	0.8-2.5	.20	5.1-5.5	3-5	Low to moderate.
Silty clay loam to sandy clay loam.	CL	A-6	100	100	93	0.8-2.5	.18	4.5-5.0	3-4	Moderate.
Sand, fine gravel	SW	A-3	90	80	5	10+	.04	[2] 5.1-5.5	1	Low.

TABLE 7.—*Brief description of the soils of Owen County, Ind.,*

Map symbol	Soil name	Description of soil and site	Depth to seasonal water table	Depth to bedrock	Depth from surface
			Feet	*Feet*	*Inches*
PaD2	Parke silt loam, 12 to 18 percent slopes, moderately eroded.				
PcB3	Parke soils, 2 to 6 percent slopes, severely eroded.				
PcC3	Parke soils, 6 to 12 percent slopes, severely eroded.				
PcD3	Parke soils, 12 to 18 percent slopes, severely eroded.				
Ph	Philo silt loam.	Moderately well drained soil formed in alluvium and subject to occasional to frequent overflow; 3 to 4 feet of friable silt loam or loam; the underlying layers below a depth of 4 feet may be sandy and stony.	More than 3.	15 or more; in a few places less than 5.	0–39 39+
PkA	Pike silt loam, 0 to 2 percent slopes.	Well-drained soils developed in shallow loess, 3½ feet or more thick, overlying material weathered from medium-textured outwash. About 1½ feet of friable silt loam over 5 to 8 feet of firm to friable silty clay loam to loam; the underlying material is stratified sand and gravel and is generally calcareous at a depth of about 10 feet.	Very deep.	20 to 100 or more.	0–15 15–103 103–144 144+
PkB2	Pike silt loam, 2 to 6 percent slopes, moderately eroded.				
Po	Pope loam.	Well-drained soils formed in alluvium and subject to occasional to frequent overflow. About 3 to 4 feet of friable silt loam to loam; in places the underlying material below a depth of 4 feet is sandy and stony.	More than 3½.	15 or more; in a few places less than 5.	0–42 42+
Pp	Pope silt loam.				
PrB	Princeton fine sandy loam, 2 to 6 percent slopes.	Well-drained soils developed in windblown sand and silt. About 1 to 1½ feet of friable fine sandy loam over 1 to 2 feet of sandy clay loam, which overlies friable fine sandy loam; the substratum consists of windblown, calcareous fine sand and coarse silt, which generally are 3 to 6 feet below the surface.	Very deep.	20 or more.	0–14 14–30 30–72 72+
PrC	Princeton fine sandy loam, 6 to 12 percent slopes.				
PrC2	Princeton fine sandy loam, 6 to 12 percent slopes, moderately eroded.				
PrD2	Princeton fine sandy loam, 12 to 18 percent slopes, moderately eroded.				
PrE2	Princeton fine sandy loam, 18 to 25 percent slopes, moderately eroded.				
Ro	Robinson silt loam.	Poorly drained soils developed in thin loessal deposits over material weathered from medium-textured lacustrine deposits. About 2 feet of friable silt loam over a dense pan layer of silty clay loam that is about 2 feet thick; the underlying strata consist of stratified clay loam, silty clay loam, silt loam, and thin layers of fine sandy loam; calcareous at a depth of 10 feet or more.	Less than 2 feet to ponded.	20 or more.	0–20 20–42 42–70+
Sh	Shoals loam.	Imperfectly drained soils formed in alluvium and subject to occasional	Less than 2.	15 or more.	0–30
Sm	Shoals silt loam.				

See footnote at end of table.

and their estimated physical and chemical properties—Continued

Classification			Percentage passing sieve—			Permeability	Available water capacity	Reaction	Potential frost action	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4	No. 10	No. 200					
						Inches per hour	*Inches per inch of soil*	*pH value*		
Silt loam and loam	CL or ML	A–4	100	99	74	0. 8– 2. 5	0. 20	5. 1–5. 6	4–5	Low.
Silt loam and loam	CL or ML	A–4	100	100	78	0. 8– 2. 5	. 20	5. 1–5. 6	4–5	Low.
Silt loam	CL or ML	A–4	100	100	90	0. 8– 2. 5	. 20	5. 1–5. 5	4–5	Low to moderate.
Silty clay loam, sandy clay loam, and loam.	CL	A–6	100	100	83	0. 8– 2. 5	. 18	5. 1–5. 5	3–4	Moderate.
Sandy clay loam, gravelly loam, and sand.	SC	A–2	100	100	29	0. 8– 2. 5	. 10	5. 6–6. 0	4	Low.
Sand and fine gravel	SW	A–2	90	50	5	10 +	. 04	(1)	1	Low.
Loam to silt loam	CL or ML	A–4	100	99	74	0. 8– 2. 5	. 20	5. 1–5. 5	4–5	Low.
Loam to silt loam	CL or ML	A–4	100	99	74	0. 8– 2. 5	. 20	5. 1–5. 5	4–5	Low.
Fine sandy loam	SM	A–2	100	100	28	2. 5– 5. 0	. 13	5. 6–6. 0	4	Low.
Sandy clay loam	SM	A–2	100	100	28	0. 8– 2. 5	. 15	5. 6–6. 0	4	Low.
Fine sandy loam	SM	A–2	100	100	13	2. 5– 5. 0	. 13	5. 6–6. 0	4	Low.
Fine sand and silt	SW or SM	A–3	100	100	10	5. 0–10. 0	. 08	(1)	1 and 4	Low.
Silt loam	CL or ML	A–4	100	99	85	0. 05– 0. 2	. 21	4. 5–5. 0	4–5	Low.
Silty clay loam	CL	A–7	100	100	95	<. 05	. 16	4. 5–5. 0	3–4	Moderate.
Clay loam, silty clay loam, and silt loam.	CL	A–6	99	98	71	0. 2– 0. 8	. 17	4. 5–5. 0	3–4	Moderate.
Silt loam, loam, and silty clay loam.	ML or CL	A–4	100	99	74	0. 2– 0. 8	. 20	6. 6–7. 3	4–5	Low to moderate.

TABLE 7.—*Brief description of the soils of Owen County, Ind.,*

Map symbol	Soil name	Description of soil and site	Depth to seasonal water table	Depth to bedrock	Depth from surface
			Feet	*Feet*	*Inches*
Sn	Shoals silty clay loam.	to frequent overflow. About 2 to 3 feet of friable silt loam to loam; the underlying layers contain more sand and in many places have layers of gravel and sand below a depth of 4 to 5 feet.			30–40+
So	Stendal silt loam.	Imperfectly drained soil formed in alluvium and subject to occasional to frequent overflow. About 4 feet of silt loam over layers of silt, sand, and loam; stony in places.	Less than 2.	15 or more; in places less than 5.	0–48 48+
Ta	Taggart silt loam.	Imperfectly drained soil developed in thin loess overlying material weathered from medium-textured outwash. About 1 foot of friable silt loam over a sticky layer of silty clay loam that is about 3 feet thick; the underlying material consists of silty clay loam to loamy sand to a depth of 8 to 10 feet; underlain by loose, calcareous sand and fine gravel.	Perched water table at a depth of less than 2 feet.	20 to 100 or more.	0–10 10–50 50–86+
TsA TsB TsB2 TsC2 TtB3	Tilsit silt loam, 0 to 2 percent slopes. Tilsit silt loam, 2 to 6 percent slopes. Tilsit silt loam, 2 to 6 percent slopes, moderately eroded. Tilsit silt loam, 6 to 12 percent slopes, moderately eroded. Tilsit soils, 2 to 6 percent slopes, severely eroded.	Moderately well drained soils developed in 2½ to 4 feet of loess over material weathered from sandstone and shale. About 2 feet of silt loam to light silty clay loam over a dense pan layer of silt loam that is somewhat impervious to water; beneath this layer is friable loam to sandy loam.	No water table.	4 to 6.	0–16 16–28 28–55 55–66
VgA VgB VgB2	Vigo silt loam, 0 to 2 percent slopes. Vigo silt loam, 2 to 6 percent slopes. Vigo silt loam, 2 to 6 percent slopes, moderately eroded.	Imperfectly drained soils developed in 40 to 60 inches of loess over weathered till. About 2 feet of friable silt loam over a dense, very slowly permeable pan of silty clay loam that is about 2 feet thick; the underlying material is friable loam till; calcareous at a depth of about 10 to 12 feet.	Perched water table above 2 feet.	20 to 50 or more.	0–23 23–50 50–144+
Vn	Vincennes silt loam.	Very poorly drained soil developed on stream terraces. About 1 to 1½ feet of friable silt loam overlying 2 to 3 feet of sticky, slowly permeable silty clay loam; the underlying strata consist of stratified clay loam, silty clay loam, and loam; subject to occasional overflow or ponding.	More than 1 foot to ponded.	15 or more.	0–15 15–40 40+
WmC WmC2 WmD WmD2 WmE	Wellston silt loam, 6 to 12 percent slopes. Wellston silt loam, 6 to 12 percent slopes, moderately eroded. Wellston silt loam, 12 to 18 percent slopes. Wellston silt loam, 12 to 18 percent slopes, moderately eroded. Wellston silt loam, 18 to 25 percent slopes.	Well-drained soils developed in thin loess and material weathered from sandstone and shale. About 1 foot of friable silt loam over 1 to 2 feet of silty clay loam to silt loam; bedrock is at a depth of 2 to 3 feet; small areas within the Wellston and Muskingum units are only 1 foot or less deep over bedrock.	No water table.	2 to 3.	0–9 9–35 35+

See footnotes at end of table.

and their estimated physical and chemical properties—Continued

Classification			Percentage passing sieve—			Permeability	Available water capacity	Reaction	Potential frost action	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4	No. 10	No. 200					
						Inches per hour	*Inches per inch of soil*	*pH value*		
Silt loam to fine sandy loam.	CL or ML	A–4	99	98	78	0. 8– 2. 5	0. 20	6. 6–7. 3	4–5	Low to moderate.
Silt loam	ML or CL	A–4	100	99	74	0. 2– 0. 8	. 20	5. 1–5. 5	4–5	Low.
Silt, sand, and loam	ML	A–4	99	98	78	0. 8– 2. 5	. 20	5. 1–5. 5	4–5	Low.
Silt loam	CL or ML	A–4	100	100	90	0. 2– 0. 8	. 21	5. 1–5. 5	4–5	Low to moderate.
Silty clay loam	CL or CH	A–6, A–7	100	100	93	0. 05– 0. 2	. 18	5. 1–5. 5	3–4	Moderate.
Silty clay loam to loamy sand.	CL or ML	A–4	100	100	90	0. 2– 0. 8	. 18	[6] 5. 1–5. 5	4–5	Low to moderate.
Silt loam	CL	A–4	98	98	88	0. 8– 2. 5	. 22	4. 5–5. 0	3–4	Low.
Silty clay loam	CL	A–6	100	100	90	0. 8– 2. 5	. 20	4. 5–5. 0	3–4	Moderate.
Silt loam	CL	A–4	95	92	67	0. 05– 0. 2	. 14	< 4. 5	3–4	Moderate.
Loam	CL or ML	A–4	94	90	68	0. 8– 2. 5	. 16	< 4. 5	4–5	Low to moderate.
Silt loam	CL	A–4	100	99	81	0. 05– 0. 2	. 21	4. 5–5. 0	3–4	Low to moderate.
Silty clay loam	CH or CL	A–7	100	99	87	<0. 05	. 16	4. 5–5. 0	3	High.
Loam	CL	A–6	99	97	71	0. 8– 2. 5	. 14	[4] 5. 6–6. 0	3–4	Moderate.
Silt loam	CL or ML	A–4	100	99	85	0. 2– 0. 8	. 21	6. 6–7. 3	4–5	Low to moderate.
Silty clay loam	CL or CH	A–6, A–7	100	100	96	0. 05– 0. 2	. 13	5. 6–6. 0	3–4	Moderate.
Clay loam, silty clay loam, and loam.	CL	A–6	100	100	78	0. 05– 0. 2	. 13	[7] 5. 6–6. 0	3–4	Moderate.
Silt loam	CL	A–4	100	98	81	0. 8– 2. 5	. 21	5. 1–5. 5	3–4	Low to moderate.
Silty clay loam to silt loam.	CL	A–6	100	100	85	0. 8– 2. 5	. 16	5. 1–5. 5	3–4	Moderate.
Bedrock										

TABLE 7.—*Brief description of the soils of Owen County, Ind.,*

Map symbol	Soil name	Description of soil and site	Depth to seasonal water table	Depth to bedrock	Depth from surface
			Feet	*Feet*	*Inches*
WmE2	Wellston silt loam, 18 to 25 percent slopes, moderately eroded.				
WnC3	Wellston soils, 6 to 12 percent slopes, severely eroded.				
WnD3	Wellston soils, 12 to 18 percent slopes, severely eroded.				
WnE3	Wellston soils, 18 to 25 percent slopes, severely eroded.				
WoF	Wellston and Muskingum soils, 25 to 35 percent slopes.				
WoF2	Wellston and Muskingum soils, 25 to 35 percent slopes, moderately eroded.				
WoG	Wellston and Muskingum soils, 35 to 70 percent slopes.				
Wt	Whitaker silt loam.	Imperfectly drained soil developed in medium-textured outwash. About 1 to 1½ feet of friable silt loam over about 3 feet of sticky silty clay loam; the underlying material below a depth of 5 feet is calcareous stratified silt, fine sand, and some clay and gravel.	Less than 2.	20 or more.	0–15 15–60 60–80+
ZaB	Zanesville silt loam, 2 to 6 percent slopes.	Well-drained soils developed in 18 to 48 inches of loess over material weathered from sandstone and shale. About 1½ to 2 feet of friable silt loam underlain by a dense, somewhat impervious pan of silt loam to silty clay loam that is 2 to 3 feet thick; a layer of friable loam to sandy loam, ½ to 1½ feet thick is between the pan and bedrock.	No water table.	4 to 8.	0–22 22–52 52–66 66+
ZaB2	Zanesville silt loam, 2 to 6 percent slopes, moderately eroded.				
ZaC	Zanesville silt loam, 6 to 12 percent slopes.				
ZaC2	Zanesville silt loam, 6 to 12 percent slopes, moderately eroded.				
ZaD	Zanesville silt loam, 12 to 18 percent slopes.				
ZaD2	Zanesville silt loam, 12 to 18 percent slopes, moderately eroded.				
ZaE	Zanesville silt loam, 18 to 25 percent slopes.				
ZaE2	Zanesville silt loam, 18 to 25 percent slopes, moderately eroded.				
ZnB3	Zanesville soils, 2 to 6 percent slopes, severely eroded.				
ZnC3	Zanesville soils, 6 to 12 percent slopes, severely eroded.				
ZnD3	Zanesville soils, 12 to 18 percent slopes, severely eroded.				
Zp	Zipp silty clay loam.	Very poorly drained depressional soil formed in fine-textured lacustrine lakebeds. About 1 foot of sticky, plastic silty clay loam underlain by very sticky, very plastic silty clay that is 4 to 5 feet thick; the substratum is stratified silty clay, silty clay loam, and silt; subject to overflow.	Ponded.	20 or more.	0–15 15–68 68+

[1] Calcareous.
[2] Calcareous below a depth of 10 feet.
[3] Calcareous in lower part.
[4] Calcareous at a depth of 10 to 12 feet.

and their estimated physical and chemical properties—Continued

Classification			Percentage passing sieve—			Permeability	Available water capacity	Reaction	Potential frost action	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4	No. 10	No. 200					
						Inches per hour	*Inches per inch of soil*	*pH value*		
Silt loam	CL	A-4	100	98	81	0. 2–0. 8	0. 20	5. 6–6. 0	3–4	Low to moderate.
Silty clay loam	CL or CH	A-6 or A-7	100	100	93	0. 2–0. 8	. 16	5. 6–6. 0	3–4	Moderate.
Silt, fine sand, some gravel and clay.	ML or CL	A-4	100	95	80	0. 8–2. 5	. 14	(1)	4–5	Low.
Silt loam	CL	A-4	98	98	88	0. 8–2. 5	. 22	4. 5–5. 0	3–4	Low.
Silt loam to silty clay loam.	CL	A-7	100	100	92	0. 05–0. 2	. 14	4. 5–5. 0	3–4	Moderate.
Loam to sandy loam	CL	A-6	99	99	88	0. 8–2. 5	. 16	4. 5–5. 0	3–4	Low to moderate.
Bedrock										
Silty clay loam	MH or OH	A-7	100	100	92	0. 05– 0. 20	. 15	6. 6–7. 3	3–5	High.
Silty clay	CH	A-7	100	100	79	<0. 05	. 14	6. 6–7. 3	3	High.
Silty clay	CH	A-7	100	100	79	<0. 05	. 14	6. 6–7. 3	3	High.

[5] Calcareous at a depth of 70 inches.
[6] The pH is 6.1 to 6.5 at a depth of 86 inches; calcareous below a depth of 10 feet.
[7] Neutral at a depth of 70 inches.

TABLE 8.—*Interpretations of engineering*

Soil series and map symbol	Suitability as a source of—			Suitability of soils and features affecting engineering practices for—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds: Reservoir area
Atkins (At)	Poor	In places layers of sand and gravel are below a depth of 4 feet.	Fair	High water table; susceptible to heaving by frost.	Not suitable
Ava (GnA, GnB, GnB2, GnC, GnC2, GoB3, GoC3).	Good	None present	Fair	Suitable material	Good; very little seepage.
Ayrshire (AyA)	Fair	Poor	Fair	Perched water table	Generally not suitable, because of rapidly permeable substratum layers.
Bartle (BaA)	Fair	Unsuitable	Fair	High water table; susceptible to heaving by frost.	Subject to seepage; lenses of fine sand in substratum.
Bewleyville (BvB2, BvC2, BvD2, BvE, BwC3, BwD3).	Fair	None present	Poor to fair.	Bedrock at a depth of 4 to 8 feet.	Generally not suitable; water seeps out through channels in the underlying limestone.
Bloomfield (ByC, ByD, ByE).	Poor	Fair; some interbedded sand.	Good	Deep sand	Rapidly permeable; not suitable.
Cincinnati (CcB, CcB2, CcC, CcC2, CcD, CcD2, CfB3, CfC3, CfD3, ChE, ChE2).	Fair	None present	Fair	Suitable material; must be protected as subjected to pumping action.	Good; very little seepage; stable material.
Corydon (CoD, CoG)	Unsuitable; too shallow and stony.	None present	Fair; bedrock too near surface.	Bedrock near surface	Not suitable; shallow to limestone bedrock.
Dubois (DbA, DbB, DbB2).	Fair	None present	Fair	High water table; susceptible to frost.	Good; very little seepage; good material.
Eel (Em, Es, Et)	Good	Some stratified sand and gravel in places below a depth of 4 feet.	Fair	Subject to flooding	Not suitable
Genesee (Gg, Gm)	Good	Some stratified sand and gravel in places below a depth of 4 feet.	Fair	Subject to flooding	Not suitable
Grayford (GrA, GrB, GrB2, GrC, GrC2, GrD, GrD2, GrE, GrE2, GrF, GsB3, GsC3, GsD3, GsE3).	Good	None present	Fair	Numerous sinkholes; irregular topography.	Generally not suitable; water seeps out through channels in underlying limestone.
Haubstadt (HaA, HaB, HaB2, HaC2, HbB3, HbC3).	Good	None present	Fair	Suitable material	Good material; no seepage problem.
Hickory (HcF, HcF2, HcG, HkE3).	Good	None present	Fair	Unstable slopes	Good material; no seepage problem.
Johnsburg (JoA, JoB, JoB2).	Fair	None present	Fair	Susceptible to heaving by frost; perched water table; 4 to 6 feet to bedrock.	Satisfactory for shallow ponds; may encounter bedrock.
Landes (La)	Poor	Some stratified sand and fine gravel in places below a depth of 4 feet.	Good	Flooding	Not suitable
Markland (MaB2, MaC2, MaD2, MaE2, MdC3).	Fair	None present	Poor to fair	Plastic soil material	Satisfactory
Martinsville (MeA, MeB2, MfA).	Good	Minor amounts of stratified sand below a depth of 5 to 6 feet.	Fair to good	Suitable material	Rapidly permeable layers in substratum; seepage a problem.

See footnote at end of table.

properties of soils in Owen County

Suitability of soils and features affecting engineering practices for—Continued				
Farm ponds—Continued: Embankment	Agricultural drainage	Terraces and diversions	Waterways	Septic tank [1] disposal field
Not suitable	High water table; use surface drainage; outlets for tile generally inadequate.	Not needed	Not needed	Not suitable; high water table.
Stable; impervious cores and blankets.	Not needed	Suitable	Suitable	2; moderately slow in permeability.
Suitable when horizons are mixed.	Tile drainage generally needed along with surface drains.	Not needed	Not needed	4; high water table.
High percentage of silt; poor stability.	High water table; needs surface and subsurface drainage.	Not needed	Not needed	4; high water table.
Fair stability; cracks when dry because of high clay content.	Not needed	Suitable if not too severely eroded or too steep for these practices.	Suitable; avoid cutting too deep into clay substratum.	2; avoid areas shallow to bedrock.
Rapidly permeable; not suitable.	Rapidly permeable; drainage not needed.	Not needed	Suitable if not too steep.	1.
Stable; impervious cores and blankets.	Not needed	Suitable in places not too severely eroded or too steep for these practices.	Suitable; favorable material for waterways.	1.
Not suitable	Not needed	Not suitable; shallow to bedrock.	Not suitable; shallow to bedrock.	Not suitable; shallow to bedrock.
Stable; impervious cores and blankets.	High water table; surface and subsurface drainage needed.	Not needed	Satisfactory material for waterways.	4; high water table.
Not suitable	Permeable material; drains satisfactorily with subsurface drainage.	Not needed	Suitable for drainageways.	Not suitable; subject to flooding.
Not suitable	Not needed	Not needed	Not needed	Not suitable; subject to flooding.
Stable; impervious cores and blankets.	Not needed	Irregular topography; generally not suitable.	Soils suitable but topography is irregular.	1.
Stable; impervious cores and blankets.	Not needed	Suitable	Suitable	2; subsoil moderately slow in permeability.
Stable; impervious cores and blankets.	Not needed	Topography too steep; not needed.	Not needed; steep topography.	1.
Stable; impervious cores and blankets.	High water table; surface drains needed; slowly permeable subsoil; questionable for tiling.	Not needed	Not needed	4; high water table; slowly permeable pan.
Not suitable	Not needed	Not needed	Not needed	Not suitable; subject to flooding.
Stable; impervious cores and blankets.	Not needed	Not needed; soil areas too small; slopes too short.	Suitable	2; subsoil moderately slow in permeability.
Stable; impervious cores and blankets if horizons are mixed.	Not needed	Suitable on slopes of 2 to 6 percent.	Suitable on slopes of 2 to 6 percent.	1.

TABLE 8.—*Interpretations of engineering*

Soil series and map symbol	Suitability as a source of— Topsoil	Suitability as a source of— Sand and gravel	Suitability as a source of— Road fill	Suitability of soils and features affecting engineering practices for— Highway location	Suitability of soils and features affecting engineering practices for— Farm ponds: Reservoir area
McGary (MgA, MgB2)	Fair	None present	Poor to fair	High water table; plastic soil material.	Satisfactory; no seepage problem.
Montgomery (Mh)	Poor	None present	Poor	High water table; subject to ponding.	Very slowly permeable material; no seepage problem.
Muskingum (MmD, MmE, MmF, MmG).	Poor	None present	Fair; shallow to bedrock.	Shallow to bedrock	Not suitable; shallow to bedrock.
Negley (NgE, NgF, NgG, NmE, NmE2, NsE3).	Fair	Good; stratified sand with some gravel below a depth of 10 to 12 feet.	Good	Unstable slopes	Not suitable; rapidly permeable substratum.
Nineveh (Nv)	Fair	Good; thick beds of gravel and sand.	Good	Suitable material	Not suitable; rapidly permeable substratum.
Ockley (OcA, OkA)	Good	Good; thick beds of gravel and sand below a depth of about 4 feet.	Fair to good	Suitable material	Not suitable; rapidly permeable substratum.
Otwell (OmA, OmB, OmB2, OmC, OmC2, OmD, OmD2, OmE, OmE2, OtF, OtG, OwC3, OwD3, OwE3).	Good	None present	Fair	Suitable material	Good; no seepage problem.
Parke (PaB, PaB2, PaC, PaC2, PaD, PaD2, PcB3, PcC3, PcD3).	Good	Good; stratified sand with some gravel below a depth of 10 to 12 feet.	Fair to good	Suitable material	Not suitable; underlying material rapidly permeable.
Philo (Ph)	Good	None present	Fair	Flooding	Not suitable
Pike (PkA, PkB2)	Good	Good; stratified sand with some gravel at a depth of 10 to 12 feet.	Fair to good	Suitable material	Not suitable; underlying material rapidly permeable.
Pope (Po, Pp)	Good	None present	Fair	Flooding	Not suitable
Princeton (PrB, PrC, PrC2, PrD2, PrE2).	Fair	Poor; minor amounts of stratified sand.	Good	Suitable material	Not suitable; some layers of substratum rapidly permeable; subject to seepage.
Robinson (Ro)	Poor	None present	Fair	High water table; frost hazard.	Very slowly permeable material; no seepage problem.
Shoals (Sh, Sm, Sn)	Fair	Some stratified sand and fine gravel in places below a depth of 4 feet.	Fair	Flooding and high water table; susceptible to frost.	Not suitable
Stendal (So)	Fair	None present	Fair	Flooding and high water table.	Not suitable
Taggart (Ta)	Fair	Good; stratified sand and some gravel below a depth of 10 to 12 feet.	Fair	High water table	Underlying layers rapidly permeable; seepage problem.
Tilsit (TsA, TsB, TsB2, TsC2, TtB3).	Fair	None present	Fair	Susceptible to frost damage; 4 to 8 feet to bedrock.	Satisfactory for shallow ponds, but may encounter bedrock; slight seepage.
Vigo (VgA, VgB, VgB2)	Poor	None present	Poor to fair.	Perched water table; susceptible to frost damage.	Good; no seepage.

See footnote at end of table.

properties of soils in Owen County—Continued

Suitability of soils and features affecting engineering practices for—Continued				
Farm ponds—Continued: Embankment	Agricultural drainage	Terraces and diversions	Waterways	Septic tank [1] disposal field
Stable; impervious cores and blankets.	High water table; surface drains needed; slowly permeable subsoil; questionable for tiling.	Not needed	Not needed	4; high water table; very slowly permeable subsoil.
Fair stability; cracks when dry because of high content of clay.	High water table; surface drains needed; slowly permeable subsoil; questionable for tiling.	Not needed	Not needed	Not suitable; ponded or high water table.
Not suitable; stony and silty	Not needed	Not needed; slopes too steep.	Not needed; slopes too steep; shallow to bedrock.	Not suitable; shallow to bedrock.
Not suitable; high content of sand and gravel.	Not needed	Not needed; slopes too steep.	Not needed; slopes too steep.	1.
Not suitable; gravel and sand; poor stability.	Not needed	Not needed; nearly level.	Not needed; nearly level.	1.
Underlying material sand and gravel; poor stability.	Not needed	Not needed; nearly level.	Not needed; nearly level.	1.
Stable; impervious cores and blankets.	Not needed	Suitable if topography not too steep for these practices.	Suitable if slopes not too steep.	1.
Upper layers suitable; lower layers contain a large amount of sand.	Not needed	Suitable	Suitable	1.
Not suitable	Soil material permeable; subsurface drains function satisfactorily.	Not needed	Not needed	Not suitable; subject to flooding.
Upper layers suitable; lower layers contain a large amount of sand.	Not needed	Suitable on 2 to 6 percent slopes; favorable soil material.	Suitable; favorable soil material.	1.
Not suitable	Not needed	Not needed	Not needed	Not suitable; subject to flooding.
Suitable if horizons are mixed	Not needed	Slopes too irregular; soil material is favorable.	Slopes too irregular	1.
Stable; impervious cores and blankets.	High water table; surface drains needed; very slowly permeable subsoil; questionable for tiling.	Not needed	Not needed	4; high water table.
Not suitable	High water table; subsurface drainage needed.	Not needed	Not needed	Not suitable; subject to flooding.
Not suitable	High water table; subsurface drainage needed.	Not needed	Not needed	Not suitable; subject to flooding.
Upper layers suitable, lower substratum sandy.	Seasonal perched high water table; subsurface drainage needed.	Not needed	Not needed	4; high water table.
Stable; impervious cores and blankets.	Not needed	Suitable; favorable soil material.	Suitable; favorable soil material.	3; slowly permeable pan.
Stable; impervious cores and blankets.	Seasonal perched water table; surface drainage needed.	Diversions are suitable.	Suitable	4; slowly permeable pan.

TABLE 8.—*Interpretations of engineering*

Soil series and map symbol	Suitability as a source of—			Suitability of soils and features affecting engineering practices for—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds: Reservoir area
Vincennes (Vn)	Fair	None present	Fair	High water table	Subject to seepage; lenses of fine sand in substratum.
Wellston (WmC, WmC2, WmD, WmD2, WmE, WmE2, WnC3, WnD3, WnE3, WoF, WoF2, WoG).	Good	None present	Fair	2 to 3 feet to bedrock	Not suitable; shallow to sandstone or shale; seepage problem.
Whitaker (Wt)	Fair	Minor amounts of stratified sand below a depth of 5 to 6 feet.	Fair	High water table	Rapidly permeable layers in substratum; seepage a problem.
Zanesville (ZaB, ZaB2, ZaC, ZaC2, ZaD, ZaD2, ZaE, ZaE2, ZnB3, ZnC3, ZnD3).	Fair	None present	Fair	Bedrock at a depth of 4 to 8 feet; susceptible to frost damage.	Satisfactory for shallow ponds, but may encounter bedrock; slight seepage.
Zipp (Zp)	Poor	None present	Poor	High water table and flooding.	Very slowly permeable material; no seepage.

[1] Ratings 1 through 4 are given to indicate the relative suitability of the soil for disposal fields for septic tanks. The ratings are for the soil as a whole, in place, and to a depth of 5 feet. Rating 1 is used for soils considered most suitable; the suitability decreases as the numbers increase, so that a soil with a rating of 4 is considered least suited.

TABLE 9.—*Engineering test data [1] for soil samples*

Soil name and location	Parent material	SCS report No.	Depth	Horizon	Moisture-density [2]: Maximum dry density	Moisture-density [2]: Optimum moisture
		S59 Ind-60-	*Inches*		*Lb.cu.ft.*	*Percent*
Bewleyville silt loam:						
NE¼NW¼ sec. 26, T. 9 N., R. 3 W. (Modal profile).	Cherty limestone.	21–4	12–39	B22	100	22
		21–5 and 6	39–48	B3	100	20
NE¼NW¼ sec. 13, T. 9 N., R. 3 W. (Shallow profile).	Cherty limestone.	23–1	3–11	A2	107	18
		23–2	17–27	B21	101	21
		23–3	27–46	B22	99	25
NW¼SW¼ sec. 12, T. 9 N., R. 3 W. (Thicker A horizon than in modal profile).	Cherty limestone.	22–1	4–14	A12	107	16
		22–2	29–44	B22	105	19
		22–3	44–63	B23	111	17
Bloomfield loamy fine sand:						
SW¼NE¼ sec. 21, T. 9 N., R. 4 W.	Windblown deposits.	5A–2	7–30	A2	104	14
		5A–4	30–78	B21	109	11

See footnotes at end of table.

properties of soils in Owen County—Continued

Suitability of soils and features affecting engineering practices for—Continued				
Farm ponds—Continued: Embankment	Agricultural drainage	Terraces and diversions	Waterways	Septic tank [1] disposal field
Stable; impervious cores and blankets.	High water table; surface and subsurface drainage needed.	Not needed.	Not needed.	Not suitable; high water table.
Shallow to bedrock; some stone above bedrock.	Not needed.	Suitable on slopes of 6 to 12 percent; use care to avoid bedrock.	Suitable on slopes of 6 to 12 percent; use care to avoid bedrock.	3; shallow to bedrock.
Stable; impervious cores and blankets if horizons are mixed.	High water table; subsurface drainage needed.	Not needed.	Not needed.	4; high water table.
Stable; impervious cores and blankets.	Not Needed.	Suitable on slopes of 2 to 12 percent.	Suitable for slopes not too steep for this practice.	3; slowly permeable pan.
Fair stability; cracks when dry because of high content of clay.	Seasonal ponding; surface drains needed; very slowly permeable subsoil; questionable for tiling.	Not needed.	Not needed.	Not suitable.

taken from 29 soil profiles, Owen County, Ind.

CBR test [3]				Mechanical analyses [4]									Liquid limit	Plasticity index	Classification	
Molded specimen		CBR	Swell	Percentage passing sieve—					Percentage smaller than—							
Dry density	Moisture content			¾-in.	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.	0.007 mm.	0.002 mm.			AASHO [5]	Unified [6]
Lb.cu.ft.	*Percent*	*Percent*	*Percent*													
98.0	22.7	8	0.6	-----	-----	-----	100	96	92	70	37	27	54	30	A-7-6(19)	CH.
102.5	20.3	6	1.5	100	99	99	98	89	84	65	45	36	51	24	A-7-6(16)	MH-CH.
[7]	[7]	[7]	[7]	-----	-----	100	99	90	87	70	35	18	32	12	A-6(9)	CL.
[7]	[7]	[7]	[7]	100	99	99	97	86	82	72	50	37	54	34	A-7-6(19)	CH.
[7]	[7]	[7]	[7]	-----	100	99	97	88	85	75	55	45	61	36	A-7-6(20)	CH.
[7]	[7]	[7]	[7]	-----	-----	100	99	92	86	72	33	18	28	5	A-4(8)	ML-CL.
[7]	[7]	[7]	[7]	-----	-----	100	99	94	92	75	46	33	41	18	A-7-6(11)	CL.
[7]	[7]	[7]	[7]	-----	-----	100	98	87	82	70	45	32	41	20	A-7-6(12)	CL.
104.0	14.2	38	0	-----	-----	100	69	10	8	5	5	2	[8]	[8]	A-3(0)	SP-SM.
108.0	10.3	21	0	-----	-----	100	69	11	10	8	7	5	16	[8]	A-2-4(0)	SP-SM.

TABLE 9.—*Engineering test data*[1] *for soil samples taken*

Soil name and location	Parent material	SCS report No.	Depth	Horizon	Moisture-density[2] Maximum dry density	Moisture-density[2] Optimum moisture
		S59 Ind-60-	*Inches*		*Lb.cu.ft.*	*Percent*
Cincinnati silt loam:						
SW¼NW¼ sec. 1, T. 9 N., R. 6 W. (Modal profile).	Illinoian till.	6-4 and 5	20–52	B2	102	20
		6–7	60–120	C1	118	12
NE¼SE¼ sec. 2, T. 11 N., R. 4 W. (Shallow phase).	Illinoian till.	7–1	1–8	A2	112	14
		7–2	12–50	B2	111	16
		7–3	50–70	B3	114	16
SE¼NW¼ sec. 10, T. 9 N., R. 5 W. (Road cut).	Illinoian till.	8–1	0–7	Ap	121	11
		8–2	26–44	B22	111	17
		8–3	57–87	C1	123	10
Genesee loam:						
NE¼NW¼ sec. 29, T. 10 N., R. 3 W. (Nonmodal).	Alluvium.	9–1	0–48	AC	112	14
NE¼SW¼ sec. 12, T. 9 N., R. 4 W. (Upper part of profile loam, lower part silt).	Alluvium.	11–1	17–74	C2	111	16
NW¼NE¼ sec. 29, T. 10 N., R. 3 W. (Sandy variant).	Alluvium.	10–1	9–42	C1	114	15
Grayford silt loam:						
SE¼ sec. 4, T. 11 N., R. 3 W.	Loess over limestone.	15A–1	14–32	B2	105	19
		15A–2	36–46	B32 and C1.	90	23
McGary silt loam:						
SW¼SW¼ sec. 26, T. 9 N., R. 4 W. (Modal profile).	Slack-water terrace.	12–2	12–32	B2	100	18
		12–3	32–80	C	108	17
SW¼NE¼ sec. 31, T. 9 N., R. 4 W. (Thinner B22 horizon than in modal profile).	Slack-water terrace.	13–1	2–10	A12	108	17
		13–2	17–27	B22	97	24
		13–2	27+	C1	110	19
SW¼NW¼ sec. 28, T. 11 N., R. 2 W. (Grades to Zipp soils).	Slack-water terrace.	14–1	00–8	Ap	103	20
		14–2	14–27	B22	100	21
		14–3	27+	C1	105	20
Negley sandy loam:						
NW¼SE¼ sec. 25, T. 9 N., R. 3 W.	Loess over outwash of Illinoian age.	32–4	16–56	B2	116	13
		32–7	90+	C1	107	12
Otwell silt loam:						
SW. corner, NW¼ sec. 25, T. 9 N., R. 3 W.	Loess over Illinoian lacustrine deposits.	36–5	15–37	B2	103	22
		36–6	37–60	B22m and C1.	102	20
		36–7	60–90	C1 and C12.	112	16
Parke silt loam:						
SW¼NW¼ sec. 27, T. 11 N., R. 3 W. (Nonmodal).	Sandy and gravelly drift Illinoian age.	16–2	24–43	B22	102	19
		16–3	59–76	B32	122	11
SW¼SE¼ sec. 22, T. 10 N., R. 3 W. (Variable substratum).	Glacial drift of Illinoian age.	17–1	3–12	A2	108	18
		17–2	18–28	B22	117	13
		17–3	42–64	B32	121	11
NE¼SE¼ sec. 33, T. 11 N., R. 3 W. (Deep, sandy substratum).	Glacial drift of Illinoian age.	15–1	3–10	A2	106	16
		15–2	25–42	B22	108	18
		15–3	58–91	B32	120	12

See footnotes at end of table.

from 29 soil profiles, Owen County, Ind.—Continued

CBR test [3]				Mechanical analyses [4]									Liquid limit	Plasticity index	Classification	
Molded specimen		CBR	Swell	Percentage passing sieve—					Percentage smaller than—						AASHO [5]	Unified [6]
Dry density	Moisture content			¾-in.	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.	0.007 mm.	0.002 mm.				
Lb.cu.ft.	*Percent*	*Percent*	*Percent*													
100.0	19.4	9	0.5	----	----	----	100	95	90	66	35	22	41	17	A-7-6(11)	ML-CL.
114.0	12.5	9	.5	100	99	96	90	64	60	45	28	15	27	12	A-6(7)	CL.
107.9	13.3	21	.1	100	69	94	89	70	67	54	27	18	26	5	A-4(7)	ML-CL.
110.3	16.7	11	.6	100	98	97	94	74	70	58	43	31	40	20	A-6(12)	CL.
108.0	13.5	3	.8	100	97	96	93	74	70	58	42	31	41	23	A-7-6(13)	CL.
116.8	11.6	28	.1	100	96	94	89	60	51	36	21	13	20	2	A-4(5)	ML.
114.1	15.5	13	----	100	95	93	86	58	53	43	32	24	34	14	A-6(6)	CL.
120.2	10.4	27	.2	100	97	94	80	35	32	25	19	17	24	8	A-2-4(0)	SC.
107.8	13.3	17	.9	----	----	100	99	74	60	35	21	15	26	6	A-4(8)	ML-CL.
105.3	16.1	19	.2	----	----	----	100	92	81	45	25	15	31	9	A-4(8)	ML-CL.
[7]	[7]	[7]	[7]	100	99	99	98	78	66	38	21	13	26	6	A-4(8)	ML-CL.
105.8	18.9	9	.3	----	----	100	98	84	79	63	38	23	36	16	A-6(10)	CL.
85.7	23.0	2	4.3	100	94	91	89	75	72	65	58	42	77	48	A-7-6(20)	CH.
89.5	17.8	1	3.5	----	----	100	99	94	91	80	60	42	46	25	A-7-6(15)	CL.
103.8	16.3	4	1.8	----	100	99	98	95	90	79	60	41	32	12	A-6(9)	CL.
[7]	[7]	[7]	[7]	----	----	100	92	71	67	58	31	13	35	14	A-6(9)	CL.
[7]	[7]	[7]	[7]	----	----	----	100	94	90	82	70	45	55	28	A-7-6(18)	CH.
[7]	[7]	[7]	[7]	----	100	99	99	98	97	95	78	48	46	23	A-7-6(14)	CL.
[7]	[7]	[7]	[7]	----	----	100	96	87	85	75	48	26	37	13	A-6(9)	ML-CL.
[7]	[7]	[7]	[7]	----	----	----	100	96	93	85	68	48	53	26	A-7-6(17)	MH-CH.
[7]	[7]	[7]	[7]	----	----	100	99	94	93	89	70	42	48	24	A-7-6(15)	CL.
----	----	----	----	----	----	----	----	----	----	----	----	----	[8]	[8]	----	
106.5	11.5	18	.5	----	----	----	100	6	4	3	3	2	[8]	[8]	A-3(0)	SP-SM.
100.2	21.7	4	0	----	----	----	100	87	82	61	36	25	38	15	A-6(10)	ML-CL.
104.0	19.9	11	0	----	----	100	99	94	89	69	33	21	48	21	A-7-6(14)	ML-CL.
109.5	15.4	9	.7	----	----	----	100	78	69	46	27	21	36	14	A-6(10)	CL.
100.5	18.2	9	.6	----	----	100	98	93	89	70	34	22	36	13	A-6(9)	ML-CL.
122.0	11.0	20	.1	----	----	100	91	29	26	22	16	13	22	5	A-2-4(0)	SM-SC.
[7]	[7]	[7]	[7]	----	----	100	98	83	78	61	29	17	31	8	A-4(8)	ML-CL.
[7]	[7]	[7]	[7]	----	----	100	96	70	66	55	31	22	26	9	A-4(7)	CL.
[7]	[7]	[7]	[7]	----	100	99	93	50	45	38	30	25	29	14	A-6(4)	SC.
[7]	[7]	[7]	[7]	----	----	100	99	90	88	73	35	16	27	4	A-4(8)	ML-CL.
[7]	[7]	[7]	[7]	----	----	100	99	92	87	68	37	27	38	16	A-6(10)	CL.
[7]	[7]	[7]	[7]	----	----	100	91	38	37	32	24	21	23	11	A-6(1)	SC.

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TABLE 9.—*Engineering test data*[1] *for soil samples taken*

Soil name and location	Parent material	SCS report No.	Depth	Horizon	Moisture-density[2]: Maximum dry density	Moisture-density[2]: Optimum moisture
Princeton fine sandy loam:		*S59 Ind-60-*	*Inches*		*Lb.cu.ft.*	*Percent*
NE¼NW¼ sec. 27, T. 9 N., R. 4 W.	Windblown deposits.	59–4	12–36	B2	121	11
		59–6	44–72	C11	112	13
Robinson silt loam:						
SW. corner, sec. 35, T. 10 N., R. 3 W.	Illinoian lacustrine deposits.	42–1	0–20	A	107	17
		42. 4	20–40	B2m	100	20
		42–6	42–70+	C1g	111	15
Tilsit silt loam:						
NE¼NE¼, sec. 16, T. 10 N., R. 4 W. (Modal profile).	Sandstone.	18–4	16–28	B21	102	21
		18–6	43–55	B3m	106	18
		18–7	55–66	C1	116	15
NE¼NW¼ sec. 32, T. 11 N., R. 4 W. (Weak pan).	Sandstone.	19–1	0–8	Ap	103	19
		19–2	25–43	B22m	109	18
		19–3	52–79	C1	120	13
SW¼NE¼ sec. 3, T. 11 N., R. 4 W. (Shallow).	Sandstone.	20–1	7–14	A2	107	18
		20–2	24–46	B22m	106	20
		20–3	46–50	C1	119	12
Vigo silt loam:						
SW¼SE¼ sec. 26, T. 10 N., R. 6 W. (Modal profile).	Illinoian till.	3–1	0–23	A	109	15
		3–2	23–42	B2m	105	18
		3–3	50–144	D1	114	16
		3–4	144+	D2	125	10
NW¼NE¼ sec. 2, T. 11 N., R. 4 W. (Grades to Ava soils).	Illinoian till.	4–1	3–12	A2	99	20
		4–2	26–38	B22m	102	20
		4–3	52–114	C1	116	12
NE¼SW¼ sec. 2, T. 9 N., R. 6 W. (Grades to Ava soils).	Illinoian till.	5–1	0–8	Ap	108	16
		5–2	25–39	B22m	110	17
		5–3	53–135	C1	113	16
Zanesville silt loam:						
NW. corner, NW¼ sec. 6, T. 10 N., R. 4 W.	Loess over stratified sandstone, siltstone, and shale.	54–5	18–36	B2 and B2m	102	20
		54–8	36–45	B24m	100	21
		54–9	52–62	C1	107	17
Zipp silty clay loam:						
SE¼SW¼ sec. 25, T. 9 N., R. 6 W.	Glacial outwash.	56–1	0–25	A and Bg	93	23
		56–3	25–45	Bg2	101	18
		56–4	45–100	C	110	17

[1] Tests performed by Purdue University in cooperation with the Indiana State Highway Commission and the U.S. Department of Commerce, Bureau of Public Roads, in accordance with standard procedures of the American Association of State Highway Officials (AASHO), except the CBR test.

[2] Based on the Moisture-density Relations of Soils Using 5.5-lb. Rammer and 12-in. Drop, AASHO Designation T 99–57, Method C.

[3] The soil sample is prepared according to AASHO Designation T 87–49. Water is added to bring the 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 and 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.

[4] Mechanical analyses according to AASHO Designation T 88-57. Results by this procedure frequently may differ somewhat from results that

from 29 soil profiles, Owen County, Ind.—Continued

CBR test [3]				Mechanical analyses [4]											Classification	
Molded specimen		CBR	Swell	Percentage passing sieve—					Percentage smaller than—				Liquid limit	Plasticity index	AASHO [5]	Unified [6]
Dry density	Moisture content			¾-in.	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.	0.007 mm.	0.002 mm.				
Lb.cu.ft.	*Percent*	*Percent*	*Percent*													
114. 5	10. 3	12	0. 4			100	85	28	27	24	15	10	18	(8)	A-2-4(0)	SM.
110. 5	13. 2	30	0			100	81	13	12	9	6	5	18	(8)	A-2-4(0)	SM.
102. 0	17. 3	21			100	99	97	85	79	54	26	15	29	8	A-4(8)	ML-CL.
101. 4	19. 3	5	1. 3			100	99	95	90	66	38	28	47	23	A-7-6(15)	CL.
112. 5	14. 8	8	. 4	100	99	98	94	71	65	46	27	18	32	12	A-6(8)	CL.
101. 0	21. 5	10	. 2				100	95	91	74	38	26	38	15	A-6(10)	ML-CL.
106. 4	18. 1	11	. 3			100	98	85	80	61	32	23	33	11	A-6(8)	ML-CL.
113. 0	14. 8	2	0	100	95	92	86	67	62	45	28	18	24	9	A-4(6)	CL.
(7)	(7)	(7)	(7)	100	98	98	95	88	85	65	30	16	35	8	A-4(8)	ML.
(7)	(7)	(7)	(7)			100	98	90	86	69	40	26	36	15	A-6(10)	CL.
(7)	(7)	(7)	(7)	100	98	93	86	59	55	46	30	23	30	14	A-6(7)	CL.
(7)	(7)	(7)	(7)				100	90	86	70	35	18	36	11	A-6(8)	ML-CL.
(7)	(7)	(7)	(7)				100	96	93	75	43	30	36	17	A-6(11)	CL.
(7)	(7)	(7)	(7)	100	94	90	86	68	57	42	23	14	21	6	A-4(7)	ML-CL.
109. 0	15. 6	21	. 1		100	99	96	81	73	39	18	12	29	9	A-4(8)	CL.
110. 2	17. 5	3	1. 5		100	99	96	87	82	63	38	26	50	29	A-7-6(18)	CL.
113. 2	15. 6	5	. 2	100	99	97	92	71	65	48	30	20	26	11	A-6(8)	CL.
123. 5	10. 3	9	. 1	100	97	93	81	51	48	36	22	13	23	8	A-4(3)	CL.
98. 0	15. 2	4				100	99	97	93	71	42	28	35	10	A-4(8)	ML-CL.
101. 6	20. 3	12	. 5				100	99	91	75	42	30	45	22	A-7-6(14)	CL.
112. 1	10. 5	4	. 1	100	97	96	92	72	65	54	32	22	31	15	A-6(9)	CL.
103. 8	14. 8	17	. 5		100	99	97	88	80	58	28	17	30	7	A-4(8)	ML-CL.
109. 0	16. 6	10	. 2	100	99	98	96	85	80	65	37	26	40	21	A-6(12)	CL.
113. 3	14. 6	8	. 7	100	99	97	91	68	65	54	37	29	39	20	A-6(11)	CL.
97. 0	19. 3	9	. 7				100	95	90	68	33	20	42	17	A-7-6(11)	ML-CL.
102. 0	21. 0	6	. 2				100	92	86	66	33	21	41	20	A-7-6(12)	CL.
107. 0	17. 1	9	. 3	100	99	99	98	88	82	61	30	18	30	11	A-6(8)	CL.
91. 6	22. 7	3	2. 1			100	99	92	97	88	68	42	54	22	A-7-5(16)	MH.
91. 3	18. 3	2	4. 8				100	79	77	72	58	37	53	31	A-7-6(19)	CH.
109. 0	17. 3	6	. 8			100	97	28	25	20	16	13	23	5	A-2-4(0)	SM-SC.

would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer 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 soil survey 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 for soils.

[5] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation M 145–49.

[6] Based on the Unified Soil Classification System, Tech. Memo. No. 3–357, v. 1, Waterways Expt. Sta., Corps of Engin., Mar. 1953.

[7] Insufficient material for CBR test.

[8] Nonplastic.

Engineering test data

Soil samples of the principal soil types of each of 15 extensive series were tested at Purdue University in cooperation with the Indiana State Highway Commission and the U.S. Department of Commerce, Bureau of Public Roads. The tests were made in accordance with standard procedures of the American Association of State Highway Officials (AASHO) to help evaluate the soils for engineering purposes. The test data are given in table 9.

Table 9 shows the moisture-density for the soils sampled. The relation of moisture content and the density of soil material are important in compaction for engineering purposes. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, 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 highest dry density obtained in the compaction test is the maximum dry density. Moisture-density data are important in earthwork because, generally, optimum stability is obtained if a soil is compacted to about maximum density when it is at approximately the optimum moisture content.

In the columns for mechanical analyses, the percentage of particles of various sizes in the soil material are given. The size and proportion of particles affect the behavior of material when it is used for engineering purposes. The mechanical analyses for the samples shown in table 9 were made in the laboratory by the combined sieve and hydrometer methods. The names for the various sizes of sand, silt, and clay used by engineers are not equivalent to the names used by soil scientists. To the soil scientist, for example, the term "clay" refers to mineral grains less than 0.002 millimeter in diameter, but to the engineer it refers to mineral grains less than 0.005 millimeter in diameter.

The liquid limit is the moisture content at which the soil material passes 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. This index indicates the range of moisture content at which a soil is in a plastic condition. The term nonplastic applies to soils that are granular or without cohesion, for which liquid or plastic limits cannot be determined.

Table 9 also gives the classification of the soils sampled according to the AASHO and Unified systems.

Descriptions of Soils

This section is provided for those who want detailed information about the soils in the county. It describes the individual soils, or mapping units; that is, the areas on the detailed soil map that are bounded by lines and are identified by a symbol. 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 acreage and proportionate extent of each soil mapped in the county are given in table 10. Their location is shown on the soil map at the back of the report.

In the descriptions that follow, each soil series is first described, and then the soils in the series. The series description mentions features that apply to all of the soils it contains.

As a general rule, only one soil profile is described in detail for each series, and that profile is considered to be representative for all the soils in the series. The descriptions of the soils in the series generally tell how their profiles differ from the one given as representative of the series.

Following the name of each soil, there is a set of symbols in parentheses. These identify the soil on the detailed map. The capability grouping as well as woodland suitability grouping are given for each mapping unit. The capability units and woodland suitability groups are described in the section "Use and Management of the Soils."

In describing the profile, a letter symbol for example "A1," was assigned to the various layers. These letter symbols have special meaning for soil scientists and others who make a special study of soils. Most readers will need to remember only that all letter symbols beginning with "A" indicate the surface layer; those beginning with "B" indicate subsoil; and those beginning with "C" indicate substratum, or parent material.

The boundaries between horizons are described so as to indicate their thickness and shape. The terms for thickness are (1) *abrupt*, if the boundary is less than 1 inch thick; (2) *clear*, if it is about 1 to 2½ inches thick; (3) *gradual*, if it is 2½ to 5 inches thick; and (4) *diffuse*, if it is more than 5 inches thick. The shape of the boundary is described as *smooth*, *wavy*, *irregular*, or *broken*.

The color of each horizon is described in words, such as yellowish brown, or can be indicated by symbols for the hue, value, and chroma, such as 10YR 5/4. These symbols, called Munsell color notations, are used by soil scientists to evaluate the colors of the soil precisely. For the soils in this report, color names and color symbols are given for a moist soil.

The texture of the soil refers to its content of sand, silt, and clay. It is determined by the way the soil material feels when rubbed between the fingers, and it is checked by laboratory analyses. Each mapping unit is identified by a textural name, such as fine sandy loam. This refers to the texture of the surface layer, or A horizon.

Structure is indicated by the way the individual soil particles are arranged in larger grains, or aggregates, and the amount of pore space between the grains. The structure of the soil is determined by the strength or grade, the size, and the shape of the aggregates. For example, a horizon may have weak, fine, blocky structure. For definitions of other terms used in describing soils, refer to the Glossary at the back of the report.

Atkins Series

In the Atkins series are deep, poorly drained, gray soils that are strongly acid. The soil profile shows little development, other than an accumulation of organic matter in the surface layer. In Owen County the Atkins soils are on narrow bottom lands. They were formed in alluvial material that washed chiefly from soils underlain by mixed Illinoian drift, shale, and sandstone.

TABLE 10.—*Approximate acreage and proportionate extent of soils*

Mapping unit	Acres	Percent
Atkins silt loam	215	0.1
Ava silt loam, 0 to 2 percent slopes	704	.3
Ava silt loam, 2 to 6 percent slopes	5,104	2.0
Ava silt loam, 2 to 6 percent slopes, moderately eroded	4,716	1.9
Ava soils, 2 to 6 percent slopes, severely eroded	625	.2
Ava silt loam, 6 to 12 percent slopes	731	.3
Ava silt loam, 6 to 12 percent slopes, moderately eroded	463	.2
Ava soils, 6 to 12 percent slopes, severely eroded	535	.2
Ayrshire loam, 0 to 2 percent slopes	97	(1)
Bartle silt loam, 0 to 2 percent slopes	1,040	.4
Bewleyville silt loam, 2 to 6 percent slopes, moderately eroded	95	(1)
Bewleyville silt loam, 6 to 12 percent slopes, moderately eroded	102	(1)
Bewleyville soils, 6 to 12 percent slopes, severely eroded	260	.1
Bewleyville silt loam, 12 to 18 percent slopes, moderately eroded	154	.1
Bewleyville soils, 12 to 18 percent slopes, severely eroded	312	.1
Bewleyville silt loam, 18 to 25 percent slopes	321	.1
Bloomfield loamy fine sand, 6 to 12 percent slopes	99	(1)
Bloomfield loamy fine sand, 12 to 18 percent slopes	176	.1
Bloomfield loamy fine sand, 18 to 35 percent slopes	92	(1)
Cincinnati silt loam, 2 to 6 percent slopes	1,710	.7
Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded	2,225	.9
Cincinnati soils, 2 to 6 percent slopes, severely eroded	255	.1
Cincinnati silt loam, 6 to 12 percent slopes	1,620	.6
Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded	4,659	1.9
Cincinnati soils, 6 to 12 percent slopes, severely eroded	12,469	5.0
Cincinnati silt loam, 12 to 18 percent slopes	1,007	.4
Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded	2,112	.8
Cincinnati soils, 12 to 18 percent slopes, severely eroded	4,514	1.8
Cincinnati and Hickory silt loams, 18 to 25 percent slopes	4,288	1.7
Cincinnati and Hickory silt loam, 18 to 25 percent slopes, moderately eroded	1,475	.6
Corydon stony silt loam, 12 to 18 percent slopes	65	(1)
Corydon stony silt loam, 35 to 70 percent slopes	828	.3
Dubois silt loam, 0 to 2 percent slopes	8,750	3.5
Dubois silt loam, 2 to 6 percent slopes	900	.4
Dubois silt loam, 2 to 6 percent slopes, moderately eroded	1,100	.4
Eel silt loam	1,937	.8
Eel loam	210	.1
Eel silty clay loam	440	.2
Genesee silt loam	4,961	2.0
Genesee loam	2,775	1.1
Gravel pits	90	(1)
Grayford silt loam, 0 to 2 percent slopes	300	.1
Grayford silt loam, 2 to 6 percent slopes	1,350	.5
Grayford silt loam, 2 to 6 percent slopes, moderately eroded	3,650	1.5
Grayford soils, 2 to 6 percent slopes, severely eroded	280	.1
Grayford silt loam, 6 to 12 percent slopes	725	0.3
Grayford silt loam, 6 to 12 percent slopes, moderately eroded	3,600	1.4
Grayford soils, 6 to 12 percent slopes, severely eroded	3,300	1.3
Grayford silt loam, 12 to 18 percent slopes	775	.3
Grayford silt loam, 12 to 18 percent slopes, moderately eroded	1,500	.6
Grayford soils, 12 to 18 percent slopes, severely eroded	1,360	.5
Grayford silt loam, 18 to 25 percent slopes	1,300	.5
Grayford silt loam, 18 to 25 percent slopes, moderately eroded	660	.3
Grayford soils, 18 to 25 percent slopes, severely eroded	176	.1
Grayford silt loam, 25 to 35 percent slopes	475	.2
Gullied land, glacial drift	1,352	.5
Gullied land, residuum	2,153	.9
Haubstadt silt loam, 0 to 2 percent slopes	350	.1
Haubstadt silt loam, 2 to 6 percent slopes	748	.3
Haubstadt silt loam, 2 to 6 percent slopes, moderately eroded	900	.4
Haubstadt soils, 2 to 6 percent slopes, severely eroded	495	.2
Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded	272	.1
Haubstadt soils, 6 to 12 percent slopes, severely eroded	275	.1
Hickory soils, 18 to 25 percent slopes, severely eroded	1,425	.6
Hickory silt loam, 25 to 35 percent slopes	7,098	2.8
Hickory silt loam, 25 to 35 percent slopes, moderately eroded	3,250	1.3
Hickory silt loam, 35 to 70 percent slopes	9,724	3.9
Johnsburg silt loam, 0 to 2 percent slopes	681	.3
Johnsburg silt loam, 2 to 6 percent slopes	270	.1
Johnsburg silt loam, 2 to 6 percent slopes, moderately eroded	125	(1)
Landes fine sandy loam	310	.1
Markland silt loam, 2 to 6 percent slopes, moderately eroded	60	(1)
Markland silt loam, 6 to 12 percent slopes, moderately eroded	60	(1)
Markland soils, 6 to 12 percent slopes, severely eroded	110	(1)
Markland silt loam, 12 to 18 percent slopes, moderately eroded	50	(1)
Markland silt loam, 18 to 25 percent slopes, moderately eroded	42	(1)
Martinsville loam, 0 to 2 percent slopes	145	.1
Martinsville silt loam, 0 to 2 percent slopes	140	.1
Martinsville loam, 2 to 6 percent slopes, moderately eroded	85	(1)
McGary silt loam, 0 to 2 percent slopes	450	.2
McGary silt loam, 2 to 6 percent slopes, moderately eroded	74	(1)
Montgomery silty clay loam	255	.1
Muck	46	(1)
Muskingum stony silt loam, 12 to 18 percent slopes	70	(1)
Muskingum stony silt loam, 18 to 25 percent slopes	665	.3
Muskingum stony silt loam, 25 to 35 percent slopes	2,010	.8
Muskingum stony silt loam, 35 to 70 percent slopes	4,325	1.7

See footnote at end of table.

TABLE 10.—*Approximate acreage and proportionate extent of soils*—Continued

Mapping unit	Acres	Percent
Negley loam, 18 to 25 percent slopes	310	0.1
Negley soils, 18 to 25 percent slopes, severely eroded	530	.2
Negley loam, 25 to 35 percent slopes	3,769	1.5
Negley loam, 35 to 70 percent slopes	16,324	6.5
Negley silt loam, 18 to 25 percent slopes	913	.4
Negley silt loam, 18 to 25 percent slopes, moderately eroded	460	.2
Nineveh loam	80	(1)
Ockley loam, 0 to 2 percent slopes	260	.1
Ockley silt loam, 0 to 2 percent slopes	75	(1)
Otwell silt loam, 0 to 2 percent slopes	325	.1
Otwell silt loam, 2 to 6 percent slopes	913	.4
Otwell silt loam, 2 to 6 percent slopes, moderately eroded	656	.3
Otwell silt loam, 6 to 12 percent slopes	450	.2
Otwell silt loam, 6 to 12 percent slopes, moderately eroded	450	.2
Otwell soils, 6 to 12 percent slopes, severely eroded	1,828	.7
Otwell silt loam, 12 to 18 percent slopes	350	.1
Otwell silt loam, 12 to 18 percent slopes, moderately eroded	455	.2
Otwell soils, 12 to 18 percent slopes, severely eroded	1,302	.5
Otwell silt loam, 18 to 25 percent slopes	880	.3
Otwell silt loam, 18 to 25 percent slopes, moderately eroded	250	.1
Otwell soils, 18 to 25 percent slopes, severely eroded	150	.1
Otwell silt loam, calcareous substratum, 35 to 70 percent slopes	2,502	1.0
Otwell silt loam, calcareous substratum, 25 to 35 percent slopes	1,436	.6
Parke silt loam, 2 to 6 percent slopes	1,323	.5
Parke silt loam, 2 to 6 percent slopes, moderately eroded	1,435	.6
Parke soils, 2 to 6 percent slopes, severely eroded	90	(1)
Parke silt loam, 6 to 12 percent slopes	1,685	.7
Parke silt loam, 6 to 12 percent slopes, moderately eroded	1,020	.4
Parke soils, 6 to 12 percent slopes, severely eroded	1,340	.5
Parke silt loam, 12 to 18 percent slopes	175	.1
Parke silt loam, 12 to 18 percent slopes, moderately eroded	535	.2
Parke soils, 12 to 18 percent slopes, severely eroded	890	.4
Philo silt loam	1,644	.7
Pike silt loam, 0 to 2 percent slopes	670	.3
Pike silt loam, 2 to 6 percent slopes, moderately eroded	255	.1
Pope silt loam	1,732	.7
Pope loam	510	.2
Princeton fine sandy loam, 2 to 6 percent slopes	649	.3
Princeton fine sandy loam, 6 to 12 percent slopes	160	.1
Princeton fine sandy loam, 6 to 12 percent slopes, moderately eroded	144	.1
Princeton fine sandy loam, 12 to 18 percent slopes, moderately eroded	168	.1
Princeton fine sandy loam, 18 to 25 percent slopes, moderately eroded	364	.1
Quarries	265	.1
Riverwash	200	.1
Robinson silt loam	1,200	0.5
Shoals loam	345	.1
Shoals silt loam	6,415	2.6
Shoals silty clay loam	1,050	.4
Stendal silt loam	8,570	3.4
Strip mines	1,004	.4
Taggart silt loam	150	.1
Tilsit silt loam, 0 to 2 percent slopes	110	(1)
Tilsit silt loam, 2 to 6 percent slopes	1,200	.5
Tilsit silt loam, 2 to 6 percent slopes, moderately eroded	1,500	.6
Tilsit soils, 2 to 6 percent slopes, severely eroded	150	.1
Tilsit silt loam, 6 to 12 percent slopes, moderately eroded	215	.1
Vigo silt loam, 0 to 2 percent slopes	8,862	3.5
Vigo silt loam, 2 to 6 percent slopes	2,200	.9
Vigo silt loam, 2 to 6 percent slopes, moderately eroded	1,600	.6
Vincennes silt loam	152	.1
Wellston silt loam, 6 to 12 percent slopes	110	(1)
Wellston silt loam, 6 to 12 percent slopes, moderately eroded	90	(1)
Wellston soils, 6 to 12 percent slopes, severely eroded	130	(1)
Wellston silt loam, 12 to 18 percent slopes	2,100	.8
Wellston silt loam, 12 to 18 percent slopes, moderately eroded	900	.4
Wellston soils, 12 to 18 percent slopes, severely eroded	700	.3
Wellston silt loam, 18 to 25 percent slopes	2,900	1.2
Wellston silt loam, 18 to 25 percent slopes, moderately eroded	650	.3
Wellston soils, 18 to 25 percent slopes, severely eroded	310	.1
Wellston and Muskingum soils, 25 to 35 percent slopes	4,900	2.0
Wellston and Muskingum soils, 25 to 35 percent slopes, moderately eroded	120	(1)
Wellston and Muskingum soils, 35 to 70 percent slopes	1,820	.7
Whitaker silt loam	153	.1
Zanesville silt loam, 2 to 6 percent slopes	1,913	.8
Zanesville silt loam, 2 to 6 percent slopes, moderately eroded	1,415	.6
Zanesville soils, 2 to 6 percent slopes, severely eroded	135	(1)
Zanesville silt loam, 6 to 12 percent slopes	1,150	.5
Zanesville silt loam, 6 to 12 percent slopes, moderately eroded	3,100	1.2
Zanesville soils, 6 to 12 percent slopes, severely eroded	3,540	1.4
Zanesville silt loam, 12 to 18 percent slopes	1,265	.5
Zanesville silt loam, 12 to 18 percent slopes, moderately eroded	1,900	.8
Zanesville soils, 12 to 18 percent slopes, severely eroded	2,200	.9
Zanesville silt loam, 18 to 25 percent slopes	457	.2
Zanesville silt loam, 18 to 25 percent slopes, moderately eroded	355	.1
Zipp silty clay loam	625	.2
Lake	960	.4
Total	250,240	100.0

[1] Less than 0.05 percent.

The Atkins soils are closely associated with the well drained Pope, the moderately well drained Philo, and the imperfectly drained Stendal soils. The associated soils were formed in strongly acid alluvial material, similar to that in which the Atkins soils developed.

Representative profile of Atkins silt loam (SW¼NE¼ sec. 13, T. 10 N., R. 5 W.):

A1—0 to 4 inches, gray (10YR 6/1) silt loam with many, medium, distinct mottles of dark yellowish brown (10YR 4/4); moderate, fine and medium, granular structure; friable; abundant roots; slightly acid; clear, smooth boundary.

C1—4 to 11 inches, dark-gray (10YR 4/1) silt loam with many, medium, distinct mottles of dark brown (7.5YR 4/4); weak, fine and medium, subangular blocky structure; friable; plentiful roots; medium acid; clear, smooth boundary.

C2—11 to 24 inches, gray (10YR 6/1) silt loam with common, fine, distinct mottles of dark brown (7.5YR 4/4); massive; friable; few roots; strongly acid; clear, smooth boundary.

C3—24 to 34 inches, gray (10YR 6/1) silt loam with many, coarse, distinct mottles of dark brown (7.5YR 4/4); massive; friable; very few roots; medium acid; clear, smooth boundary.

C4—34 inches +, gray (10YR 6/1) stratified loam, silt loam, and fine sandy loam; many, coarse, distinct mottles of dark brown (7.5YR 4/4); massive; friable; strongly acid.

Atkins silt loam (At).—This is the only Atkins soil mapped in the county. Its surface layer is strongly acid if it has not been limed. The soil material below a depth of 30 inches is strongly acid or medium acid.

This soil is generally back from the main streams and is adjacent to the uplands. It is in low areas where much seepage occurs and where flooding is frequent in winter and spring. Artificial drainage is hard to establish because of the poor natural drainage, low position, and difficulty in obtaining adequate outlets. If surface drains are used, however, this soil generally can be drained sufficiently to be used for pasture. Where drainage is adequate, corn and soybeans can be grown successfully.

A large acreage of this soil has never been cleared, and many cleared areas are now idle. If the soil is used for pasture, large amounts of lime and of a fertilizer that includes nitrogen are needed for good yields. The best plants for pasture are shallow-rooted legumes, such as ladino clover, and grasses that tolerate wetness. The soil should not be pastured when wet. Good pasture management is especially important and should include rotating livestock from one field to another. (Capability unit Vw-1; woodland suitability group 11)

Ava Series

In the Ava series are deep, moderately well drained, nearly level to sloping soils. These soils have a dark-brown surface layer, a dark yellowish-brown subsoil, and a moderately developed fragipan. They developed in 30 to 50 inches of loess underlain by till, and they are leached free of carbonates to a depth of 10 feet or more. The Ava soils are in small areas throughout the glaciated part of the county. They occupy the breaks of shallow drainageways that extend into the Vigo flats, and they are on ridgetops in the more rolling areas.

The Ava soils are closely associated with the imperfectly drained Vigo and the well-drained Cincinnati soils. All these soils developed from the same kind of parent material.

Representative profile of Ava silt loam, 2 to 6 percent slopes (SE¼SE¼ sec. 10, T. 10 N., R. 5 W.):

Ap—0 to 8 inches, dark-brown to brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A2—8 to 12 inches, brown (10YR 5/3) silt loam; weak, medium, subangular blocky structure; friable; strongly acid; clear, smooth boundary.

B1—12 to 16 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; strongly acid; clear, smooth boundary.

B21t—16 to 24 inches, grayish-brown (10YR 5/2) light silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; firm; strongly acid; clear, smooth boundary.

B22x—24 to 30 inches, light brownish-gray (10YR 6/2) silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, prismatic structure that breaks to moderate, medium, subangular blocky; firm; moderately developed fragipan, strongly acid; gradual, smooth boundary.

B23x—30 to 46 inches, yellowish-brown (10YR 5/4) silty clay loam; many, medium, distinct, light brownish-gray (10YR 6/2) mottles; strong, coarse, prismatic structure that breaks to strong, coarse, subangular blocky; firm; moderately developed fragipan; thin, brown (10YR 5/3) clay films on the faces of peds; very strongly acid; gradual, smooth boundary.

IIB31x—46 to 58 inches, light yellowish-brown (10YR 6/4) gritty silt loam with many, light brownish-gray (10YR 6/2) silt streaks and gray (10YR 5/1) clay films; weak, coarse, prismatic structure; friable; many black manganese concretions; very strongly acid; gradual, smooth boundary.

IIB32—58 to 140 inches, brown (10YR 5/3) to yellowish-brown (10YR 5/4) loam till with varying amounts of light brownish-gray (10YR 6/2) silt streaks; massive; friable; very strongly acid, becoming less acid with increasing depth.

IIC—140 inches +, grayish-brown (10YR 5/2) loam till; massive; friable; calcareous.

The color of the surface layer ranges from dark gray in forested areas to dark brown in cultivated fields. The depth to the fragipan and the degree of development varies with the slope. The soils that have slopes of 0 to 6 percent have a more strongly developed fragipan than the soils that have slopes greater than 6 percent. The thickness of the loess ranges from 30 to 50 inches. Although the profile is generally leached free of carbonates to a depth of 10 feet or more, some areas of Ava soils are included that are underlain by leached till over sandstone or shale bedrock at a depth of 50 to 70 inches.

The Ava soils are low in available phosphate and low to medium in potash. The content of organic matter is medium to low. Moisture-supplying capacity is good, and permeability is moderate. The penetration of roots is somewhat limited by the fragipan in the lower part of the subsoil. These soils are very strongly acid if they have not been limed.

The main problem in cultivating these soils is erosion. Terraces and diversions or suitable cultural practices should be used to help control erosion. These soils are suited to most of the crops grown in the county, and they are moderately productive. The crops respond well to lime and fertilizer.

Ava silt loam, 0 to 2 percent slopes (GnA).—The profile of this soil is similar to the one described for the series. It is on nearly level ridgetops in rolling areas and in small areas on the outer edges of the Vigo flats.

Small areas of an imperfectly drained Vigo soil are included in the mapped areas of this soil.

Runoff is slow and little erosion occurs on Ava silt loam, 0 to 2 percent slopes. The small areas of this soil are generally managed with the adjoining soils. (Capability unit IIs–5; woodland suitability group 9)

Ava silt loam, 2 to 6 percent slopes (GnB).—The profile of this soil is described as representative of the series. This soil is on gently rolling, rounded ridges with steeper Cincinnati soils, and it is on the broader ridges with the nearly level Vigo soils. Runoff is medium. Small areas of an imperfectly drained soil are included in the mapped areas of this soil.

Most of the acreage is in cultivated crops, but some areas on ridges between the steeper draws are in permanent pasture or forest. The areas are generally small and are managed the same way as the adjoining soils. A few areas that have longer slopes are managed separately. If this soil is cultivated, erosion is the major hazard. It is generally necessary to control erosion by using terraces and diversions or suitable cultural practices. Seepy or wet spots may require drainage. This soil is well suited to row crops. If it is managed properly, good yields can be obtained consistently. (Capability unit IIe–7; woodland suitability group 9)

Ava silt loam, 2 to 6 percent slopes, moderately eroded (GnB2).—The profile of this soil is similar to the one described for the series. The present plow layer is partly yellowish-brown light silty clay loam that was formerly subsoil. In some places the present surface layer is made up entirely of material that was formerly subsoil. A few small areas have been severely eroded, and there are a few shallow gullies. This soil is on gently sloping ridges adjacent to steeper soils and on breaks from the nearly level areas. Runoff is medium. Included in the mapped areas of this soil are some small areas of an imperfectly drained soil.

Most of the acreage is cultivated. The soil is well suited to cultivated crops, and if it is managed properly, good yields can be obtained consistently. Terraces and diversions or suitable cultural practices are necessary to control erosion. Occasional wet or seepy spots may require drainage. The small areas of this soil are generally managed in the same way as the adjoining soils. (Capability unit IIe–7; woodland suitability group 9)

Ava soils, 2 to 6 percent slopes, severely eroded (GoB3).—The profile of these soils is similar to the one described as typical for the series. Most of the original surface layer, however, has been removed by erosion, and the present surface layer is now predominantly yellowish-brown silty clay loam. In places there are some shallow gullies and an occasional deep gully.

These soils are generally on the upper ends of drainageways and extend into imperfectly drained, nearly level areas and gently sloping ridges. Runoff is medium. The moisture-supplying capacity is a little lower than that of the uneroded soils. A few small areas of an imperfectly drained soil are included in the mapped areas of these soils.

Most of the acreage is cultivated. The plowed soils are likely to be cloddy, and a good seedbed is difficult to prepare. These soils are suited to cultivated crops, but they cannot be farmed so intensively as the uneroded Ava silt loam, 2 to 6 percent slopes. Terraces and diversions or suitable cultural practices are needed in most places to help control erosion. (Capability unit IIIe–7; woodland suitability group 9)

Ava silt loam, 6 to 12 percent slopes (GnC).—This soil has a profile similar to the one described for the series. Its slopes are predominantly 7 to 8 percent. It is not extensive and is generally in small areas with steeper soils.

This soil is used chiefly for permanent pasture or forest. Erosion is a problem on the cultivated areas. Under proper management timber grows rapidly and is of good quality. (Capability unit IIIe–7; woodland suitability group 9)

Ava silt loam, 6 to 12 percent slopes, moderately eroded (GnC2).—This soil has a profile similar to the one described for the series, but the fragipan is less well developed. The surface layer has mixed in it a moderate amount of yellowish-brown silty clay loam that was formerly subsoil. This soil is generally on sloping breaks around drainageways that extend into the nearly level, imperfectly drained Vigo flats. The slopes are mainly 7 to 8 percent. A few small areas have been severely eroded, and in some places there are a few shallow gullies. Included in the mapped areas of this soil are small areas of an imperfectly drained Vigo soil and of a well-drained Cincinnati soil.

Most of the acreage is cultivated, but a small acreage is idle or in pasture. Runoff is fairly high, which creates an erosion problem. Terraces and diversions or suitable cultural practices are needed in most places to help control erosion. An occasional seepy spot may require drainage. (Capability unit IIIe–7; woodland suitability group 9)

Ava soils, 6 to 12 percent slopes, severely eroded (GoC3).—The profile of these soils is similar to the one described for the series, but the fragipan is less well developed. Most of the original surface layer has been removed by erosion. The present surface layer is predominantly yellowish-brown silty clay loam. In places there are some shallow gullies and an occasional deep gully.

These soils are generally along the breaks and drainageways that extend into the flats occupied by imperfectly drained Vigo soils. Their slopes are mainly 7 to 8 percent and a little steeper. Runoff is medium. The moisture-supplying capacity is a little lower than that of the uneroded soils. Included in the mapped areas of these soils are a few small areas of an imperfectly drained soil.

Most of the acreage is in cultivation, but some areas are in permanent pasture or are idle. The plowed soils are likely to be cloddy, and a good seedbed is difficult to prepare. These soils should be farmed less intensively than the uneroded Ava silt loam, 6 to 12 percent slopes, and they require more intensive conservation practices. They are probably best suited to hay and meadow crops. Erosion is a serious problem. Terraces and diversions or suitable cultural practices are needed in most places to help prevent further erosion. An occasional seepy or wet spot may require drainage. (Capability unit IVe-7; woodland suitability group 9)

Ayrshire Series

The Ayrshire soils are deep and imperfectly drained. They have a dark grayish-brown surface layer and a subsoil that is gray and mottled. These soils developed in fairly thick deposits of calcareous, windblown coarse silt and fine sand.

The Ayrshire soils are in nearly level areas or in slight depressions in the uplands. They are associated with the well-drained Princeton soils, which developed from similar parent material.

Representative profile of Ayrshire loam, 0 to 2 percent slopes (NW. corner NW¼ sec. 2, T. 10 N., R. 6 W.):

- Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loam with common, fine, faint, gray (10YR 5/1) mottles; weak, medium, granular structure; friable; neutral; abrupt, smooth boundary.
- A2—8 to 15 inches, pale-brown (10YR 6/3) loam with many fine, distinct mottles of yellowish brown (10YR 5/8); weak, thick, platy structure; friable; slightly acid; clear, smooth boundary.
- B1—15 to 21 inches, light brownish-gray (10YR 6/2) loam with common, fine, distinct mottles of strong brown (7.5YR 5/6); weak, coarse, subangular blocky structure; friable; strongly acid; clear, wavy boundary.
- B21t—21 to 30 inches, light-gray to gray (N 6/0) light silty clay loam with common, medium, distinct mottles of strong brown (7.5YR 5/8); weak, coarse, subangular blocky structure; firm; light-gray to gray (10YR 6/1) clay films and fine sand films; some grit; medium acid; clear, wavy boundary.
- B22t—30 to 39 inches, light-gray to gray (10YR 6/1) silty clay loam with many, medium, distinct mottles of strong brown (7.5YR 5/8); weak, coarse, subangular blocky structure; firm; light-gray to gray (10YR 6/1) clay films and fine sand films; some grit; medium acid; clear, wavy boundary.
- B3t—39 to 52 inches, light-gray to gray (N 6/0) clay loam with many, fine, distinct mottles of strong brown (7.5YR 5/8); weak, coarse, subangular blocky structure; firm; light-gray to gray (N 6/0), thin films of clay and fine sand; medium acid.
- C1—52 to 70 inches, yellowish-brown (10 YR 5/6) and strong brown (7.5YR 5/8) fine sandy loam; massive; very friable; grayish-brown (10YR 5/2) bands of silty clay loam; slightly acid.
- C2—70 to 80 inches, light brownish-gray (10YR 6/2) silt loam with common, medium, distinct mottles of strong brown (7.5YR 5/6); massive; neutral.
- C3—80 inches +, gray (10YR 5/1) silt; calcareous.

In some places the texture of the surface layer is fine sandy loam. The depth to calcareous silt and sand in some places is only about 60 inches, but in other places it is 80 inches or more.

The Ayrshire soils are low in available phosphate and potash and low in content of organic matter. They are slow in permeability and high in moisture-supplying capacity. Runoff is slow or very slow.

Ayrshire loam, 0 to 2 percent slopes (AyA).—This is the only soil of the Ayrshire series mapped in the county. The main problem in managing it is excess water. Drainage is necessary to maintain good yields of cultivated crops. Tile and surface drains generally are satisfactory in overcoming wetness. Unless it has been limed, this soil is medium acid. Where it has been drained and limed, crops respond well if a large amount of fertilizer is applied.

This soil is suited to most of the crops grown in the county, and it is moderately productive. Shallow-rooted legumes are generally grown instead of alfalfa because of the excess water in the subsoil in spring. A large amount of nitrogen for corn normally gives good results. (Capability unit IIw-2; woodland suitability group 5)

Bartle Series

The Bartle soils are moderately deep or deep, imperfectly drained soils on low stream terraces. They have a gray to grayish-brown surface layer, a gray, mottled subsoil, and a weakly developed fragipan. These soils developed in stratified silt, clay, and fine sand washed mainly from areas underlain by sandstone, siltstone, shale, and Illinoian till.

The Bartle soils are closely associated with the well drained Otwell, the moderately well drained Haubstadt, and the very poorly drained Vincennes soils, all of which developed in parent material similar to that of the Bartle soils. The Bartle soils are similar to the Dubois soils in color and natural drainage, but they are at a lower elevation than those soils and have a more weakly developed profile. The Bartle soils also have less clay in the subsoil.

Representative profile of Bartle silt loam, 0 to 2 percent slopes (SE¼SE¼NW¼ sec. 11, T. 10 N., R. 6 W.):

- Ap—0 to 8 inches, gray (10YR 5/1) silt loam; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.
- A2—8 to 13 inches, gray (10YR 6/1) silt loam with common, fine, distinct mottles of yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6); moderate, medium, platy structure; friable; neutral; clear, wavy boundary.
- B1—13 to 17 inches, gray (10YR 6/1) silt loam with common, fine, distinct mottles of yellowish brown (10YR 5/6); weak, medium and thick, platy structure; friable; very strongly acid; clear, irregular boundary.
- B21x—17 to 36 inches, gray (10YR 6/1) silt loam with many, fine, distinct mottles of yellowish brown (10YR 5/6); moderate, medium and coarse, prismatic structure (medium in upper part and coarse in lower part); friable and fragile (fragipan); very strongly acid; clear, wavy boundary.
- 22Bx—36 to 50 inches, gray (10YR 6/1) light silty clay loam with many, medium, distinct mottles of yellowish brown (10 YR 5/8); massive; firm and fragile (fragipan); gray (10YR 5/1) flows of clay are present; thin, gray silt films on peds; many old root channels and wormholes are filled with gray silt; very strongly acid; clear, wavy boundary.
- C—50 to 70 inches +, gray (10YR 6/1), stratified silty clay loam, loam, silt, and fine sand with streaks and splotches of yellowish brown (10YR 5/8); massive; firm; medium acid, but neutral and in some places calcareous at a depth of about 10 feet.

In some areas the profile is more mottled and less grayish than the profile described. The texture in the upper part of the B2 horizon ranges from light silty clay loam to silt loam.

The Bartle soils are low in available phosphate, potash, and organic matter. They are slow in permeability and high in moisture-supplying capacity. Runoff is slow or very slow. These soils are very strongly acid.

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Bartle silt loam, 0 to 2 percent slopes (BaA).—This is the only Bartle soil mapped in the county. Most areas are nearly level, but some small areas are gently sloping. Minor areas of a lighter gray, more poorly drained soil are included in the mapped areas of this soil.

The major problem in managing this soil is excess water. Drainage is needed to maintain good yields of cultivated crops. Tile and surface drains generally are satisfactory in overcoming wetness. Where the soil has been drained and limed, crops respond well if a large amount of fertilizer is added.

This soil is suited to most of the crops grown in the county, and it is moderately productive. Shallow-rooted legumes are generally grown instead of alfalfa because of the excess water in the subsoil in spring. A large amount of nitrogen for corn normally gives good results. (Capability unit IIw–2; woodland suitability group 5)

Bewleyville Series[10]

In the Bewleyville series are deep, well-drained, gently sloping to moderately steep soils that have a surface layer of dark-brown silt loam. The lower part of the subsoil is reddish-brown silty clay or clay. These soils were formed in shallow loess, 18 to 48 inches thick, over material that weathered from impure, cherty limestone. The upper horizons developed in the loess, and the lower horizons, in material weathered from the underlying cherty limestone. Depth to the unweathered limestone is generally about 60 inches or more. Sinkholes are common in most areas.

The Bewleyville soils are mainly in the souteastern part of the county. They are below and adjacent to soils formed in material from standstone, and above and adjacent to lakebed soils.

Representative profile of Bewleyville silt loam, 6 to 12 percent slopes, moderately eroded (NE. corner of NW¼ sec. 26, T. 9 N., R. 3 W., about 300 feet E. of county road in an abandoned field where the slope is 7 percent):

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; medium acid; abrupt, smooth boundary.

A2—8 to 9 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B1—9 to 12 inches, dark-brown (7.5YR 4/4) silt loam; moderate, fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—12 to 21 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, medium, angular and subangular blocky structure; firm; medium acid; gradual, smooth boundary.

B22t—21 to 39 inches, dark-brown (7.5YR 4/4) silty clay loam with thin, reddish-brown (5YR 4/4) clay coatings on peds; moderate, medium, angular and subangular blocky structure; firm (loess-residuum boundary); strongly acid; gradual, smooth boundary.

B23t—39 to 43 inches, yellowish-red (5YR 4/6) silty clay loam with some thin, light-gray (10YR 7/2) coatings of silt on peds and some thin, reddish-brown (5YR 4/4) clay films; moderate, medium and coarse, angular blocky structure; firm; very strongly acid; clear, smooth boundary.

IIB24t—43 to 48 inches, red (2.5YR 4/8) silty clay with many black concretions of manganese and iron; moderate, medium and coarse, angular blocky structure; firm; very strongly acid; clear, smooth boundary.

IIB25t—48 to 54 inches, dark-red (2.5YR 3/6) clay with many black concretions of manganese and iron; massive; very firm; plastic and very sticky when wet; about 50 percent chert fragments 1 inch to 2 inches in diameter; medium acid in upper part, becoming calcareous within about an inch of limestone rock; clear, wavy boundary.

R—54 inches +, limestone bedrock.

Depth to bedrock ranges from about 50 to 100 inches. The amount of chert in the horizon just above the bedrock ranges from very little to as much as 70 percent of the horizon. In some gently sloping areas, the soil is deeper to bedrock, is moderately compact, and has gray streaks of silty material in the B2 horizons. The silty material, or loess cap, is generally 30 to 48 inches thick on gentle slopes and 18 to 30 inches thick on the steeper slopes.

The content of organic matter in the plow layer is medium to low, and the moisture-supplying capacity is good. Runoff is medium to rapid. Natural fertility is moderate, and the reaction is medium to strongly acid, except where the soil has been limed. Response to lime and fertilizer is very good.

Erosion is a major problem on the Bewleyville soils. Many areas have been severely eroded, and some have been taken out of cultivation because of serious gullying. These soils are well suited to meadow and pasture crops, particularly alfalfa and bluegrass. Where the slope permits and erosion is controlled, most crops commonly grown in the county can be grown successfully.

Bewleyville silt loam, 2 to 6 percent slopes, moderately eroded (BvB2).—This soil is on ridgetops adjacent to steeper Bewleyville soils. Its profile is similar to the one described as representative of the series, but the silty material is generally about 48 inches deep, and depth to bedrock is about 70 to 80 inches or more. In addition, the horizons below the plow layer are generally thicker. In some places there is a weakly developed fragipan in the profile. This soil is productive, but it is in small areas associated with steeper soils. (Capability unit IIe–1; woodland suitability group 1)

Bewleyville silt loam, 6 to 12 percent slopes, moderately eroded (BvC2).—The profile of this soil is the one described as typical for the series. This soil is not extensive; it occurs in scattered areas, along with gently sloping and moderately steep soils. In the more sloping and eroded areas, the surface layer of dark-brown silt loam is thinner than in other areas. In small areas the present surface layer is made up of dark yellowish-brown material that was formerly subsoil. Runoff is medium.

This soil is well suited to most of the crops commonly grown. It erodes easily, however, if it is cultivated. (Capability unit IIIe–1; woodland suitability group 1)

Bewleyville soils, 6 to 12 percent slopes, severely eroded (BwC3).—Most of the original surface layer of these soils has been lost through erosion. In more than half of the acreage, the present surface layer is made up of dark-brown silty clay loam that was formerly subsoil. In some places there are deep gullies that extend to bedrock. Runoff is medium to rapid.

Much of this soil is cultivated. The soil is probably best suited to small grain and meadow or to permanent

[10] After this report and the soil map had been prepared for publication, the soils in this county that were called Bewleyville were classified as Crider.

pasture. (Capability unit IVe-1; woodland suitability group 1)

Bewleyville silt loam, 12 to 18 percent slopes, moderately eroded (BvD2).—The profile of this soil is similar to the one described as representative of the series. Bedrock is 10 to 15 inches nearer the surface, however, and the silty material and all the horizons are a little thinner. A few deep gullies extend to bedrock. Runoff is rapid, and the hazard of erosion is serious. A few small areas are only slightly eroded. (Capability unit IVe-1; woodland suitability group 1)

Bewleyville soils, 12 to 18 percent slopes, severely eroded (BwD3).—Most of the surface layer of these steep soils has been lost through erosion. In more than half of the acreage, the present surface layer is made up of dark-brown silty clay loam that was formerly subsoil. Bedrock is 10 to 15 inches nearer the surface than in the representative profile, and the silty material and all the horizons are a little thinner. In places deep gullies extend to bedrock. Runoff is rapid, and these soils erode easily if they are not protected.

Much of the acreage is idle or is in poor-quality pasture. Under proper management, however, these soils produce excellent pasture. (Capability unit VIe-1; woodland suitability group 1)

Bewleyville silt loam, 18 to 25 percent slopes (BvE).—The profile of this soil is similar to the one described as representative of the series, except that all the horizons are thinner and there has been little erosion. The silty material is only 18 to 30 inches thick, and depth to bedrock is about 50 inches. Sinkholes occur in many places. In some areas around the sinks, the slopes are as steep as 30 percent. Runoff is rapid. Most of the acreage is in forest. (Capability unit VIe-1; woodland suitability group 6)

Bloomfield Series

In the Bloomfield series are very deep, somewhat excessively drained, rolling to very steep soils that are somewhat hummocky. The surface layer is dark-brown to yellowish-brown loamy fine sand. The subsoil, at a depth of 3 feet or more, consists of bands of loose fine sand and coherent fine sandy loam. The bands of fine sand and fine sandy loam range from ¼ inch to 10 to 20 inches in thickness. These soils developed in windblown, calcareous fine sand in the uplands adjacent to the valley of the West Fork of the White River. They generally are not more than one-half mile from the bottom lands.

The Bloomfield soils are closely associated with the Princeton soils, which also formed in windblown material. They contain less silt than the Princeton soils, and they lack a continuous textural B horizon at a depth of 18 to 36 inches.

Representative profile of Bloomfield loamy fine sand, 6 to 12 percent slopes (SW¼NE¼ sec. 21, T. 9 N., R. 4 W., 100 feet N. of county road about 1 mile E. of Freedom where the slope is 8 percent):

Ap—0 to 7 inches, dark-brown (10YR 3/3) loamy fine sand; weak, fine, granular structure; very friable; slightly acid; abrupt, smooth boundary.

A21—7 to 11 inches, brown (10YR 5/3) loamy fine sand; single grain; very friable; slightly acid; clear, smooth boundary.

A22—11 to 30 inches, light yellowish-brown (10YR 6/4) loamy fine sand; single grain; very friable; slightly acid; abrupt, wavy boundary.

A23 and B2t—30 to 78 inches, light brownish-gray (10YR 6/2) fine sand with many discontinuous bands of dark-brown (7.5YR 4/4) fine sandy loam; the bands are 4 to 6 inches apart and ½ to 1 inch thick in the upper part; single grain; very friable; between a depth of 54 and 78 inches, the bands of fine sandy loam to sandy clay loam comprise about one-half of the horizon; medium acid in the upper part but neutral in the lower part; clear, wavy boundary.

C—78 inches +, very pale brown (10YR 7/3) fine sand; single grain; very friable; calcareous.

The thickness of the bands in the B2 horizon ranges from 1/16 inch to 4 inches or more. The texture of the bands ranges from fine sandy loam to sandy clay loam. Depth at which the bands occur ranges from about 30 to 36 inches, and the thickness of the horizons between the bands ranges from 1 inch to 6 inches or more. In many places a layer of sandy clay loam, 10 to 20 inches thick, is at a depth of 40 to 80 inches.

The content of organic matter and natural fertility are low. The moisture-supplying capacity is low for shallow-rooted crops and fair for deep-rooted crops. There is little runoff because the soils have rapid permeability. The major problem is droughtiness and some wind erosion when the soils are dry. Repeated applications of fertilizer are needed because the soils leach readily.

The special crops to which these soils are well suited are cantaloups, watermelons, brambles, sweetpotatoes, and early tomatoes. Peaches are the most suitable of the tree fruits, and alfalfa is the most suitable of the general farm crops.

Bloomfield loamy fine sand, 6 to 12 percent slopes (ByC).—The profile of this soil is representative of the series. The relief is generally rolling, and the areas resemble dunes. Some small areas are gently rolling. Some of the sandy areas and the knolls that are exposed to wind are moderately eroded. (Capability unit IVe-9; woodland suitability group 15)

Bloomfield loamy fine sand, 12 to 18 percent slopes (ByD).—The profile of this soil is similar to the one described as representative of the series. This soil is strongly sloping, and the areas resemble dunes. Some areas have been moderately eroded by wind. Most of the acreage is cultivated. (Capability unit IVe-9; woodland suitability group 15)

Bloomfield loamy fine sand, 18 to 35 percent slopes (ByE).—The profile of this soil is similar to the one described as typical for the series. In most places this soil is steep, but in some small areas it is strongly sloping. Most of this soil is in forest or brushy pasture. (Capability unit VIIe-1; woodland suitability group 15)

Cincinnati Series

The Cincinnati soils are deep and well drained. They have a dark-brown surface layer and a dark yellowish-brown subsoil. They are gently sloping to moderately steep and generally have a moderately developed fragipan. These soils were developed in 10 to 48 inches of loess underlain by till. They are leached free of carbonates to a depth of 10 feet or more.

These soils occur throughout the glaciated areas of the county. They are closely associated with the imperfectly drained Vigo and the moderately well drained Ava soils, which developed from the same type of parent material as the Cincinnati soils.

Representative profile of Cincinnati silt loam, 2 to 6 percent slopes (SW¼NW¼ sec. 1, T. 9 N., R. 6 W.):

All—0 to 2 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, granular structure; friable; many fine roots; medium acid; abrupt, smooth boundary.

A12—2 to 6 inches, brown (10YR 5/3) silt loam; moderate, thin, platy structure; friable; many fine roots; medium acid; clear, smooth boundary.

A2—6 to 11 inches, dark-brown (10YR 4/3) silt loam; moderate, very fine and fine, subangular blocky structure; few fine roots; friable; medium acid; clear, smooth boundary.

B1t—11 to 20 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; firm; very few fine roots; strongly acid; clear, smooth boundary.

B21t—20 to 27 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; firm; grayish-brown (10YR 5/2) coatings on peds; strongly acid; clear, smooth boundary.

IIB22x—27 to 52 inches, (fragipan), dark-brown (10YR 4/3) gritty silt loam with many, medium, distinct, grayish-brown (10YR 5/2) mottles and brown (7.5YR 5/4) and light-gray (10YR 7/1) clay flows or films; weak, medium and coarse, prismatic structure that breaks to weak, coarse, subangular blocky; friable; strongly acid; gradual, smooth boundary.

IIB31—52 to 122 inches, yellowish-brown (10YR 5/4 to 5/6) loam to clay loam with many, prominent, gray (10YR 6/1) silt streaks and clay flows; massive but breaks to weak, coarse, subangular blocky structure; friable; medium acid becoming slightly acid in lower part; diffuse, irregular boundary.

IIB32—122 to 132 inches, yellowish-brown (10YR 5/4 to 5/6) loam with common, faint, gray (10YR 6/1) silt streaks; massive; friable; neutral; abrupt, smooth boundary.

IIC—132 inches +, pale-brown (10YR 6/3), calcareous loam till.

The color of the surface layer ranges from very dark grayish brown in forested areas to brown in cultivated fields. Depth to calcareous till is 10 feet or more. In the gently sloping to moderately steep areas, there is a deposit of loess that ranges from a few inches to 40 inches or more in thickness. In the steeper areas the horizons are thinner and there is less development of a fragipan.

The Cincinnati soils are low in available phosphate and medium in potash. The content of organic matter in the surface layer is medium to low. The moisture-supplying capacity is good. The fragipan in the lower part of the subsoil restricts somewhat the penetration of roots and slows the infiltration of moisture. Permeability is moderate. These soils are very strongly acid if they have not been limed. Crops grown on them respond well to lime and fertilizer. The steeper areas are mostly in forest and produce excellent timber.

Cincinnati silt loam, 2 to 6 percent slopes (CcB).—The profile of this soil is representative of the series. Some gently rolling areas on ridges that are adjacent to sloping or moderately steep soils are cultivated or used for permanent pasture. These areas generally are managed in the same way as the adjoining steeper soils. Other gently rolling areas are on ridges between steep and very steep draws that are mainly in forest. Because they are small, those areas are generally left in forest. Runoff is medium. If the soil is cultivated, practices should be used to control erosion. (Capability unit IIe–7; woodland suitability group 1)

Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded (CcB2).—The profile of this soil is similar to the one described as typical for the series. This soil is generally gently rolling and is on ridges adjacent to sloping to moderately steep areas. The plow layer has a moderate amount of light yellowish-brown light silty clay loam mixed in it. In some places the present surface layer is made up entirely of material that was formerly subsoil. A few small areas are severely eroded, and there are a few shallow gullies in places. Included in the mapped areas of this soil are some small areas of a soil that is moderately well drained.

Most of the acreage is cultivated. Some areas are in permanent pasture or are idle. If this soil is cultivated, practices to control erosion are needed. (Capability unit IIe–7; woodland suitability group 1)

Cincinnati soils, 2 to 6 percent slopes, severely eroded (CfB3).—The profile of these soils is similar to the one described for the series, except that erosion has removed most of the original surface layer and a large part of the subsoil. The surface layer is now predominantly light yellowish-brown to dark-brown silty clay loam, but in many small areas it is silt loam. In places there are some shallow gullies and an occasional deep gully.

These soils are mainly on gently sloping ridgetops and along the upper ends of drainageways that extend into less sloping areas. Many of the areas are small, and they are generally managed in the same way as the adjoining soils. Runoff is medium. The moisture-supplying capacity is a little lower than that in the uneroded soils. Included in the mapped areas of this soil are some small areas of a soil that is moderately well drained.

Most of the acreage is in cultivation, but some of it is in permanent pasture or is idle. The plowed soils are likely to be cloddy, and a good seedbed is difficult to prepare. Erosion is the major hazard. Terraces and diversions or suitable cultural practices are needed in most places to help control erosion. (Capability unit IIIe–7; woodland suitability group 1)

Cincinnati silt loam, 6 to 12 percent slopes (CcC).—The profile of this soil is similar to the one described as representative of the series. This soil is generally on breaks from the more nearly level areas and on ridges between steep draws that are in forest. Because this soil is in such small areas and is on narrow ridges, it is generally managed in the same way as the adjoining soils. Runoff is rapid.

Included in the mapped areas of this soil are some small areas of a moderately well drained soil. Also included are minor areas where the soil is less than 70 inches deep over sandstone and shale bedrock. In these included areas the fragipan is more strongly developed than in areas where the till is deeper.

Cincinnati silt loam, 6 to 12 percent slopes, is mainly in timber or permanent pasture. If the soil is cultivated, erosion is the major problem, and some type of erosion control should be practiced. Under proper management good yields of cultivated crops and pasture are obtained. In wooded areas rapid growth of timber of high quality can generally be expected. (Capability unit IIIe-7; woodland suitability group 1)

Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded (CcC2).—The profile of this soil is similar to the one described as typical for the series. In many places, however, the surface layer has mixed with it a moderate amount of light yellowish-brown to dark-brown light silty clay loam that was formerly subsoil. Some places are severely eroded, and in those areas the present surface layer is made up entirely of material that was formerly subsoil. There are also a few shallow gullies in places.

This soil is generally on the breaks and draws that extend into the nearly level areas of the associated Vigo and Ava soils. It also occupies sloping ridges in areas that are steeper. Runoff is rapid. Included in the mapped areas of this soil are minor areas where the soil is less than 70 inches deep over sandstone and shale bedrock. In these included areas the fragipan is more strongly developed than in areas where the till is deeper.

Most of the acreage is cultivated, but a small acreage is idle or in pasture. Erosion is the major problem. If this soil is cultivated, terraces and diversions and suitable cultural practices are generally needed to help control erosion. Under proper management most of the cultivated crops grown in the county make good yields. (Capability unit IIIe-7; woodland suitability group 1)

Cincinnati soils, 6 to 12 percent slopes, severely eroded (CfC3).—These soils have a profile similar to the one described as representative for the series. Most of the original surface layer, however, has been lost through erosion, and the present surface layer is predominantly light yellowish-brown to dark-brown silty clay loam. There are some shallow gullies and a few deep gullies. The moisture-supplying capacity is a little lower than that of uneroded soils. Runoff is medium.

Included in the mapped areas of these soils are minor areas where the soil is less than 70 inches deep over sandstone or shale bedrock. In the included areas the fragipan is more strongly developed than in areas where the till is deeper.

Most of the acreage is cultivated, but some areas are idle or in pasture. The plowed soils are likely to be cloddy, and a good seedbed is difficult to prepare. Erosion is a serious problem. Terraces and diversions or suitable cultural practices that control erosion are needed in most places to help prevent further erosion. These soils cannot be farmed so intensively as the uneroded Cincinnati silt loam, 6 to 12 percent slopes. They require more intensive conservation practices and are probably best suited to hay or meadow. (Capability unit IVe-7; woodland suitability group 1)

Cincinnati silt loam, 12 to 18 percent slopes (CcD).—The profile of this soil is similar to the one described as representative of the series, except that all the horizons are somewhat thinner and the solum is a little shallower. This soil is mainly on moderately steep breaks, in draws, and on ridges adjacent to the steeper Hickory soils. Included in the mapped areas of this soil are minor areas where the soil is less than 70 inches deep over bedrock.

Most of the acreage is in trees or permanent pasture. If the soil is cultivated, practices that control erosion should be used. In the wooded areas timber of high quality makes rapid growth. Under proper management good yields of forage can be expected. (Capability unit IVe-7; woodland suitability group 1)

Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded (CcD2).—This soil has a profile similar to the one described as typical for the series, except that it is slightly shallower and all the horizons are somewhat thinner. In addition, the fragipan is less well developed. In the present surface layer, a moderate amount of light yellowish-brown to dark-brown light silty clay loam is mixed with material from the original surface layer. Some places are severely eroded, and in those areas the present surface layer is made up entirely of material that was formerly subsoil. In some places there are a few shallow gullies.

This soil is generally in moderately steep draws and on breaks from the more nearly level areas of the associated Vigo and Ava soils. It is also on moderately steep ridges adjacent to the steeper Hickory soils. Runoff is rapid. Included in the mapped areas of this soil are a few small areas where the soil is less than 70 inches deep over bedrock.

Most of the acreage is cultivated or in permanent pasture, but some of it is idle. Erosion is the main problem. If this soil is cultivated, terraces and diversions are needed and suitable cultural practices should be used to help prevent further erosion. This soil should be kept in permanent vegetation most of the time and cultivated only occasionally. It is best suited to hay or permanent pasture. Under proper management yields of forage are good. (Capability unit IVe-7; woodland suitability group 1)

Cincinnati soils, 12 to 18 percent slopes, severely eroded (CfD3).—These soils have a profile that is similar to the representative profile described for the series. All the horizons, however, are somewhat thinner, and the solum is a little shallower over bedrock. Also, the fragipan is not so well developed. Most of the original surface layer has been removed by erosion, and the present surface layer is now predominantly dark-brown to light yellowish-brown silty clay loam. In some places there are shallow gullies, and in a few places there are deep gullies.

These soils are on moderately steep breaks in less sloping areas and on moderately steep ridges adjacent to steeper soils. The moisture-supplying capacity is lower than that of the uneroded Cincinnati soils. Runoff is rapid or very rapid. Mapped with these soils are minor areas where the soil is less than 70 inches deep over sandstone or shale.

Most of the acreage is cultivated or is idle. Erosion is a serious hazard, however, and limits the use of these soils for row crops. Under proper management good pasture is produced. (Capability unit VIe-1; woodland suitability group 1)

Cincinnati and Hickory silt loams, 18 to 25 percent slopes (ChE).—This mapping unit consists of intermixed areas of Cincinnati and Hickory soils in steep draws and on breaks from the less sloping associated soils. The profile of each soil is similar to the representative one described, but all the horizons are thinner, development of the fragipan in the Cincinnati soil is weak, and the depth to calcareous material is generally 5 to 7 feet. In some places bedrock is at a depth of less than 6 feet. Runoff is very rapid.

Most of the acreage is in forest or permanent pasture. Erosion is the major problem if permanent vegetation is not maintained. A rapid growth of high-quality timber can be obtained in forested areas. If these soils are cleared and managed properly, they produce good pasture. (Capability unit VIe-1; woodland suitability group 2)

Cincinnati and Hickory silt loams, 18 to 25 percent slopes, moderately eroded (ChE2).—These soils are generally in small areas in steep draws and on breaks and ridges. Their profile is similar to the representative profile described for each series, except that all the horizons are thinner, development of the fragipan is weak, and depth to calcareous material is generally 5 to 7 feet. In some places bedrock is at a depth of less than 6 feet. In places the original surface layer has been mixed with dark-brown to light yellowish-brown material that was formerly subsoil. In a few places the present surface layer is made up entirely of material that was formerly subsoil. Some areas are severely eroded, and there are some shallow gullies.

Most of the acreage is in pasture or is idle. These soils are subject to severe erosion if permanent vegetation is not maintained. They are suited to permanent pasture or trees. (Capability unit VIe-1; woodland suitability group 2)

Corydon Series

In the Corydon series are shallow, moderately steep to very steep, somewhat excessively drained soils that are underlain by limestone. The surface layer is very dark grayish brown. The material below the A horizon is brown to dark brown. These soils were developed in material weathered from high-grade cherty limestone. They have no B horizon or only a weakly developed one. In places there is a very thin mantle of loess. Depth to limestone bedrock is generally less than 18 inches. In many places there are numerous fragments of rock on the surface, and outcrops of rock are common in most areas.

The Corydon soils are closely associated with the well-drained Bewleyville and Grayford soils. Their profile is shallower than that of the Bewleyville soils. Unlike the Grayford soils, the Corydon soils have a shallow profile. They also developed in residuum from cherty limestone rather than in loess over strongly leached till underlain by red clay weathered from limestone. The Corydon soils are similar to the Muskingum soils, but they are darker and less friable, and they are underlain by limestone instead of by sandstone and shale.

Representative profile of Corydon stony silt loam, 35 to 70 percent slopes (SW¼NE¼ sec. 32, T. 11 N., R. 3 W., where the slope is 45 percent):

A0—½ inch to 0, leaf litter; neutral.

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) stony silt loam; moderate, medium, granular structure; friable; abundant roots; stones on the surface; neutral; clear, smooth boundary.

A2—3 to 9 inches, very dark grayish-brown (10YR 3/2) heavy silt loam; moderate, medium, granular structure; firm; abundant roots; neutral; gradual, smooth boundary.

C—9 to 15 inches, brown to dark-brown (10YR 4/3) silty clay loam; moderate, medium, subangular blocky structure; numerous limestone fragments; few roots; neutral to slightly calcareous; calcareous near stone fragments; abrupt, irregular boundary.

R—15 inches +, limestone bedrock with numerous cracks filled with weathering soil material and some roots.

The main variations are in the thickness of the mantle of silty material that overlies bedrock and in the degree of profile development. Generally, there is a weakly developed B horizon in the deeper profiles and little development of a B horizon in the shallower profiles. The amount of rock fragments on the surface and the number of outcrops vary considerably within short distances.

The Corydon soils have very rapid runoff, and they erode easily. They are mainly in forest, but a few moderately steep areas have been cleared and are used for pasture. These soils, however, are somewhat droughty even for pasture.

Corydon stony silt loam, 12 to 18 percent slopes (CoD).—This soil has a profile similar to the one described for the series. In most places little erosion has taken place on this sloping to moderately steep soil, but there are some small, gently sloping to steep areas that are slightly to moderately eroded. Under good management fair pastures can be obtained. Areas that have not been cleared should be left in timber. (Capability unit VIe-1; woodland suitability group 7)

Corydon stony silt loam, 35 to 70 percent slopes (CoG).—Little erosion has occurred on this steep, forested soil. There are numerous stones and outcrops throughout the area. Slippage occurs occasionally, especially in cleared areas. In some places the soil material is as deep as 24 inches or more. These deeper areas generally support trees of higher quality than do the normal areas. In places there are a few moderately steep and somewhat eroded areas.

This soil should be left in trees because of the severe hazard of erosion. Runoff is very rapid in cleared areas. (Capability unit VIIe-1; woodland suitability group 7)

Dubois Series

The Dubois soils are moderately deep, imperfectly drained, and nearly level or gently sloping. Their surface layer is grayish brown, and their subsoil is gray and mottled. They have a somewhat impervious layer in the subsoil. The parent material is strongly weathered, lake-laid clay and silt that is leached to an average depth of 10 to 12 feet.

These soils are in the old Lake Quincy area in the northeastern part of the county and west along Mill Creek. They are also in the Fat Woods area southeast of Spencer and along many of the small streams.

The Dubois soils are closely associated with the well drained Otwell, the moderately well drained Haubstadt, and the poorly drained Robinson soils. All of these soils developed in the same kind of parent material as the Dubois soils.

Representative profile of Dubois silt loam, 0 to 2 percent slopes (SE¼ sec. 27, T. 10 N., R. 3 W.):

A00—1 to ¼ inch, undecomposed leaf litter.

A0—¼ inch to 0, partly decomposed leaf litter (organic material).

A1—0 to 1 inch, very dark gray (10YR 3/1) silt loam; moderate, fine, granular structure; friable; plentiful roots; neutral; abrupt, smooth boundary.
A21—1 to 3 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; friable; many manganese concretions; plentiful roots; very strongly acid; abrupt, smooth boundary.
A22—3 to 13 inches, gray (10YR 6/1) silt loam with many, fine, distinct, yellowish-brown (10YR 5/8) mottles; weak, medium, subangular blocky structure; friable; few manganese concretions; plentiful roots; very strongly acid; clear, smooth boundary.
B1t—13 to 20 inches, gray (10YR 6/1) light silty clay loam with many, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; firm; thin, gray silt coatings on peds; few roots; very strongly acid; clear, irregular boundary.
B21t—20 to 30 inches, gray (10YR 6/1) silty clay loam with many, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, columnar structure; firm; few roots; few manganese concretions; gray silt coatings on peds; very strongly acid; clear, smooth boundary.
B22t—30 to 42 inches, gray (10YR 6/1) silty clay loam with many, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, coarse and very coarse, columnar structure; massive inside of columns; firm; few roots; few manganese concretions; gray silt coatings on peds; very strongly acid; gradual, smooth boundary.
IIB3—42 to 50 inches, gray (10YR 6/1) silt loam with many, medium, distinct, yellowish-brown (10YR 5/8) mottles; weak, coarse, columnar structure; friable; no roots; few manganese concretions; some light-gray (10YR 7/1) silt fillings; very strongly acid; abrupt, wavy boundary.
IIC1—50 to 120 inches, stratified clay loam, clay, silt loam, and fine sandy loam; very strongly acid in upper part and neutral in lower part.
IIC2—120 inches +, calcareous, stratified clay, clay loam, silty clay loam, silt, and fine sandy loam to a depth of 30 feet or more as determined by exposures in deep cuts.

The color of the surface layer ranges from grayish brown in cultivated fields to dark gray or very dark gray in virgin forested areas. In many places the structure of the A22 horizon is platy. In places the silt loam A2 horizon extends to a depth of 20 to 26 inches, where there is an abrupt change to a B2 horizon of silty clay loam.

The combined thickness of the A2 and B1 horizons is 20 to 26 inches in the Dubois soils mapped in old Lake Quincy in the northeastern part of the county and along Mill Creek. Along streams and in the glacial lake and Flat Woods area southeast of Spencer, these horizons are generally only 14 to 22 inches thick. There is a nearly continuous layer of an old buried soil at a depth of 50 to 70 inches in the Lake Quincy area. This dark, buried soil has a gleyed profile that generally consists of 20 to 30 inches of slightly acid silty clay to clay loam. A buried soil does not occur to any extent in the soils mapped in the Flat Woods area nor in soils along other streams in the county.

The Dubois soils are low in available phosphate and potash and in content of organic matter. Their moisture-supplying capacity is good. Runoff is slow or very slow, and permeability is very slow. These soils are very strongly acid if they have not been limed. If they are drained, the response to lime and fertilizer is good.

These soils are moderately productive and are suited to most of the crops commonly grown in the county. Roots penetrate only moderately deep because of the high water table and the somewhat impervious subsoil. For this reason alfalfa is not well suited. The main problem in managing these soils is excess water. Drainage is necessary to maintain good yields of cultivated crops. Both surface and tile drains can be used, but in some areas tile seem to function better than in other areas. Generally, surface ditches that are designed and maintained properly give good drainage.

Dubois silt loam, 0 to 2 percent slopes (DbA).—The profile of this soil is described as representative for the series. Because most of the acreage has been cultivated, however, the surface layer is grayish brown rather than very dark gray.

In the Lake Quincy and Flat Woods regions, this soil is in broad areas and can generally be farmed as individual fields of 40 acres or more. Along some of the streams in the other parts of the county, where the soil is in smaller areas of only 5 to 20 acres, it is generally farmed with the more rolling soils in the same field. (Capability unit IIIw–7; woodland suitability group 5)

Dubois silt loam, 2 to 6 percent slopes (DbB).—The profile of this soil is similar to the one described for the series. Most of the acreage has been cultivated, and as a result, the surface layer is grayish brown. In most places the slopes are about 3 percent.

Because of the gentle slope, the removal of excess water is less difficult than in nearly level areas. Some erosion takes place on long slopes that are cultivated. If continued good yields are to be expected, both erosion control and the removal of excess water need to be considered in managing this soil. (Capability unit IIIw–3; woodland suitability group 5)

Dubois silt loam, 2 to 6 percent slopes, moderately eroded (DbB2).—The profile of this soil is similar to the one described for the series, but the surface layer is gray to grayish brown. In places the surface layer contains a moderate amount of material that was formerly subsoil. Most of the soil has slopes of 3 to 4 percent. There are a few shallow gullies.

The problem of excess water is less severe than on the soil for which a representative profile is described. However, erosion control and the problem of excess water should be considered if continued good yields are to be expected. (Capability unit IIIw–3; woodland suitability group 5)

Eel Series

In the Eel series are deep, moderately well drained, dark-brown to dark yellowish-brown soils that were formed in alluvium. These soils have grayish, mottled layers starting at a depth of 16 to 24 inches. They are neutral to mildly alkaline and are on the bottom lands along the White River, the Eel River, and Mill Creek. The soil profile shows little development other than an accumulation of organic matter in the surface layer.

The Eel soils are associated with the well-drained Genesee soils and the imperfectly drained Shoals soils, which were formed from the same kind of neutral alluvial material. The Eel soils are less acid than the Philo soils, and they formed in a different kind of alluvial material.

Representative profile of Eel silt loam (SE¼NW¼ sec. 16, T. 9 N., R. 4 W.):

- Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.
- A2—8 to 11 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, thick, platy structure; friable; neutral; clear, smooth boundary.
- C1—11 to 16 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; neutral; clear, smooth boundary.
- C2—16 to 40 inches, grayish-brown (10YR 5/2) silt loam with many, fine, faint, dark-brown (10YR 4/3) mottles; weak, medium, subangular blocky structure; friable; neutral; gradual, wavy boundary.
- C3—40 to 60 inches +, grayish-brown (10YR 5/2) stratified silt loam, loam, and sandy loam, with many, fine, faint, dark-brown (10YR 4/3) mottles; massive; friable; neutral.

The texture of the subsoil ranges from heavy loam to light silty clay loam. Gravel and sand occur below a depth of 4 or 5 feet in many places. Originally these bottom-land soils were covered by a dense forest of sycamore, soft maple, elm, ash, cottonwood, and tulip trees. Most of the areas have now been cleared.

The soils are subject to frequent flooding from December to June, and their use is governed by the hazard of flooding. Floods generally damage crops seeded in fall and make it impractical to use a systematic cropping system. Corn and soybeans are popular crops because of their high acre value and because they can be planted in summer and harvested early in fall, when floods are not serious.

Eel silt loam (Es).—The profile of this soil is described as representative of the series. This nearly level soil is mainly in the valleys of Mill Creek, the White River, and the Eel River. In wooded areas or in old pastures, the uppermost few inches may be slightly darker and richer in organic matter than in other areas.

Included in the large mapped areas of this soil are minor areas of imperfectly drained and well-drained soils of the bottom lands. Also included are some areas of a medium acid soil.

Overflow and wetness are problems on Eel silt loam. Generally, surface drains and tile are needed for maximum production. The moisture-supplying capacity is high. Crops grown on the soil respond well to good management. This soil has a medium phosphate requirement and a low potassium requirement. Corn grown on it generally responds to large applications of nitrogen.

Small, irregular areas in the narrow bottom lands of tributary streams that are dissected by meandering streams are generally kept in trees or pasture. Most of the larger areas that occur with other bottom-land soils are cultivated. (Capability unit IIw–7; woodland suitability group 8)

Eel loam (Em).—This soil has a profile like the one described for the series except that the surface layer is loam. Also, somewhat coarser material is generally throughout the profile. In places in wooded areas or in old pastures, the uppermost few inches contains more organic matter and is slightly darker than in cultivated fields.

Occasional areas where the surface layer is fine sandy loam and minor areas where it is silt loam are included in the mapped areas of this soil. Also included are areas of a strongly acid soil formed in strongly acid alluvial material washed from uplands that are adjacent to the bottom lands. (Capability unit IIw–7; woodland suitability group 8)

Eel silty clay loam (Et).—The profile of this soil is like the one described as representative for the series, but it has a surface layer and a subsoil of silty clay loam. In addition, below a depth of 3 feet, the underlying layers are generally finer textured to a depth of 5 feet or more. Eel silty clay loam is normally in abandoned channels of the White and Eel Rivers and is somewhat lower than the Genesee soils that generally surround it.

This soil has high moisture-supplying capacity. It has a medium phosphate requirement and a low potassium requirement. Crops grown on it respond well to good management.

Overflow and wetness are the principal problems in managing this soil. Hard clods form if the soil is cultivated when it is wet. The hazard of flooding is somewhat greater on the large stream bottoms than in other areas. Normally, some surface drains and tile are needed to bring this soil into maximum production. Corn and soybeans are the principal crops. Corn generally responds well if large amounts of nitrogen are applied. No lime is needed. (Capability unit IIw–7; woodland suitability group 8)

Genesee Series

In the Genesee series are deep, well-drained, dark yellowish-brown to dark-brown soils that formed in alluvium. The soils are neutral to mildly alkaline and are on the bottom lands along the West Fork of the White River, the Eel River, and Mill Creek. Their profile shows little development other than the accumulation of organic matter in the surface layer.

The Genesee soils are associated with the moderately well drained Eel soils and the imperfectly drained Shoals soils, which were formed in the same kind of neutral alluvial material as the Genesee soils. The Genesee soils are less acid than the Pope soils, and they formed in neutral alluvium rather than in acid alluvial material washed chiefly from soil areas of mixed Illinoian drift, shale, and sandstone.

Representative profile of Genesee loam, where the slope is 0 to 2 percent (NE¼ sec. 29, T. 10 N., R. 3 W., 300 feet W. of highway 43 and about 800 feet S. of the West Fork of the White River):

- Ap—0 to 9 inches, dark yellowish-brown (10YR 3/4) loam; weak, fine, granular structure; friable; neutral; abrupt, smooth boundary.
- C1—9 to 26 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium and fine, subangular blocky structure that breaks to weak, medium, granular structure; friable; neutral; diffuse, wavy boundary.
- C2—26 to 42 inches, dark-brown (10YR 4/3) silt loam; weak, medium and fine, subangular blocky structure that breaks to weak, medium, granular structure; friable; neutral; clear, wavy boundary.
- C3—42 to 63 inches, brown (10YR 5/3) sandy loam; massive; friable; neutral; clear, wavy boundary.
- C4—63 inches +, brown (10YR 5/3) stratified loam, silt, fine sand, and silt loam; massive; friable, neutral.

The major variations are in the texture of the horizons. Generally, the texture is loam near the main channels of the large streams, and silt loam away from the main streams. Some areas along large streams, such as the White River, are slightly calcareous from the surface downward.

These soils are subject to frequent flooding from December to June. Their use is governed primarily by the hazard of flooding. Floods damage many crops, chiefly those seeded in fall, and make it impracticable to use a systematic crop rotation. Corn and soybeans are popular crops because they can be planted in summer and harvested early in fall, when floods are less likely to occur. Wheat, alfalfa, red clover, and other crops that stand over the winter can be grown only on the higher natural levees from which waters recede quickly, or in areas protected by manmade levees.

Originally, all of these bottom-land soils were covered by a dense forest of sycamore, soft maple, elm, ash, cottonwood, and tulip trees. Most of this forest has now been cleared, but timber has been left along the larger streams. The timber protects the banks and prevents changes in the course of the streams.

Genesee silt loam (Gm).—This nearly level soil has a profile like the one described for the series, but the surface layer is silt loam. Also, the silty material extends deeper in the underlying material than in the typical profile. In wooded areas or old pastures, the uppermost few inches may be slightly darker and richer in organic matter than in other areas.

Included in the mapped areas of this soil are some areas of a medium acid soil that formed in alluvium. Also included are a few areas on higher bottom lands that are less susceptible to flooding than the areas generally occupied by Genesee silt loam.

Genesee silt loam has high moisture-supplying capacity and responds well to good management. It has a medium phosphate requirement and a low potassium requirement. Corn grown on this soil generally responds well to large applications of nitrogen. The small, irregular fields on the narrow bottom lands of tributary streams are generally dissected by meandering stream channels. They are normally kept in trees or pasture because of the difficulty of using machinery. (Capability unit I-2; woodland suitability group 8)

Genesee loam (Gg).—The profile of this soil is described for the series. This soil is fairly uniform, but it varies somewhat in the amount of sand in the layers below the plow layer. In some places in wooded areas or old pastures, the uppermost few inches is slightly darker and contains more organic matter than other areas.

Small areas of fine sandy loam and of silt loam are included in many places in the mapping of this soil. Also included on some of the narrow bottoms are areas of a medium acid soil.

Genesee loam has high moisture-supplying capacity and responds well to good management. It has a medium phosphate requirement and a low potassium requirement. Corn grown on this soil generally responds to large applications of nitrogen. No lime is needed. The small, irregularly shaped fields on the narrow bottom lands of tributary streams are generally dissected by meandering stream channels. They are normally kept in trees or pasture because of the difficulty of using machinery. (Capability unit I-2; woodland suitability group 8)

Gravel Pits

This miscellaneous land type is along the White River and in outwash material throughout the county. The pits along the White River are in beds of gravel and sand that underlie alluvial and terrace soils. Other pits in the county are in the underlying gravelly and sandy substratum layers beneath the Negley, Parke, and Pike soils. Areas of Gravel pits are identified on the map by a symbol.

The material taken from the pits is used for roads and for concrete and construction work. In places willows and shrubs, which provide habitats for wildlife, grow in Gravel pits. (Capability unit VIIIs-1; not placed in a woodland suitability group)

Grayford Series

The Grayford soils are deep, well drained, and nearly level to very steep. Their surface layer is dark grayish brown to brown, and their subsoil is dark brown. They developed in 10 to 50 inches of loess over weathered Illinoian till that is underlain by material weathered from limestone. Depth to bedrock ranges from 3 to 8 feet.

These soils are in the sinkhole areas in the northeastern part of the county. Most of the acreage is north of Gosport. Numerous sinkholes give the relief a characteristic pothole appearance.

The Grayford soils are closely associated with the imperfectly drained Vigo, the moderately well drained Ava, and the well drained Cincinnati soils, all of which developed where the depth of silt and till is 10 to 12 feet or more over limestone. The associated soils are intermixed throughout areas of Grayford soils.

Representative profile of Grayford silt loam, 12 to 18 percent slopes (SE¼NE¼ sec. 23, T. 10 N., R. 3 W.):

A0—½ inch to 0, accumulated layer of partly decomposed grasses and leaves.

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; numerous roots; neutral; abrupt, smooth boundary.

A2—3 to 10 inches, dark-brown (10YR 4/3) silt loam; weak, medium, platy structure; friable; abundant roots; neutral; clear, smooth boundary.

B1—10 to 15 inches, dark-brown (7.5YR 4/4) heavy silt loam; moderate, medium, subangular blocky structure; friable; few roots; slightly acid; clear, smooth boundary.

B21t—15 to 31 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, medium, subangular blocky and angular blocky structure; firm; very strongly acid; gradual, smooth boundary; till-loess boundary is at a depth of 31 inches.

B22t—31 to 39 inches, dark-brown (7.5YR 4/4) light silty clay loam with dark-brown (7.5YR 4/4) clay films and pinkish-gray (7.5YR 6/2) silt streaks; moderate, medium, subangular blocky structure; firm; very strongly acid; gradual, smooth boundary.

IIB23t—39 to 50 inches, yellowish-red (5YR 4/6) gritty silt loam with dark-brown (7.5YR 4/4) clay films and pinkish-gray (7.5YR 6/2) silt streaks; weak, coarse, subangular blocky structure; friable; strongly acid; clear, smooth boundary.

IIIB24tb—50 to 55 inches, dark reddish-brown (5YR 3/4) silty clay; massive; plastic; medium acid; clear, wavy boundary.

IIIB25tb—55 to 60 inches, dark-red (2.5YR 3/6) clay; massive; plastic; neutral to calcareous.

R—60 inches +, limestone bedrock with tongues of soil material extending into the cracks.

The color of the surface layer ranges from dark grayish brown in uncultivated areas to dark brown in cultivated fields. In most places near the bottoms of sinkholes, the soil material is 3 feet or less deep, and it is as much as 8 feet deep on the ridges between the sinks. Depth to bedrock varies within any mapped area. The loess cap, or silty material, on the ridges between sinks is 50 inches or more thick, and it is thin or absent on steeper slopes. The thickness of the till ranges from a few inches to 36 inches or more.

The Grayford soils are low in available phosphate and medium in potash. The content of organic matter in the surface layer is medium to low. Moisture-supplying capacity is good, and permeability is moderate. These soils are strongly acid if they have not been limed. Crops grown on them respond well to applications of lime and fertilizer. Because of the kind of underlying material, there are generally few good pond sites on the Grayford soils.

Grayford silt loam, 0 to 2 percent slopes (GrA).—The profile of this soil is similar to the one described for the series, but it is generally deeper to bedrock—about 6 to 8 feet. This soil is in small areas, 5 acres or less, mostly on flat ridges between sinkholes. Included in the mapped areas of this soil are some small areas of a soil that has sandy and gravelly outwash between the loess and the material weathered from limestone.

Grayford silt loam, 0 to 2 percent slopes, is not extensive in this county and is generally managed in the same way as the adjoining soils. It is highly productive and is excellent for fruit trees and alfalfa. (Capability unit I–1; woodland suitability group 1)

Grayford silt loam, 2 to 6 percent slopes (GrB).—This soil has a profile similar to the one described as representative of the series, except that all the horizons are a little thicker, the thickness of loess is 30 to 50 inches, and depth to bedrock is 4 to 7 feet. This soil is in areas of gently sloping ridges, shallow sinks, and fairly smooth slopes. Many of the sinks have outlets for surface water. Open or noncrossable sinkholes, however, are rare. Included in the mapped areas of this soil are small areas of Cincinnati soils.

This is among the best soils of the county for crops, and most of it is in cultivation. It is excellent for fruit trees and alfalfa. Under proper management good yields can be expected consistently. Many narrow ridges of this soil between sinkholes in the steep areas are used in the same way as the adjoining steeper soils. Erosion is the major problem if the soil is cultivated. On uniform slopes, terraces and diversions can be used to help control erosion. Only cultural or vegetative practices can be used in the sinkhole areas. (Capability unit IIe–1; woodland suitability group 1)

Grayford silt loam, 2 to 6 percent slopes, moderately eroded (GrB2).—The profile of this soil is similar to that of Grayford silt loam, 2 to 6 percent slopes, except that this soil has been moderately eroded. The present surface layer is partly dark-brown silty clay loam that was formerly subsoil. In some places the surface layer is made up entirely of material that was formerly subsoil. A few small areas have been severely eroded, and there are a few shallow gullies.

Most of the acreage is cultivated. This soil is good for crops, and with the proper management, good yields can be expected. It is excellent for fruit trees and alfalfa. Some type of erosion control, however, is needed to help prevent further erosion. Generally, it is necessary to use vegetative and cultural practices to control erosion in the sinkhole areas where constructing terraces and diversions is impractical. (Capability unit IIe–1; woodland suitability group 1)

Grayford soils, 2 to 6 percent slopes, severely eroded (GsB3).—The profile of these soils is similar to that of Grayford silt loam, 2 to 6 percent slopes, except that in most places severe erosion has occurred. Most of the original surface layer has been lost through erosion, and the present surface layer is predominantly dark-brown silty clay loam. In places there are some shallow gullies and an occasional deep gully, which causes the bedrock to be exposed. In some places, on the ridges between sinks, the soil has been only moderately eroded. The moisture-supplying capacity of these soils is a little lower than that of the uneroded soils.

Most of the acreage is in cultivation. The plowed soils are likely to be cloddy, and a good seedbed is difficult to prepare. These eroded soils cannot be farmed so intensively as the uneroded soils, but with proper management good crop yields can be expected. Fruit trees and alfalfa do well. The hazard of further erosion is serious, and some type of erosion control is generally necessary. Where the slopes are not uniform enough for terraces and diversions, it is generally necessary to depend on vegetative or cultural practices. (Capability unit IIIe–1; woodland suitability group 1)

Grayford silt loam, 6 to 12 percent slopes (GrC).—The profile of this soil is similar to the one described for the series, except that the thickness of loess is 20 to 40 inches and the depth to bedrock is 4 to 6 feet. Some areas have numerous sinkholes; others have fairly uniform slopes and only a few sinkholes. Most of the sinkholes are shallow and filled with silt, but some are open and not crossable. The sinkholes provide outlets for some of the surface water. Runoff is medium to rapid.

Some small areas of Cincinnati soils are included in the mapped areas of this soil. The included soils are on gently sloping ridges between the sinks.

Most of Grayford silt loam, 6 to 12 percent slopes, is in permanent pasture or trees, but part of it is in cultivation. The soil is mainly in small areas and is managed in the same way as the steeper adjoining soils. The larger areas are well suited to crops, and with proper management good yields can be obtained. Fruit trees and alfalfa do well. Erosion is the major problem in cultivating this soil. If the soil is cultivated, terraces or diversions can be used on the uniform slopes, or on about half of the acreage, to help control erosion. Vegetative or cultural practices are used where terraces and diversions are not suitable. (Capability unit IIIe–1; woodland suitability group 1)

Grayford silt loam, 6 to 12 percent slopes, moderately eroded (GrC2).—The profile of this soil is similar to that of Grayford silt loam, 6 to 12 percent slopes, but moderate erosion has taken place. The thickness of loess is 20 to 40 inches, and the depth to bedrock is 4 to 6 feet. The surface layer is partly dark-brown silty clay loam that was formerly subsoil. In some places the surface layer is made up entirely of material that was formerly subsoil. A few small areas, generally near the sinks, have been severely eroded, and there are a few shallow gullies in places.

Most of the acreage is cultivated. This soil is suited to crops, and if it is managed properly, good yields of all the crops commonly grown in the county can be obtained. Fruit trees and alfalfa grow especially well. Measures that help control further erosion are needed. Vegetative or cultural practices that control erosion are necessary on about half of the acreage on the complex slopes where constructing terraces and diversions is generally impractical. (Capability unit IIIe-1; woodland suitability group 1)

Grayford soils, 6 to 12 percent slopes, severely eroded (GsC3).—These soils have a profile similar to the one described for Grayford silt loam, 6 to 12 percent slopes, except that severe erosion has occurred. Most of the original surface layer has been removed by erosion, and the present surface layer is predominantly dark-brown silty clay loam. Some shallow gullies and an occasional deep gully, which in many places exposes the bedrock, are present. In some places, on the ridges between sinks, the soil has been only moderately eroded. The moisture-supplying capacity is a little lower than that of the uneroded soils.

Most of the acreage is in cultivation, but permanent pasture or meadow is generally the best use. Fruit trees and alfalfa grow well. Plowing makes these eroded soils cloddy, and a good seedbed is difficult to prepare. Erosion is a serious problem. Some practices are needed to prevent further erosion. About half of the acreage has complex slopes, where constructing terraces and diversions is generally not practical. In those areas vegetative or cultural practices are necessary. These eroded soils should not be farmed so intensively as the slightly eroded and moderately eroded soils. (Capability unit IVe-1; woodland suitability group 1)

Grayford silt loam, 12 to 18 percent slopes (GrD).—The profile of this soil is the one described as representative of the series. The loess is generally 15 to 30 inches thick, and the average depth to bedrock is 3 to 5 feet. About 50 to 70 percent of this soil has complex slopes, and there are numerous deep sinkholes throughout part of the acreage. The soil also has fairly uniform slopes where there is only an occasional sinkhole. Many of the sinkholes are filled with silt, but there are numerous deep sinks that are open or noncrossable. The sinkholes provide outlets for most of the surface water, and limestone bedrock is exposed in many places near the bottom of the sinks.

This soil is mainly in permanent pasture or forest. It is probably best suited to hay and is excellent for alfalfa. Under proper management good yields can be obtained. Erosion is a serious hazard if the soil is cultivated. Vegetative or cultural practices are needed in some places to control erosion. (Capability unit IVe-1; woodland suitability group 1)

Grayford silt loam, 12 to 18 percent slopes, moderately eroded (GrD2).—This soil has a profile like the one described as representative of the series, but it is moderately eroded. The thickness of loess is generally 15 to 30 inches, and the average depth to bedrock is 3 to 5 feet. Mixed in the surface layer is a moderate amount of dark-brown silty clay loam that was formerly subsoil. A few small areas have been severely eroded, and in them the present surface layer is original subsoil. In places there are a few shallow gullies. About 35 percent of the soil has complex slopes.

This soil is mainly in cultivation or permanent pasture. It is probably best suited to hay, and under proper management yields are good. The soil is excellent for alfalfa. To prevent further erosion, suitable vegetative or cultural practices should be used in cultivated areas. However, the soil should be kept in permanent vegetation most of the time. (Capability unit IVe-1; woodland suitability group 1)

Grayford soils, 12 to 18 percent slopes, severely eroded (GsD3).—These soils have a profile similar to the one described for the series, but they have been severely eroded. The thickness of loess is generally 15 to 30 inches, and the average depth to bedrock is 3 to 5 feet. Most of the original surface layer has been removed by erosion, and the present surface layer is predominantly dark-brown silty clay loam. Some shallow gullies and an occasional deep gully, which in many places exposes the bedrock, are present. In some places, on the ridges between sinks, the soils have been only moderately eroded. The moisture-supplying capacity is a little lower than that of the uneroded soils. In about half of the acreage, the soils have complex slopes.

Most of the acreage is in cultivation or permanent pasture. These soils are probably best suited to permanent pasture, and they produce good pasture under proper management. Generally, erosion is excessive in cultivated areas. (Capability unit VIe-1; woodland suitability group 1)

Grayford silt loam, 18 to 25 percent slopes (GrE).—The profile of this soil is similar to the one described for the series, except that the thickness of loess is only 20 inches or less and the average depth to bedrock is 3 to 4 feet. This soil has some complex slopes that are moderately steep to very steep. It also has fairly uniform slopes that are steep. There are numerous deep sinkholes throughout part of the acreage, and most of them are open and noncrossable. Limestone bedrock is generally exposed near the bottom of the sinks. The sinkholes provide outlets for some of the surface water. Runoff is very rapid.

This soil is mainly in trees or permanent pasture. Under proper management it produces good pasture. Erosion is a serious hazard if permanent vegetation is not maintained. (Capability unit VIe-1; woodland suitability group 6)

Grayford silt loam, 18 to 25 percent slopes, moderately eroded (GrE2).—This soil has a profile similar to that of Grayford silt loam, 18 to 25 percent slopes, except that moderate erosion has taken place. The surface layer is thinner, and in many places it consists partly of dark-brown material that was formerly subsoil. A few small areas have been severely eroded, and in them the surface layer is made up entirely of subsoil. In places there are a few shallow gullies.

Most of this soil is in permanent pasture, and the best use is for permanent pasture or forest. Good yields of pasture are produced under proper management. Erosion is a severe problem if good permanent vegetation is not maintained. (Capability unit VIe–1; woodland suitability group 6)

Grayford soils, 18 to 25 percent slopes, severely eroded (GsE3).—These soils have a profile similar to that of Grayford silt loam, 18 to 25 percent slopes, except that severe erosion has occurred. Most of the original surface layer has been removed, and the present surface layer is predominantly dark-brown silty clay loam. Some shallow gullies and an occasional deep gully, which in many places causes the bedrock to be exposed, are present. In some places, on the ridges between sinks, the soils have been only moderately eroded. The moisture-supplying capacity is a little lower than that of the uneroded soils. In about half of the acreage, the soils have complex slopes.

Most of these eroded soils are in permanent pasture. Timber or permanent pasture are probably the best uses, and moderately good pasture is produced under proper management. Erosion is a serious hazard if a good cover of permanent vegetation is not maintained. (Capability unit VIe–1; woodland suitability group 6)

Grayford silt loam, 25 to 35 percent slopes (GrF).—The profile of this soil is similar to the one described as representative of the series, but there is little or no deposit of loess and all the horizons are thinner. Depth to bedrock ranges from 20 to 96 inches or more. There are deep sinkholes throughout most of the acreage, and in most places narrow ridges are between them. Most of the sinkholes have open bottoms and provide outlets for surface water. Limestone bedrock is generally exposed near the bottom of the sinkholes. A few areas are moderately eroded, and some are severely eroded. Included in the mapped areas of this soil are small areas of Cincinnati and Corydon soils.

Grayford silt loam, 25 to 35 percent slopes, is mainly in forest or permanent pasture, the best uses for this soil. Under proper management good yields of high-quality timber are obtained. Severe erosion is likely to occur if a good cover of permanent vegetation is not maintained. (Capability unit VIe-1; woodland suitability group 6)

Gullied Land

Gullied land, glacial drift (Gt).—This miscellaneous land type consists of severely gullied areas, where the underlying material is deep and moderately friable. The gullies are 3 to 8 feet or more deep, and in many places they cut into the friable substratum. The underlying substratum is friable glacial till, outwash gravel and sand, and stratified clay, silt, and fine sand. Most of the original soil profile has been destroyed, except on narrow ridges between the gullies. The soil material that remains between the gullies consists of profiles, or of parts of profiles, of Cincinnati, Otwell, Parke, and Negley soils.

Most of Gullied land, glacial drift, is bare of vegetation, but in a few areas shrubs, weeds, and wild grasses are starting to grow. This land type is capable of producing pine trees that are suitable for Christmas trees. Diversion ditches that divert the water and help to prevent further erosion can be constructed above the gullied areas. More information about the use and management of this land type is given in the woodland section. (Capability unit VIIe–1; woodland suitability group 3)

Gullied land, residuum (Gu).—This miscellaneous land type consists of severely gullied land. Bedrock of limestone or standstone is 4 to 6 feet from the surface in most places or outcrops in many of the gullies. Most of the original soil profile has been destroyed, except on narrow ridges between the gullies. The soils that remain on the narrow ridges consist of profiles, or parts of profiles, of Bewleyville (fig. 10), Grayford, Zanesville, or Wellston soils. In areas underlain by limestone, the remaining soil material, except for that on the upper part of the narrow ridges, is generally very plastic, reddish clay. In areas underlain by sandstone, the remaining soil material is generally friable silt and some sand weathered from the underlying bedrock.

Most of this land type is bare of vegetation, but in a few areas, shrubs, weeds, and wild grasses are starting to grow. The soil material between the gullies can be stabilized by planting pine trees. Diversion ditches that divert the water and help to prevent further erosion can be constructed above the gullied areas. More information about the use and management of this land type is given in the woodland section. (Capability unit VIIe–1; woodland suitability group 14)

Haubstadt Series

The Haubstadt soils are deep, moderately well drained, and nearly level to sloping. Their surface layer is grayish brown, and their subsoil is light yellowish brown and has mottles in the lower part. These soils have a moderately developed fragipan. They formed in strongly weathered, water-deposited clay, silt, and some fine sand and coarser material.

These soils are in the old Lake Quincy area in the northeastern part of the county and west along Mill Creek. They are also in the Flat Woods area southeast of Spencer and along many of the small streams.

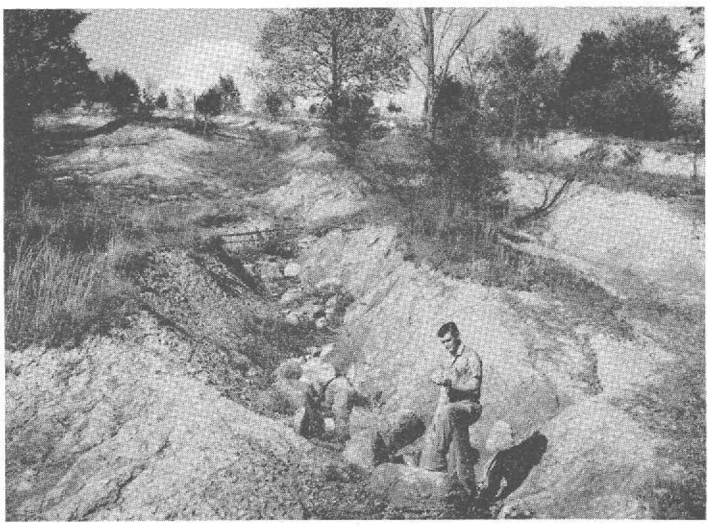

***Figure 10.*—Soil scientist examining a piece of chert taken from the profile of a Bewleyville silt loam on the narrow ridges. Limestone bedrock is exposed in the bottom of the gullies of Gullied land, residuum.**

The Haubstadt soils are associated with the well-drained Otwell, the imperfectly drained Dubois, and the poorly drained Robinson soils. All of these soils formed in the same type of parent material.

Representative profile of Haubstadt silt loam, 2 to 6 percent slopes (SW¼ sec. 26, T. 9 N., R. 3 W., on a ridge about 300 feet N. of a gravel road, 20 feet S. of an electric pole where the slope is 5 percent):

Ap—0 to 7 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, fine, granular structure; friable; abundant roots; strongly acid; abrupt, smooth boundary.

A2—7 to 11 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; few roots; strongly acid; clear, wavy boundary.

B1—11 to 17 inches, yellowish-brown (10YR 5/4 to 5/6) silt loam; moderate, medium, subangular blocky structure; friable; very strongly acid; gradual, wavy boundary.

B21t—17 to 22 inches, strong-brown (7.5YR 5/6) heavy silt loam; moderate, medium, subangular blocky structure; firm; very strongly acid; gradual, wavy boundary.

B22x—22 to 30 inches, light yellowish-brown to yellowish-brown (10YR 6/4 to 5/8) silt loam with common, medium, distinct, gray (10YR 6/1) mottles; moderate, medium, prismatic structure; fragipan development; firm and fragile; very strongly acid; gradual, wavy boundary.

B23x—30 to 36 inches, yellowish-brown (10YR 5/6) silt loam with many, medium, distinct mottles of gray (10YR 6/1) and yellowish red (5YR 5/8); weak, coarse, prismatic structure that breaks to medium, subangular blocks; firm and very fragile; strong-brown (7.5 YR 5/6) clay flows and light-gray (10YR 7/1) silt streaks; very strongly acid; gradual, wavy boundary.

B24x—36 to 43 inches, yellowish-brown (10YR 5/6) silty clay loam with many, medium, distinct, gray (10YR 6/1) mottles; weak, coarse, prismatic structure with fragipan development; firm and slightly fragile; light brownish-gray (10YR 6/2) clay flows; very strongly acid; gradual, wavy boundary.

IIB3—43 to 53 inches, gray (10YR 6/1) silty clay loam with many, medium, distinct, yellowish-brown (10YR 5/8) mottles; massive; firm; some manganese and iron concretions; light brownish-gray (10YR 6/2) clay flows; very strongly acid; gradual, wavy boundary.

IIC—53 to 83 inches +, light yellowish-brown (10YR 6/4) stratified clay loam, silty clay loam, and thin layers of silt loam; massive; firm; few manganese and iron concretions; very strongly acid.

The color of the surface layer ranges from dark gray in wooded areas to yellowish brown in cultivated fields. Depth to mottling ranges from 18 to about 26 inches. Depth to calcareous material ranges from 1 to 12 feet, and the thickness of the loess, from 10 to 50 inches or more.

The Haubstadt soils are low in available phosphate and medium in potash. Their content of organic matter is medium to low. Moisture-supplying capacity is good, and permeability is moderate to moderately slow. The penetration of roots is limited somewhat by the fragipan in the lower part of the subsoil. These soils are very strongly acid if they have not been limed.

Most of these soils are cultivated. They are suited to most of the crops grown in the county, and they are moderately productive. Under good management the response to lime and fertilizer is very good. On sloping areas that are cultivated, terraces, diversions, and cultural practices that help control erosion should be used.

Haubstadt silt loam, 0 to 2 percent slopes (HaA).—This soil is on nearly level ridges near steeper Otwell and Haubstadt soils. It is not extensive and is generally in small areas. Runoff is medium to rapid.

Some small areas of an imperfectly drained Dubois soil are included in the mapped areas of this soil (Capability unit IIs–5; woodland suitability group 9)

Haubstadt silt loam, 2 to 6 percent slopes (HaB).—The profile of this soil is considered representative of the series. This soil is mainly on the gently sloping breaks from the nearly level areas of lake plains that are occupied by the Dubois soils. It is also on narrow ridges that are dissected by streams and that extend out from the nearly level lake plains. This soil is subject to slight to moderate erosion if it is cultivated. Some drainage may be needed in seepy spots.

Included in the mapped areas of this soil are some small areas of an imperfectly drained Dubois soil. (Capability unit IIe–7; woodland suitability group 9)

Haubstadt silt loam, 2 to 6 percent slopes, moderately eroded (HaB2).—This soil has a profile like the one described for the series, but it is moderately eroded. The surface layer is partly yellowish-brown silt loam that was formerly subsoil. This soil is mainly on the gently sloping breaks of the nearly level areas of Dubois soils, or on narrow ridges that extend out from the nearly level areas. In most places the slopes are between 3 and 4 percent. Some small areas of imperfectly drained Dubois soils are included in the mapped areas of this soil.

Haubstadt silt loam, 2 to 6 percent slopes, moderately eroded, is subject to moderate erosion if it is cultivated. Some drainage may be needed in seepy spots. (Capability unit IIe–7; woodland suitability group 9)

Haubstadt soils, 2 to 6 percent slopes, severely eroded (HbB3).—These soils have a profile similar to the one described for the series, but they are severely eroded. Most of the original surface layer has been lost through erosion, and the present surface layer is yellowish-brown heavy silt loam that is very low in content of organic matter. These soils are on the gently sloping breaks adjacent to the nearly level plains occupied by Dubois soils. Some small areas of imperfectly drained Dubois soils are included in the mapped areas of these soils.

Haubstadt soils, 2 to 6 percent slopes, severely eroded, are less productive than the soils that are not severely eroded. Cultural practices or terraces and diversions are needed in many cultivated areas. To farm the areas most efficiently, drainage may be needed in seepy spots. (Capability unit IIIe–7; woodland suitability group 9)

Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded (HaC2).—This soil has a profile similar to the one described for the series, except that moderate erosion has occurred. The slopes are mainly between 6 and 9 percent. This soil is in small areas scattered throughout the lakebed areas. It occurs with the Otwell soils in cultivated fields or on breaks adjacent to the Dubois soils. The major problem is erosion. (Capability unit IIIe–7; woodland suitability group 9)

Haubstadt soils, 6 to 12 percent slopes, severely eroded (HbC3).—These soils have a profile similar to that of Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded, but they are severely eroded. The present surface layer is yellowish-brown heavy silt loam to light silty clay loam mixed with material from the original surface layer.

The content of organic matter is very low. These soils are generally in cultivated fields with the Otwell soils or on breaks adjacent to the Dubois soils. The major problem is erosion. These soils are more difficult to work and are less productive than the less eroded soils. (Capability unit IVe–7; woodland suitability group 9)

Hickory Series

The Hickory series consists of deep, well-drained soils that have a brown surface layer and a dark yellowish-brown subsoil. These soils developed in thin silt or loess over loam to coarse clay loam till of Illinoian age. They are leached free of carbonates to a depth of 3 to 6 feet or more.

The Hickory soils are associated with the Cincinnati soils. They are generally steeper than those soils and lack a fragipan.

Representative profile of Hickory silt loam, 25 to 35 percent slopes (NE¼ sec. 2, T. 11 N., R. 4 W.):

A00—1 to ½ inch, undecomposed leaf litter.

A0—½ inch to 0, partly decomposed leaf litter; very strongly acid.

A1—0 to 1 inch, gray (10YR 5/1) silt loam; moderate, fine, granular structure; friable; abundant roots; very strongly acid; abrupt, wavy boundary.

A2—1 to 8 inches, pale-brown (10YR 6/3) silt loam; moderate, thick, platy structure; friable; abundant roots; some worm fillings from the A1 horizon; very strongly acid; abrupt, wavy boundary.

B1—8 to 12 inches, light yellowish-brown (10YR 6/4) silt loam; weak, medium, subangular blocky structure; friable; plentiful roots; very strongly acid; clear, smooth boundary.

IIB21t—12 to 29 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; few roots; very strongly acid; gradual, smooth boundary.

IIB22t—29 to 50 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; few roots; very strongly acid; gradual, smooth boundary.

IIB3t—50 to 70 inches, yellowish-brown (10YR 5/4) clay loam; weak, coarse, subangular blocky structure; firm; few roots (some thin clay films and a few manganese concretions); medium acid; abrupt, wavy boundary.

IIC—70 inches +, grayish-brown (10YR 5/2) loam till; massive; friable; few roots; calcareous.

These soils range from 3 to 6 feet or more in depth to carbonates. The B horizon is less than a foot thick on some steep slopes and 50 to 60 inches thick on moderately steep slopes. The degree of development is stronger in the thicker profiles.

These soils are mainly in forest. Poplar, oak, and hickory make excellent growth on them.

Hickory soils, 18 to 25 percent slopes, severely eroded (HkE3).—These soils have a profile similar to the one described as representative of the series. Most of the original surface layer, however, has been removed by erosion, and the present surface layer is predominantly dark-brown to light yellowish-brown silty clay loam. There are some shallow gullies and an occasional deep gully in places.

These soils are on moderately steep breaks and ridges throughout the glaciated areas. The moisture-supplying capacity is a little lower than that of the uneroded soils. Runoff is very rapid. Included in the mapped areas of these soils are minor areas where sandstone and shale bedrock are at a depth of less than 70 inches.

Most of the acreage is in permanent pasture or idle. Permanent pasture or forest are the best uses. Under proper management moderately good pasture is produced. The response to lime and fertilizer is good. Erosion is a serious hazard if permanent vegetation is not maintained. (Capability unit VIIe–1; woodland suitability group 2)

Hickory silt loam, 25 to 35 percent slopes (HcF).—The profile of this soil is described as representative of the series. The material in which the soil formed contained little or no loess.

This soil is mainly in large areas where very steep, fairly deep drainage channels have cut into the deep till. In places it is on narrow, sloping to moderately steep ridges that extend between the deep channels. A few outcrops of bedrock are in valley fills and spots where the till is shallow. Some small areas are very steep and cause difficulty in logging operations. Runoff is very rapid.

Most of this soil is in timber, which is probably the best use for it, but good pasture is produced under good management. Also, under good management trees grow rapidly and are of good quality. Erosion is a problem if good permanent vegetation is not maintained. Improperly planned logging roads and trails cause accelerated erosion in many places. (Capability unit VIe–1; woodland suitability group 2)

Hickory silt loam, 25 to 35 percent slopes, moderately eroded (HcF2).—This soil has a profile similar to the one described for the series, except that moderate erosion has occurred. The surface layer is thinner, and in some places it consists entirely of material that was formerly subsoil. Included in the mapped areas of this soil are some minor areas where bedrock is nearer the surface than that underlying the soil for which a typical profile was described.

Most of the acreage was cleared for cultivation or permanent pasture, but now most of it has been reforested. Heavy grazing of forested areas has caused some accelerated erosion. Forest is probably the best use, and the soil should be managed in the same way as Hickory silt loam, 25 to 35 percent slopes. (Capability unit VIe–1; woodland suitability group 2)

Hickory silt loam, 35 to 70 percent slopes (HcG).—The profile of this soil is similar to the one described for the series, but the horizons are somewhat thinner, and depth to calcareous material is only 30 to 50 inches. This soil is in large areas where there are deep channels that have cut into the deep till. In some places there are narrow, sloping to moderately steep ridges that extend between these channels. An occasional outcrop of bedrock is in spots where the till is shallow. In some areas near Cataract Lake, there has been little weathering or development of a profile, and the calcareous till is exposed through soil slippage. Runoff is very rapid.

Nearly all of this soil is in timber, which is the best use for it. Under good management trees grow rapidly and are of good quality. Erosion is a problem if a good cover of vegetation is not maintained. Improperly planned logging roads and trails cause accelerated erosion. It is difficult to build the logging trails because of the extremely steep slopes. (Capability unit VIIe–1; woodland suitability group 4)

Johnsburg Series

The Johnsburg soils are deep, imperfectly drained, and nearly level to gently sloping. They have a light brownish-gray surface layer and a mottled subsoil. A moderately compacted layer, or fragipan, is at a depth of about 20 inches and extends to a depth of 40 inches or more. These soils are very strongly acid. They developed in 30 to 48 inches of leached silt over material weathered from sandstone, siltstone, and shale. Bedrock is generally 50 to 70 inches from the surface.

The Johnsburg soils are on broad ridges throughout the areas of sandstone and shale. They are surrounded by better drained soils from sandstone, which are on the adjoining slopes.

The Johnsburg soils are closely asociated with the moderately well drained Tilsit and the well drained Zanesville soils. All of these soils formed in the same material, but the Johnsburg soils are nearly level to gently sloping, and the Tilsit and Zanesville are gently sloping to moderately sloping.

Representative profile of Johnsburg silt loam, 0 to 2 percent slopes (NE. corner sec. 12, T. 10 N., R. 5 W.):

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) silt loam; weakly developed, medium, platy structure; friable; abundant fine roots; neutral; abrupt, smooth boundary.

A2—6 to 9 inches, gray (10YR 6/1) silt loam with many, coarse, distinct mottles of yellowish brown (10YR 5/4); weak, medium and thick, platy structure; friable; few fine roots; strongly acid; clear, smooth boundary.

B1—9 to 19 inches, yellowish-brown (10YR 5/6) silt loam with many, medium, distinct mottles of light brownish gray (10YR 6/2); moderate, medium, subangular blocky structure; friable; few fine roots; very strongly acid; clear, smooth boundary.

B21x—19 to 24 inches, yellowish-brown (10YR 5/6 to 5/8) light silty clay loam; weak, coarse, prismatic structure that breaks to moderate, medium, subangular blocky structure; weak to moderate fragipan; friable; peds are thickly coated with gray (10YR 6/1) silt; no roots; very strongly acid; clear, smooth boundary.

B22x—24 to 30 inches, light yellowish-brown (10YR 6/4) silt loam to light silty clay loam with medium, distinct mottles of yellowish brown (10YR 5/8); weak, coarse, prismatic structure that breaks to weak, coarse, subangular blocky; weak to moderate fragipan; friable; peds are coated with thin, light-gray (10YR 7/1) silt; very strongly acid; clear, smooth boundary.

IIB3x—30 to 56 inches, yellowish-brown (10YR 5/4 to 5/6) silt loam and gritty silt loam to loam in lower part, with thin, light-gray (10YR 7/1) silt coatings; weak, coarse, prismatic structure; weak fragipan; strongly acid; clear, smooth boundary.

IIC—56 to 62 inches, brownish-yellow (10YR 6/6) sandy loam to loam; massive; very friable; strongly acid; clear, smooth boundary.

R—62 inches +, sandstone and shale bedrock.

The amount of mottling is greater in nearly level areas where runoff is very slow than in gently sloping areas where the runoff is slow. The fragipan is more strongly developed in the wider, more nearly level areas than in the more rolling areas. The B2 horizons ranges from heavy silt loam to medium silty clay loam. The depth to bedrock, which consists of sandstone, siltstone, and shale, ranges from 50 to 70 inches or more.

The Johnsburg soils are very low in available phosphate and potash and in content of organic matter. Runoff is slow or very slow, and permeability is slow. The moderately developed fragipan restricts the penetration of roots and moisture to a moderate degree. These soils are strongly acid if they have not been limed. They need moderate to large applications of limestone every 5 to 8 years to maintain good production. Drainage is needed in most places for maximum production.

Johnsburg silt loam, 0 to 2 percent slopes (JoA).—The profile of this soil is the one described for the series. This soil is generally wet early in spring unless it has been drained. Surface drains are needed in most places to maintain maximum production. Wheat and other small grains generally do well on this soil. Legumes and grasses are needed to maintain good soil structure. A moderate amount of row crops can be used in the cropping system. Under proper management medium to moderately high yields can be obtained. (Capability unit IIIw-7; woodland suitability group 5)

Johnsburg silt loam, 2 to 6 percent slopes (JoB).—The profile of this soil is similar to the one described for the series. In most places the slope is about 3 percent. Surface drainage is generally needed for maximum production. This soil is subject to moderate erosion if it is cultivated. (Capability unit IIIw-3; woodland suitability group 5)

Johnsburg silt loam, 2 to 6 percent slopes, moderately eroded (JoB2).—This soil has a profile similar to that of Johnsburg silt loam, 2 to 6 percent slopes, except that it is moderately eroded. About half of the surface layer has been lost through erosion, and some of the yellowish-brown material that was formerly in the subsoil has been mixed with the original surface layer. In a few places the present surface layer is made up entirely of material that was formerly subsoil. The dominant slopes are 3 to 4 percent.

Erosion and drainage are problems on this soil. If the soil is cultivated intensively, special attention should be given to practices that control erosion. (Capability unit IIIw-3; woodland suitability group 5)

Landes Series

In the Landes series are deep, sandy, well-drained soils formed in alluvium. Their surface layer is dark grayish brown to dark brown. These soils are neutral to mildly alkaline. There has been little soil development other than the accumulation of organic matter in the surface layer.

These soils are on the bottom lands along the West Fork of the White River, and along Mill Creek. They are closely associated with the well drained, medium-textured Genesee soils and the moderately well drained Eel soils.

Representative profile of Landes fine sandy loam (SE¼NW¼ sec. 29, T. 10 N., R. 3 W.):

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

C1—8 to 12 inches, brown (10YR 5/3) fine sandy loam; weak, fine, granular structure; very friable; neutral; clear, wavy boundary.

C2—12 to 16 inches, dark-brown (10YR 3/3) loam; weak, fine, granular structure; friable; neutral; clear, wavy boundary.

C3—16 to 24 inches, yellowish-brown (10YR 5/4) fine sandy loam; massive; very friable; neutral; clear, wavy boundary.

C4—24 to 48 inches +, yellowish-brown (10YR 5/4) stratified layers, 2 to 4 inches thick, of loamy fine sand, fine sand, fine sandy loam, and loam; single grain; very friable; neutral.

The major variations are in the thickness and texture of the layers below the surface layer. These layers range from less than 1 inch to a foot or more in thickness and from fine sand to loam and silt loam in texture.

Landes fine sandy loam (La).—This is the only soil of the Landes series mapped in the county. It is nearly level and formed in alluvium. Most of this soil is on natural levees near the main channel of the White River, mainly near the bends in the channel. In cultivated fields the surface layer is dark-brown to dark yellowish-brown, neutral to calcareous fine sandy loam to a depth of 10 inches. The surface layer grades to yellowish-brown fine sandy loam that contains thin layers of sandy loam, loam, and fine sand. The depth of this sandy material is normally 3 feet or more, but it is extremely variable because the changing currents of the river cause more coarse material to be deposited in some places than in others. In some places fine gravel is mixed with the sand, and in other places there are thin strata of loamy or silty material. Small shells are mixed through the deposits. This soil is moderately coherent and has fair moisture-supplying capacity.

Included in the mapping of this soil are a few minor areas of coarse sand, which extend to a depth of 20 to 30 inches. Below the sand the material is similar to that in a normal profile of a fine sandy loam. The included areas are low in fertility, low in moisture-supplying capacity, and droughty.

Only a small acreage of Landes fine sandy loam is mapped in this county. Corn is the major crop grown, but the soil is also well suited to alfalfa. This soil has a medium requirement for phosphate and a moderately high requirement for potash. Corn responds well to medium to large applications of nitrogen. No lime is needed. (Capability unit I–2; woodland suitability group 8)

Markland Series

In the Markland series are deep, well drained to moderately well drained, gently sloping to moderately steep soils. These soils have a yellowish-brown surface layer and a brown to yellowish-brown subsoil. They were formed in calcareous, water-deposited clay and a small amount of silt. The depth to calcareous material is about 36 inches in most places.

The Markland soils are along the White River between the soils of the bottom lands and the soils of the uplands. They are closely associated with the imperfectly drained McGary soils, the very poorly drained, moderately dark colored Zipp soils, and the very poorly drained, dark colored Montgomery soils. All of the associated soils developed in the same kind of parent material as the Markland soils.

Representative profile of Markland silt loam, 18 to 25 percent slopes, moderately eroded (NW. corner of SW¼ sec. 29, T. 11 N., R. 2 W., in a pasture where the slope is 23 percent):

Ap—0 to 6 inches, yellowish-brown (10YR 5/4) silt loam; moderate, fine and medium, granualr structure; friable; strongly acid; abrupt, smooth boundary.

B1—6 to 9 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, subangular blocky structure; friable; roots and worm fillings from the A1 horizon throughout; very strongly acid; abrupt, smooth boundary.

IIB2t—9 to 27 inches, brown (7.5YR 4/4) silty clay; moderate to strongly developed, medium, angular blocky structure; firm; peds have pale-brown (10YR 6/3) clay coatings; roots and worm fillings from the Ap horizon throughout; very strongly acid; clear, smooth boundary.

IIB3t—27 to 41 inches, yellowish-brown (10YR 5/6) silty clay loam or light silty clay; moderate to strong, coarse, angular blocky structure; friable; peds have pale-brown (10YR 6/3) clay coatings; very strongly acid; abrupt, smooth boundary.

IIC1—41 to 50 inches, very pale brown (10YR 7/4) silty clay; massive; firm; calcareous; abrupt, smooth boundary.

IIC2—50 to 55 inches, very pale brown (10YR 7/4) silt; massive; friable; calcareous; abrupt, smooth boundary.

IIC3—55 to 70 inches +, very pale brown (10YR 7/4) silty clay and silt; massive; friable; calcareous.

In the Markland soils the depth to calcareous material ranges from about 30 to 48 inches. The horizons below the plow layer are thicker in the deeper, leached profiles than in the shallower profiles. In some minor areas the subsoil is silty clay loam. The coarser textured subsoil is generally associated with underlying material that is coarser textured than that normally underlying the Markland soils. Some very thin strata of fine sand are interbedded with the underlying clay and silt.

The Markland soils are low in content of organic matter, low in phosphate, and medium in potash. Moisture-supplying capacity is good, runoff is medium to very rapid, and permeability is moderate to moderately slow. The root zone is deep.

These soils are well suited to alfalfa. The crops respond well to lime and fertilizer. The major hazard is erosion, and in cultivated areas special attention should be given to practices that help control erosion.

Markland silt loam, 2 to 6 percent slopes, moderately eroded (MaB2).—The profile of this soil is similar to the one described as representative of the series. In cultivated fields the plow layer is yellowish brown. There is some mottling at a depth of about 20 to 30 inches. A few areas are only slightly eroded.

This soil is generally in areas of 5 acres or less and is therefore managed with the other steeper Markland soils that adjoin it. If it is cultivated intensively, special attention should be given to practices that help to control erosion. (Capability unit IIIe–7; woodland suitability group 1)

Markland silt loam, 6 to 12 percent slopes, moderately eroded (MaC2).—This soil has a profile similar to the one described for the series, except that the surface layer is partly brown to yellowish-brown silty clay to silty clay loam that was formerly subsoil. In some places the present surface layer is made up entirely of material that was formerly subsoil. A few areas are only slightly eroded.

Most of this soil is in pasture or in cultivated crops. Where the soil is cultivated, special attention should be given to practices that help control erosion. (Capability unit IVe–1; woodland suitability group 1)

Markland soils, 6 to 12 percent slopes, severely eroded (MdC3).—The profile of these soils is similar to the one described for the series, but the surface layer has a large amount of brown to yellowish-brown silty clay to silty clay loam that was formerly subsoil mixed in it. In many areas the surface layer is made up entirely of clayey material that was originally subsoil.

These soils are mainly cultivated or idle, but they are probably best suited to pasture. They are in narrow areas where the slope is short and are therefore managed with the soils that surround them. Erosion is the major hazard. Where the soils are cultivated, special attention should be given to practices that limit erosion. If the soils are worked when they are wet or too dry, they become cloddy, and as a result, a good seedbed is difficult to prepare. (Capability unit VIe-1; woodland suitability group 1)

Markland silt loam, 12 to 18 percent slopes, moderately eroded (MaD2).—The profile of this soil is similar to the one described for the series. The present surface layer is partly brown to yellowish-brown silty clay to silty clay loam that was formerly subsoil. In a few places the surface layer is made up entirely of material that was formerly subsoil. A few areas are only slightly eroded, and a few are severely eroded. Most of this soil is in pasture, the use to which it is probably best suited. (Capability unit VIe-1; woodland suitability group 1)

Markland silt loam, 18 to 25 percent slopes, moderately eroded (MaE2).—The profile of this soil is described as representative of the series. A few areas are only slightly eroded, and a few areas are severely eroded. Runoff is very rapid, and erosion is a major hazard. This soil is mainly in pasture. Under good management excellent yields of forage are obtained. (Capability unit VIIe-1; woodland suitability group 2)

Martinsville Series

In the Martinsville series are deep, well-drained, nearly level to gently sloping soils that have a dark-brown surface layer and subsoil. These soils developed in stratified silt and sand and are underlain by calcareous silt and sand at a depth of about 60 inches.

These soils are on low terraces along the White River. A few gently sloping to sloping areas occur as breaks from the nearly level areas.

The Martinsville soils are associated with the imperfectly drained Whitaker soils, which developed from similar parent material and have similar underlying material. They are also closely related to the well-drained Ockley and the excessively drained Nineveh soils. The Ockley soils have more gravel in the lower part of the profile than the Martinsville soils, and they are underlain by calcareous gravel and sand at a depth of 42 to 60 inches. The Nineveh soils are less acid, have less development, a thinner solum, and are underlain by calcareous gravel and sand at a depth of 24 to 42 inches.

Representative profile of Martinsville loam, 0 to 2 percent slopes (SE¼ sec. 21, T. 11 N., R. 2 W., 300 feet W. of Morgan County line and 200 feet N. of Highway 67):

Ap—0 to 8 inches, dark-brown (10YR 3/3) loam; moderate, medium, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2—8 to 14 inches, dark-brown (10YR 4/3) loam; weak, medium, subangular blocky structure that breaks to moderate, medium, granular structure; friable; medium acid; clear, smooth boundary.

B1—14 to 19 inches, dark-brown (7.5YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; medium acid; clear, wavy boundary.

B21t—19 to 31 inches, dark-brown (7.5YR 4/4) silty clay loam with reddish-brown (5YR 4/4), thin clay films; moderate, medium, subangular blocky structure; firm; medium acid; clear, wavy boundary.

IIB22t—31 to 51 inches, dark-brown (7.5YR 4/4) sandy clay loam with reddish-brown (5YR 4/4), thin clay films; weak, medium, subangular blocky structure; firm; medium acid; gradual, wavy boundary.

IIB3—51 to 80 inches, dark-brown (7.5YR 4/4) loamy sand with minor layers of sandy clay loam; single grain to massive; very friable; medium acid; abrupt, wavy boundary.

IIIC—80 inches +, stratified coarse sand, fine gravel, and silt; calcareous.

Generally, in the Martinsville silt loams the texture of the subsoil is somewhat smoother and contains less sand than that in the subsoil of the Martinsville loams. Depth to calcareous sand and silt ranges from 42 to 80 inches.

These soils are low in content of organic matter, medium in potash, and low in phosphate. They are moderately permeable and have a deep root zone. They are strongly acid if they have not been limed. All the crops commonly grown in the county are suitable, and they respond well to large applications of lime and fertilizer.

Martinsville loam, 0 to 2 percent slopes (MeA).—The profile of this soil is described as representative of the series. There is very little erosion and runoff. This soil is easy to till and is one of the better soils for agriculture in the county. Included in the mapping of this soil are minor areas of fine sandy loam. (Capability unit I-1; woodland suitability group 1)

Martinsville silt loam, 0 to 2 percent slopes (MfA).—The profile of this soil is similar to the one described for the series, but the surface layer is silt loam instead of loam. The subsoil is generally smoother and contains less sand than that in the profile described. There is very little erosion and runoff. A few areas are gently sloping and moderately eroded. This is one of the best soils for cultivation in the county. (Capability unit I-1; woodland suitability group 1)

Martinsville loam, 2 to 6 percent slopes, moderately eroded (MeB2).—This soil has a profile similar to the one described for the series, but it is gently sloping and has been moderately eroded. Depth to calcareous sand and silt is generally less on this soil than in the more nearly level soils. Most of this soil is cultivated, and erosion is a moderate problem.

Included in the mapped areas of this soil are a few small areas of Martinsville loam, 6 to 12 percent slopes, and several small areas of Martinsville fine sandy loam, 6 to 12 percent slopes, severely eroded. (Capability unit IIe-1; woodland suitability group 1)

McGary Series

In the McGary series are moderately deep, imperfectly drained, nearly level to gently sloping soils. The surface layer is grayish brown, and the subsoil is mottled grayish brown. These soils developed in calcareous clay and silt that were deposited by water.

These soils are on benches 6 to 10 feet above the level of the soils formed in alluvium along the White River. They are closely associated with the well-drained Markland, the very poorly drained, moderately dark colored Zipp, and the very poorly drained, dark colored Montgomery soils. All of the associated soils developed in the same kind of parent material as did the McGary soils.

Representative profile of McGary silt loam, 0 to 2 percent slopes (SW. corner of sec. 26, T. 9 N., R. 4 W., 200 feet S. of Thompson's house):

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.
A2—8 to 10 inches, light brownish-gray (10YR 6/2) silt loam; fine, granular structure; friable; neutral; abrupt, smooth boundary.
B1t—10 to 12 inches, grayish-brown (10YR 5/2) light silty clay loam with common, fine, distinct, brownish-yellow (10YR 6/6) mottles; moderate, medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.
IIB2t—12 to 32 inches, grayish-brown (10YR 5/2) silty clay with many, coarse, faint, yellowish-brown (10YR 5/6) mottles; upper part has moderate, medium, angular blocky structure, becoming coarse, angular blocky with increasing depth; firm; medium acid becoming neutral in lower part; abrupt, wavy boundary.
IIC—32 inches +, grayish-brown (10YR 5/2) stratified clay, silt, and minor layers of fine sand with many, coarse, faint, yellowish-brown (10YR 5/6) mottles and lime concretions; below a depth of 65 inches, calcareous stratified silty clay and silt; massive; firm to friable.

In the McGary soils the depth to calcareous material ranges from about 24 to 50 inches. The horizons below the plow layer are thicker in the deeper profiles. In some areas the B2 horizon is silty clay loam rather than silty clay. The coarser textured subsoil is generally associated with coarser textured underlying material than is normal for the McGary soils. In some areas thin layers of fine sand are interbedded with the underlying clay and silt.

These soils are low in available phosphate and potash and very low in content of organic matter. The moisture-supplying capacity is fair to good, runoff is slow or very slow, and permeability is very slow. Roots penetrate only moderately deep because of excess water, which is the chief problem in managing the soils. If these soils are drained, the response to lime and fertilizer is good. These soils are suited to most crops commonly grown in the county, and they are moderately productive.

McGary silt loam, 0 to 2 percent slopes (MgA).—The profile of this soil is described as representative of the series. This soil is on flat benches that have short, steep escarpments that extend down to the soils of the bottom lands. In some places the breaks are long enough that Markland soils are mapped on them. McGary silt loam, 0 to 2 percent slopes, is generally farmed separately because of the steep escarpments. The size of the fields ranges from a few acres to 40 acres or more. (Capability unit IIIw-6; woodland suitability group 5)

McGary silt loam, 2 to 6 percent slopes, moderately eroded (MgB2).—This soil has a profile similar to the one described for the series, but it is gently sloping. Also, the surface layer is partly grayish-brown silty clay loam that was formerly subsoil. In a few places the surface layer is made up of material that was formerly subsoil. A few areas are only slightly eroded.

This soil is in small areas and is not extensive. It is generally farmed with the nearly level McGary soil. Wetness and erosion are hazards where crops are grown. If the soil is cultivated, special management is needed to help control erosion. (Capability unit IIIw-6; woodland suitability group 5)

Montgomery Series

The Montgomery soils are deep and very poorly drained. Their surface layer is black, and their subsoil is dark gray. The parent material is calcareous clay and silty clay deposited by slack water, and there are thin layers of silt and fine sand. The soils developed in a swamp under a mixed deciduous forest and marsh grasses.

These soils of lake plains are in slight depressions on benches 6 to 10 feet above the level of the soils formed in alluvium along the White River and its tributaries. They are associated with the imperfectly drained McGary, the well-drained Markland, and the very poorly drained, moderately dark colored Zipp soils. All of the associated soils formed in the same kind of parent material as the Montgomery soils.

Representative profile of Montgomery silty clay loam (NE¼ sec. 28, T. 11 N., R. 2 W., 200 feet S. of highway 67):

Ap—0 to 7 inches, black (10YR 2/1) silty clay loam; structureless; hard when dry, plastic and sticky when wet; the content of organic matter high; neutral; clear, smooth boundary.
A12—7 to 13 inches, very dark gray (10YR 3/1) silty clay loam; strong, medium and fine, angular blocky structure; very firm; neutral; clear, smooth boundary.
B21g—13 to 25 inches, dark-gray (10YR 4/1) silty clay with a few, fine, yellowish-brown (10YR 5/4) specks; strong, medium and coarse, angular blocky structure; very firm; neutral; clear, smooth boundary.
B22g—25 to 37 inches, gray to dark-gray (10YR 5/1 to 4/1) silty clay with dark yellowish-brown (10YR 4/4) mottles; strong, medium, columnar structure that breaks to strong, medium and coarse, angular blocky structure; very firm; neutral; clear, smooth boundary.
B23g—37 to 40 inches, gray to dark-gray (5Y 5/1 to 4/1) silty clay mottled with yellowish brown (10YR 5/8); strong, medium, columnar structure that breaks to strong, coarse, angular blocky structure; plastic; neutral; clear, smooth boundary.
B3g—40 to 66 inches, dark-gray (5Y 4/1) and olive-brown (2.5Y 4/4) silty clay; massive; plastic; neutral to slightly calcareous; clear, smooth boundary.
C—66 inches +, dark-gray (5Y 4/1) and olive-brown (2.5Y 4/4) stratified silty clay, clay, silt, and fine sand; calcareous.

The content of organic matter in the surface layer varies; it is generally lower where the soil has been cultivated than in wooded areas or in areas used for pasture. The A horizon is as much as 18 inches thick in some places. Depth to calcareous clay and silt ranges from about 40 to 60 inches.

The Montgomery soils are medium to high in natural fertility, and they do not require lime. Moisture-supplying capacity is good, and permeability is very slow. Roots penetrate only moderately deep because of excess water.

Montgomery silty clay loam (Mh).—This is the only Montgomery soil mapped in the county. It occurs in slight depressions on benches.

Included in the mapped areas of this soil are minor areas of a Montgomery silt loam. Also included are several areas of dark-colored depressional soils in the Flat

Woods area southeast of Spencer. These areas total about 150 acres. The depressional soils differ from Montgomery silty clay loam in having a subsoil of silty clay loam. Also, they are underlain by neutral silty clay loam, clay loam, and silt. These included soils are on seepy foot slopes. The excess water comes from adjoining higher soils that are underlain by limestone.

Montgomery silty clay loam is well suited to corn, soybeans, small grains, and meadow crops. Alfalfa is not well suited, because of the high water table in spring. Water accumulates on this soil, and therefore wetness is the major problem in management. If the soil is worked when wet, it becomes cloddy and puddles easily. If it is drained, the soil is highly productive, and the response to fertilizer is good. (Capability unit IIIw–2; woodland suitability group 11)

Muck (Mk)

Muck has developed from decomposed wood, grasses, and sedges. It occupies permanent marshes and areas that once were ponds, where the constant saturation favored the growth of organic matter but restricted its decomposition. All of the Muck in this county occurs in swampy and seepy areas near soils that formed in alluvium. It consists of 12 to 42 inches of well-decomposed, black organic matter over light brownish-gray, loam mineral material.

Representative profile of Muck (NW¼SE¼ sec. 1, T. 11 N., R. 5 W.):

01—0 to 6 inches, black (10YR 2/1) muck; well decomposed; moderate, medium, granular structure; contains few to many fragments of wood; friable; abundant roots; neutral.

02—6 to 40 inches, black (10YR 2/1) muck; well decomposed; moderate, medium, granular structure; nonsticky; contains numerous partly decomposed woody fragments mixed with fibrous material from grass, reeds, and sedges; neutral.

IIC—40 to 48 inches +, light brownish-gray (2.5Y 6/2) loam; massive; friable; calcareous.

In many places the uppermost 5 to 10 inches contains much silty material that was washed from adjacent mineral soils.

Muck occupies about 50 acres in the county. It is scattered along the alluvial bottom lands in small patches of 5 acres or less. Some of the acreage has been drained and is cultivated along with the soils of the bottom lands. Most of it, however, is not drained or cultivated and is swampy.

Included in the mapped areas of moderately deep Muck are minor areas of deeper organic soils where as much as 60 inches of organic material overlies the loam mineral material. The reaction ranges from medium acid to neutral in the organic material and from neutral to calcareous in the underlying mineral material.

Muck is low in available phosphate and potash. When this organic soil is drained, it decomposes rapidly and releases nitrogen for plant use.

In most places open ditches give satisfactory drainage. Tile are used in many places and are generally installed along the base of the slopes to intercept the water. If the soil is drained and heavily fertilized, good yields of corn are produced. Corn and grass are the most suitable general crops. The soil is also well suited to such special crops as sweet corn, onions, carrots, and celery. (Capability unit IIw–10; not suitable for woodland)

Muskingum Series

In the Muskingum series are shallow, excessively drained, steep or very steep soils underlain by sandstone, siltstone, and shale. The surface layer is very dark grayish brown to yellowish brown, and the subsoil is dark yellowish brown. In some places there are outcrops of bedrock, and in most places there are fragments of sandstone on the surface and throughout the profile. The parent material is weathered, interbedded, noncalcareous sandstone, siltstone, and shale that have thin caps of loess in places. Bedrock is generally less than 20 inches from the surface.

The Muskingum soils are associated with the moderately deep, well drained Wellston; the deep, well drained Zanesville; the moderately well drained Tilsit; and the imperfectly drained Johnsburg soils. They are generally the steeper soils adjacent to these associated soils. The Muskingum soils are similar to the Corydon soils in depth to bedrock, but the Corydon soils developed in limestone and have a neutral to calcareous profile.

Representative profile of Muskingum stony silt loam, 18 to 25 percent slopes (NE¼ sec. 24, T. 9 N., R. 3 W., in a slightly eroded area where the slope is 24 percent):

A0—1 inch to 0, loose forest litter; slightly acid; ½ inch to 1 inch thick.

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) stony silt loam; weak, fine, granular structure; friable; abundant roots; slightly acid; abrupt, smooth boundary.

A2—2 to 9 inches, dark yellowish-brown (10YR 3/4 to 4/4) stony silt loam; weak, medium, platy structure; friable; abundant roots; some weak, medium, subangular blocky structure in lower part of horizon; medium acid; clear, wavy boundary.

BC—9 to 15 inches, dark yellowish-brown (10YR 3/4) stony loam; weak, coarse, granular and weak, fine, subangular blocky structure; friable; few roots; few red (2.5YR 5/6) spots; medium acid; gradual, wavy boundary.

R—15 inches +, sandstone bedrock with some partly decomposed sandstone and shaly material mixed with loam; crevices between the sandstone are filled with soil material; strongly acid.

The thickness of the profile ranges from about 10 to 20 inches. In some places there is a weakly developed B horizon. In some areas there are numerous sandstone rocks on the surface, and in others there are relatively few.

These soils are low in content of organic matter, low in phosphate, and medium in potash. Moisture-supplying capacity is low, and runoff is rapid or very rapid. These soils erode easily if they are not protected, and most of the areas are in forest. The areas that were cleared for cultivation or pasture eroded severely, and the supply of plant nutrients was depleted. These areas were then left idle or reverted to forest.

Muskingum stony silt loam, 12 to 18 percent slopes (MmD).—This soil is less steep than the soil for which a profile is described, but its profile is similar. The soil is somewhat droughty and shallow.

This soil is closely associated with the Wellston and Zanesville soils. In some areas mapped as this soil, especially in large, wooded tracts, as much as 15 percent of the area consists of Wellston and Zanesville soils.

Muskingum stony silt loam, 12 to 18 percent slopes, is used mainly for forest, but it can be used for pasture if it is renovated. If the soil is properly managed and if it is limed and fertilized, fair pasture can be obtained. Farm machinery is difficult to operate because of the stones. (Capability unit VIe-1; woodland suitability group 10)

Muskingum stony silt loam, 18 to 25 percent slopes (MmE).—The profile of this soil is described as representative of the series. This soil is shallow and somewhat droughty. Runoff is very rapid. In some areas mapped as this soil, as much as 15 percent of the area consists of Wellston and Zanesville soils.

Muskingum stony silt loam, 18 to 25 percent slopes, is probably best suited to trees. If it has been cleared and is not too stony, it can be renovated for pasture under careful management. (Capability unit VIIe-1; woodland suitability group 10)

Muskingum stony silt loam, 25 to 35 percent slopes (MmF).—This soil is steeper than the soil for which a profile is described, but its profile is similar. The soil is shallow and somewhat droughty. Runoff is very rapid. This soil is mainly in forest, to which it is best suited. Included in the mapped areas of this soil are areas of Wellston and Zanesville soils. (Capability unit VIIe-1; woodland suitability group 12)

Muskingum stony silt loam, 35 to 70 percent slopes (MmG).—This soil has a profile similar to the one described for the series. It is very steep, however, and there are some outcrops of sandstone and shale. The soil material above bedrock is less than 12 inches thick in many places. This soil is shallow and droughty. Runoff is very rapid.

This soil is mainly in forest, to which it is best suited. A number of soils that are generally closely associated are included in the large mapped areas of this soil. (Capability unit VIIe-1; woodland suitability group 12)

Negley Series

In the Negley series are moderately deep or deep, well-drained to excessively drained, steep or very steep soils. The surface layer is dark grayish brown to brown, and the subsoil is brown, dark brown, or reddish brown. These soils formed chiefly in highly weathered, reddish, sandy and gravelly outwash. In some places, however, mainly on the ridgetops, the outwash is capped by a layer of loess that is less than 18 inches thick.

The Negley soils are closely associated with the Parke and Pike soils, which are well drained and also formed in outwash. The layer of loess in the Negley soils is less than 18 inches thick, but it is more than 42 inches thick in the Pike soils and 18 to 42 inches thick in the Parke soils. Also, the Negley soils are steep or very steep and are generally on side slopes, unlike the nearly level to gently sloping Pike soils on ridgetops. Their relief and position also differ from the gently sloping to moderately steep Parke soils on ridges and adjoining slopes.

Representative profile of Negley loam, 18 to 25 percent slopes (NE¼SE¼ sec. 33, T. 11 N., R. 3 W.):

A00—1½ inches to 1 inch, undecomposed leaf litter.

A0—1 inch to 0, partly decomposed leaf litter (organic material) ; neutral.

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) loam; moderate, fine, granular structure; friable; plentiful roots; very strongly acid; abrupt, wavy boundary.

A2—2 to 11 inches, brown (10YR 5/3) loam; weak, fine, granular structure; friable; plentiful roots; very strongly acid; clear, smooth boundary.

B2—11 to 26 inches, brown (10YR 5/3) fine sandy loam; weak, medium, subangular blocky structure; friable; plentiful roots; very strongly acid; abrupt, wavy boundary.

B3—26 to 50 inches, strong-brown (7.5YR 5/6) sandy loam; weak, coarse, subangular blocky structure; very friable; few clay films; strongly acid; diffuse, smooth boundary.

C1—50 to 70 inches, strong-brown (7.5YR 5/6) loamy fine sand; single grain; very friable; few roots; very strongly acid; gradual, smooth boundary.

C2—70 to 120 inches, strong-brown (7.5YR 5/6) coarse sand; single grain; loose; very few roots; very strongly acid in upper part but neutral in lower part; abrupt, wavy boundary.

C3—120 inches +, stratified sand with some fine gravel; calcareous.

The thickness of the horizons varies greatly; it depends mainly on the steepness of the slope. In many very steep areas, the underlying strata of sandy and gravelly material are within 36 inches of the surface. In steep soils the subsoil is more strongly developed and the horizons are thicker than in the very steep soils. The degree of oxidation is less in the very steep soils than in the less steep soils because geological erosion has kept up with oxidation. Conversely, the subsoil of the more gently sloping Negley soils is more reddish and more clayey than that in the more strongly sloping soils. In many of the deeper cuts, where the substratum can be observed, the calcareous sand and gravel are strongly cemented together by carbonates. The outwash is as much as 80 to 100 feet thick in places.

In the Negley soils permeability is moderate to moderately rapid, and runoff is rapid. These soils are mainly in forest; they have a dark surface layer, 2 to 3 inches thick, that contains a moderate amount of organic matter. Even in the wooded areas, there are a few deep gullies that cut deep into the friable substratum. These soils are well suited to forest; trees grow rapidly and are of high quality. If the soils are cleared and cultivated, erosion is a major problem.

Negley loam, 18 to 25 percent slopes (NgE).—The profile of this soil is described as representative of the series. On most of this soil, little erosion has taken place, but a small acreage is moderately eroded. This soil should remain in permanent pasture or forest, however, because of the severe hazard of erosion if it is cultivated.

Included in the mapping of this soil are some areas of silt loam, mainly on the narrow ridges. Also included are some areas where the slope is less than 18 percent. (Capability unit VIe-1; woodland suitability group 2)

Negley soils, 18 to 25 percent slopes, severely eroded (NsE3).—The profile of these soils is similar to the one described as representative of the series, except that most of the surface layer, or about 6 to 8 inches of soil material, has been removed by erosion. Also, a few gullies have cut into the friable substratum.

Most of the acreage was once cleared and cultivated, but much of it is now idle. The soils should be kept in permanent pasture or forest because of the severe hazard of erosion if they are cultivated. (Capability unit VIIe-1; woodland suitability group 2)

Negley loam, 25 to 35 percent slopes (NgF).—The profile of this soil is similar to the one described for the series. Little erosion has taken place on most of this soil, but a few small areas are moderately eroded. This soil is too steep and too susceptible to erosion for cultivation. Its best use is for forest or pasture.

Included in the mapping of this soil are small areas of sandy loam and a few areas, mainly on narrow ridges, where a thin layer of loess is present and the surface layer is silt loam. Also included are some areas of Parke soils. (Capability unit VIe–1; woodland suitability group 2)

Negley loam, 35 to 70 percent slopes (NgG).—The profile of this soil is thinner and less well developed than that of the less steep soils. On many of the steeper breaks, the underlying sandy strata are at the surface or within 3 feet of it. Little erosion has taken place on this steep, wooded soil. Forest is the best use. Included in the mapping of this soil are minor areas of sandy loam. (Capability unit VIIe–1; woodland suitability group 4)

Negley silt loam, 18 to 25 percent slopes (NmE).—The profile of this soil is similar to the one described for the series, except that it is somewhat deeper, the surface layer is silt loam, and the subsoil is less sandy. Most of the acreage is only slightly eroded, but some small areas are moderately eroded. Included in the mapped areas of this soil are areas of Parke soils on some of the narrow ridges.

Some of Negley silt loam, 18 to 25 percent slopes, has been cleared and is used for pasture, but most of it is still in forest. This soil makes good pasture if it is limed, fertilized, and otherwise managed properly. (Capability unit VIe–1; woodland suitability group 2)

Negley silt loam, 18 to 25 percent slopes, moderately eroded (NmE2).—The profile of this soil is similar to the one described for the series, but it is somewhat deeper, the surface layer is silt loam, and the subsoil is less sandy than the subsoil of the Negley loams. In addition, the soil is moderately eroded. Included in the mapped areas of this soil are some areas of Parke soils on the narrow ridges.

Most of the acreage has been cleared and is used for pasture. This soil makes good pasture if it is limed, fertilized, and otherwise managed properly. (Capability unit VIe–1; woodland suitability group 2)

Nineveh Series

The Nineveh soils are moderately deep, excessively drained, and nearly level. They have a dark-brown surface layer and subsoil. These soils developed in calcareous, stratified gravel and sand on low terraces along the White River. The largest area, about 70 acres, is near the boundary between Morgan and Owen Counties east of Gosport.

The Nineveh soils are closely associated with the Ockley and Martinsville soils. They are less deep than the Ockley soils; calcareous gravel and sand are at a depth of 24 to 42 inches, rather than at a depth of 42 to 60 inches. Also, the Nineveh soils developed in coarser textured material than the Martinsville soils, which developed mainly in calcareous, stratified sand and silt.

Representative profile of Nineveh loam (SE¼ sec. 28, T. 11 N., R. 2 W., 500 feet S. of house):

Ap—0 to 8 inches, dark-brown (10YR 3/3) loam; moderate, medium and fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

B1t—8 to 14 inches, dark-brown (10YR 3/3) clay loam with small amounts of fine gravel; moderate, medium, subangular blocky structure; friable; neutral; clear, wavy boundary.

B2t—14 to 25 inches, dark-brown (7.5YR 4/4) gravelly clay loam; moderate, medium, subangular blocky structure; friable; neutral; clear, irregular boundary.

B3—25 to 34 inches, yellowish-red (5YR 4/6) gravelly loam; weak, medium, subangular blocky structure; friable; neutral; abrupt, irregular boundary.

IIC—34 inches +, pale-brown (10YR 6/3) stratified sand and gravel; loose; calcareous.

The main variation in the profile is the depth to calcareous sand and gravel. In some places there is more gravel and sand in the profile than in others. Some of the slightly elevated areas have a gravelly surface layer. The slightly concave areas have a surface layer of silt loam and are generally deeper than 34 inches.

Nineveh loam (Nv).—This is the only Nineveh soil mapped in the county. On it there is little runoff or erosion. Permeability is moderate to moderately rapid, and the moisture-supplying capacity is fair. The soil is somewhat droughty and is neutral or slightly acid. Fertility is medium to low. Crops respond well to moderate applications of fertilizer. This soil is well suited to alfalfa and to small grains seeded in fall, but yields of corn and oats are limited in most places by a shortage of moisture. (Capability unit IIs–1; woodland suitability group 1)

Ockley Series

In the Ockley series are deep, well-drained, nearly level soils that have a dark-brown surface layer and subsoil over calcareous, stratified gravel and sand.

The Ockley soils are on low terraces along the White River. They are associated with the well-drained Martinsville and the excessively drained Nineveh soils. The Ockley soils developed in more gravelly material than the Martinsville soils, which formed in calcareous, stratified sand and silt. The calcareous gravel and sand underlying the Ockley soils is at a depth of about 60 inches instead of at a depth of 24 to 42 inches like that underlying the Nineveh soils. In some areas the Ockley soils are closely associated with the imperfectly drained Whitaker soils.

Representative profile of Ockley loam, 0 to 2 percent slopes (SW¼NW¼ sec. 21, T. 10 N., R. 3 W.):

Ap—0 to 6 inches, dark-brown (10YR 3/3) loam; moderate, fine and medium, granular structure; friable; neutral; abrupt, smooth boundary.

A2—6 to 11 inches, dark grayish-brown (10YR 4/2) to brown (10YR 4/3) loam; moderate, thin and medium, platy structure; friable; neutral; abrupt, smooth boundary.

B1—11 to 16 inches, dark grayish-brown (10YR 4/2) to brown (10YR 4/3) loam; moderate, medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21t—16 to 28 inches, dark-brown (7.5YR 3/2) to dark yellowish-brown (10YR 3/4) heavy loam; moderate, medium and coarse, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B22t—28 to 46 inches, dark-brown (7.5YR 3/2) to dark reddish-brown (5YR 3/3) clay loam; moderate, medium, subangular blocky structure; firm; contains various quantities of gravel and sand; medium acid; clear, smooth boundary.

B23t—46 to 62 inches, dark reddish-brown (5YR 3/3) clay loam; weak, coarse, subangular blocky structure; firm; medium acid in the upper part of the horizon, grading to neutral in lower part; abrupt, irregular boundary.

IIC—62 inches +, dark-brown (10YR 3/3), stratified gravel and coarse sand with few, medium, distinct, light-gray (10YR 7/2) mottles; single grain; loose; calcareous.

In some places the soil material appears not to be loess, and in other places the loess is as thick as 36 inches. The depth to loose, calcareous gravel and sand ranges from as little as 42 inches to as much as 70 inches or more. The content of gravel and sand in the B2 horizon varies. Generally, it is greater in the upper part of the B2 horizon in the Ockley loams than in the Ockley silt loams. The texture in the lower part of the B horizon ranges from sandy loam to clay loam. The B23 horizon, just above the loose gravel and sand, varies in color and in thickness. In some places tongues or wedges of material from that horizon extend deep into the gravel.

These soils are low in content of organic matter, medium in potash, and low in phosphate. They are medium acid or strongly acid if they have not been limed. Surface drainage is slow, but internal drainage is medium to rapid. There is little danger of erosion. These soils have a deep rooting zone, and they are especially well suited to alfalfa. However, other crops commonly grown in the county grow well. They respond to moderate or large applications of fertilizer.

Ockley loam, 0 to 2 percent slopes (OcA).—The profile of this soil is described as representative of the series. Most of this soil is nearly level, but some minor areas are gently sloping. Little erosion has taken place. This soil is easy to till and it is one of the better soils for agriculture in the county. (Capability unit I–1; woodland suitability group 1)

Ockley silt loam, 0 to 2 percent slopes (OkA).—The profile of this soil is similar to the one described for the series, but the surface layer is silt loam. Some minor areas are gently sloping. (Capability unit I–1; woodland suitability group 1)

Otwell Series

In the Otwell series are deep, well-drained, nearly level to steep soils that have a moderately developed fragipan. The surface layer is dark grayish brown, and the subsoil is yellowish brown to light yellowish brown. The parent material is mainly strongly weathered (lake-formed) clay and silt deposited by water, but it contains some fine sand and coarser material. In some places there is a layer of loess.

These soils are in the old Lake Quincy area in the northeastern part of the county, and they extend westward along Mill Creek. They are also in the Flat Woods area southeast of Spencer and along many of the small streams.

The Otwell soils are closely associated with the moderately well drained Haubstadt, the imperfectly drained Dubois, and the poorly drained Robinson soils. All of these soils developed in the same kind of parent material.

Representative profile of Otwell silt loam, 2 to 6 percent slopes (SW. corner NW¼ sec. 25, T. 9 N., R. 3 W.; on a steep cut by a stream on the west side of a county road where the slope is 3 percent).

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam; fine, medium, granular structure; friable; medium acid; abrupt, smooth boundary.

A21—2 to 5 inches, yellowish-brown (10YR 5/4) to light yellowish-brown (10YR 6/4) silt loam; fine, medium, granular structure; friable; medium acid; clear, smooth boundary.

A22—5 to 10 inches, light yellowish-brown (10YR 6/4) to brownish-yellow (10YR 6/6) silt loam; weak, thin and medium, platy structure; friable; very strongly acid; clear, smooth boundary.

B1t—10 to 15 inches, yellowish-brown (10YR 5/6) heavy silt loam to light silty clay loam; weak, fine, subangular blocky structure; friable; very strongly acid; clear, smooth boundary.

B21t—15 to 25 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; firm; very strongly acid; clear, wavy boundary.

B22x—25 to 42 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, prismatic structure; firm; fragipan; the peds are coated with light brownish-gray (10YR 6/2) silt; very strongly acid; clear, wavy boundary.

IIB3—42 to 82 inches, light brownish-gray (10YR 6/2) silty clay loam to silty clay with many, medium, distinct, yellowish-brown (10YR 5/6) mottles and minor lenses of silt loam; massive; firm; very strongly acid; gradual, wavy boundary.

IIC—82 to 160 inches +, stratified clay and silty clay loam with some silt and fine sand; strongly acid in the upper part but neutral to calcareous below a depth of 120 inches.

The surface layer ranges from dark gray in forested areas to yellowish brown in cultivated fields. Throughout the lake plain and westward along the valley of Mill Creek are many places where there are buried soils, generally at a depth of 40 to 60 inches. Depth to calcareous material is 10 to 12 feet or more in the nearly level to strongly sloping areas and only 4 to 5 feet where the slopes are more than 25 percent. In some of the very steep areas, where Otwell silt loam, calcareous substratum, 35 to 70 percent slopes, is mapped, depth to carbonates is as little as 30 inches. Where the soils are nearly level to very strongly sloping, there is a covering of loess that ranges from a few inches to 40 inches or more in thickness. There is little or no loess in the steeper areas. The thickness of the layers and the degree of fragipan development vary with the slope; on steeper slopes, the layers are thinner and the fragipan is less strongly developed.

The Otwell soils are low in available phosphate and medium in potash. The content of organic matter is medium to low. Moisture-supplying capacity is good, and permeability is moderate. These soils are very strongly acid if they have not been limed. The penetration of roots is limited somewhat by the fragipan in the lower part of the subsoil.

The chief problem in these soils is erosion. Where the sloping soils are cultivated, terraces and diversions should be established and cultural practices used to help control erosion. Under good management the crops grown on these soils respond well to lime and fertilizer. The steeper soils are mainly in trees, and the growth of timber is excellent.

Otwell silt loam, 0 to 2 percent slopes (OmA).—This soil has a profile similar to the one described for the series, but it is nearly level. It is on ridges with steeper Otwell soils, where runoff is rapid. This soil is not extensive; it generally is in areas of 10 acres or less. (Capability unit IIs–5; woodland suitability group 1)

Otwell silt loam, 2 to 6 percent slopes (OmB).—The profile of this soil is the one described as representative of the series. The soil is gently rolling and is on narrow ridges with steeper Otwell soils. Runoff is medium. Because of its small extent, this soil is generally left in forest where the steep adjoining soils are in forest. If it is cultivated, it is subject to moderate erosion. (Capability unit IIe–7; woodland suitability group 1)

Otwell silt loam, 2 to 6 percent slopes, moderately eroded (OmB2).—The profile of this soil is similar to the one described for the series, except that the surface layer is partly yellowish-brown heavy silt loam that was formerly subsoil. In some places the surface layer is made up entirely of material that was formerly subsoil. A few areas are severely eroded. This soil is on gently rolling, narrow ridges near steeper Otwell soils. If it is cultivated, practices that help to control erosion should be used. (Capability unit IIe–7; woodland suitability group 1)

Otwell silt loam, 6 to 12 percent slopes (OmC).—This soil has a profile similar to the one described for the series, but it has stronger slopes. It is not extensive and generally is in small areas near steeper Otwell soils. This soil is mainly in permanent pasture or trees. (Capability unit IIIe–7; woodland suitability group 1)

Otwell silt loam, 6 to 12 percent slopes, moderately eroded (OmC2).—The profile of this soil is similar to the one described for the series, but the surface layer is partly yellowish-brown material that was formerly subsoil. In some places the surface layer is made up entirely of material that was formerly subsoil. This soil is on breaks from nearly level to gently rolling lake plains or high terraces and on narrow ridges. It is associated with more poorly drained soils formed from the same kind of parent material.

Most of the acreage is cultivated. The main problem in managing this soil is erosion. If cultivated crops are grown, terraces, diversions, and cultural practices that help to control erosion are needed. (Capability unit IIIe–7; woodland suitability group 1)

Otwell soils, 6 to 12 percent slopes, severely eroded (OwC3).—The profile of these soils is similar to the one described for the series, but most of the original surface layer has been lost through erosion. The present surface layer is predominantly yellowish-brown to light yellowish-brown heavy silt loam to light silty clay loam.

These soils are on narrow ridges and on breaks from nearly level to gently rolling lake plains. They are associated with more poorly drained soils formed in the same kind of material. Runoff is medium to rapid, and the moisture-supplying capacity is a little lower than that of uneroded soils. Included in the mapped areas of these soils are small areas of an imperfectly drained soil.

Most of the acreage is in cultivation, but a small part is idle or in pasture. These soils are difficult to work. Plowing makes them cloddy. As a result, it is difficult to prepare a good seedbed and to get an even stand. Occasional seepy spots require drainage. If cultivated crops are grown, terraces, diversions, and cultural practices that help to control erosion are needed. (Capability unit IVe–7; woodland suitability group 1)

Otwell silt loam, 12 to 18 percent slopes (OmD).—The profile of this soil is similar to the one described for the series, but it is slightly shallower and all the horizons are somewhat thinner. Most of this soil is in trees because it is in small areas near the steeper Otwell soils, which are in trees. If cultivated crops are grown, terraces, diversions, and cultural practices that help control erosion are needed. (Capability unit IVe–7; woodland suitability group 1)

Otwell silt loam, 12 to 18 percent slopes, moderately eroded (OmD2).—The profile of this soil is similar to the one described for the series, but all the horizons are somewhat thinner. Also, a moderate amount of the original surface layer has been lost through erosion, and as a result, the present surface layer is partly yellowish-brown heavy silt loam.

Most of this soil is cultivated or in pasture. If cultivated crops are grown, terraces and diversions are needed, and cultural practices should be used to help control erosion. (Capability unit IVe–7; woodland suitability group 1)

Otwell soils, 12 to 18 percent slopes, severely eroded (OwD3).—These soils have a profile similar to the one described, except that most of the original surface layer has been lost through erosion. The present surface layer is predominantly yellowish-brown to light yellowish-brown heavy silt loam to light silty clay loam.

These soils are on narrow ridges and on breaks from nearly level to gently rolling lake plains. They are in the same general areas as soils that are generally more poorly drained but that formed in the same kind of material. Runoff is rapid, and the moisture-supplying capacity is a little lower than that of an uneroded soil.

These eroded soils are mainly cultivated or idle. Their best use, however, is permanent grass, and good yields of forage are obtained. Response to lime and fertilizer is good, but erosion is a serious problem. These soils are difficult to work. Plowing when wet makes them cloddy, and as a result, it is difficult to prepare a good seedbed and to get an even stand. (Capability unit VIe–1; woodland suitability group 1)

Otwell silt loam, 18 to 25 percent slopes (OmE).—In this soil the horizons are somewhat thinner than those in the profile described, and there is only weak fragipan development. In addition, the depth to calcareous material is generally only 5 to 7 feet. The surface layer is dark gray and is covered by a shallow layer of partly decomposed leaf litter.

This soil is mainly in forest because it is in small areas with steeper Otwell soils that are mainly in forest. If the soil is cleared, it produces good pasture. Response to lime and fertilizer is good. (Capability unit VIe–1; woodland suitability group 2)

Otwell silt loam, 18 to 25 percent slopes, moderately eroded (OmE2).—The profile of this soil is similar to the one described for the series, except that all the horizons are somewhat thinner, and there is only weak fragipan development. In addition, the depth to calcareous material is generally only 5 to 7 feet.

This soil is in small areas that are mainly in pasture or idle. Runoff is very rapid. As a result, the soil is subject to severe erosion if it is not used for permanent pasture or forest. Good yields of forage are obtained, and the response to lime and fertilizer is good. (Capability unit VIe–1; woodland suitability group 2)

Otwell soils, 18 to 25 percent slopes, severely eroded (OwE3).—These steep, severely eroded soils are on breaks within areas of cultivated soils that are less sloping and less eroded. The acreage is small. Runoff is very rapid, and the hazard of further erosion is severe.

These soils are probably best suited to permanent pasture or forest. Moderately good yields of forage are obtained, and the response to lime and fertilizer is good. (Capability unit VIIe-1; woodland suitability group 2)

Otwell silt loam, calcareous substratum, 35 to 70 percent slopes (OtG).—The profile of this soil is fairly thin, and there has been little or no development of a fragipan. Calcareous parent material generally is at a depth of only 30 to 50 inches. This soil is in areas where the lakebed material is 40 to 60 feet or more deep, and dissection by streams has been rapid.

Included in the mapping of this soil, mainly around Cataract Lake, are some areas of loam to very fine sandy loam. In the included areas there has been little weathering or development of a profile.

Most of the acreage is in forest. The trees grow rapidly and are of good quality. (Capability unit VIIe-1; woodland suitability group 4)

Representative profile of Otwell silt loam, calcareous substratum, 35 to 70 percent slopes (in the center of SE¼SE¼ sec. 27, T. 10 N., R. 3 W., where the slope is 45 percent):

A00—1½ inches to ½ inch, undecomposed leaves and moss litter.
A0—½ inch to 0, partly decomposed leaves and moss litter.
A1—0 to 2 inches, dark-gray (10YR 4/1) silt loam; weak, fine, granular structure; friable; abundant roots; strongly acid; abrupt, smooth boundary.
A2—2 to 7 inches, light yellowish-brown (10YR 6/4) light silt loam; weak, medium, subangular blocky structure that breaks to weak, fine, granular structure; friable; abundant roots; very strongly acid; abrupt, wavy boundary.
B1—7 to 12 inches, yellowish-brown (10YR 5/6) silt loam; moderate to weak, medium, subangular blocky structure; friable; few roots; very strongly acid; clear, wavy boundary.
B21t—12 to 20 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky and angular blocky structure; firm; very strongly acid; clear, wavy boundary.
B22t—20 to 26 inches, brown (7.5YR 5/4) silty clay loam; weak, medium and coarse, prismatic structure; firm to very firm; thick, pale-brown (10YR 6/3) silt flows and few manganese concretions; strongly acid; clear, wavy boundary.
B23t—26 to 35 inches, brown (10YR 5/3) silty clay loam with scattered patches of reddish yellow (7.5YR 6/8) to strong brown (7.5YR 5/8); weak, coarse, prismatic structure; firm; strongly acid in upper part, but neutral in lower part; gradual, wavy boundary.
IIC1—35 to 46 inches, brown (10YR 5/3) silty clay; massive; firm; calcareous; abrupt, wavy boundary.
IIC2—46 to 62 inches, pale-brown (10YR 6/3) silt; massive; friable; calcareous; abrupt, wavy boundary.
IIC3—62 to 80 inches, light brownish-gray (10YR 6/2) heavy silt loam with thin layers of fine sand and silty clay loam; massive; friable; calcareous.
IIC4—80 inches +, interbedded silt, fine sand, silty clay, silty clay loam, clay loam, and clay.

Otwell silt loam, calcareous substratum, 25 to 35 percent slopes (OtF).—This soil has a profile similar to that of Otwell silt loam, calcareous substratum, 35 to 70 percent slopes, except that the horizons are somewhat thicker. In addition, the depth to carbonates is 4 to 6 feet. This soil is mainly in forest. The trees grow rapidly and are of good quality. (Capability unit VIe-1; woodland suitability group 2)

Parke Series

The Parke soils are deep, well drained, and gently sloping to sloping. They have a dark grayish-brown to yellowish-brown surface layer and a brown to reddish-brown subsoil. These soils formed in loess that is 18 to 42 inches thick over strongly leached outwash. Stratified, calcareous sand and gravel are generally at a depth of 10 to 15 feet.

The Parke soils are on ridges and adjacent slopes. They are closely associated with the well-drained, nearly level Pike soils and with the well-drained to excessively drained, steeper Negley soils. All of these soils formed in similar parent material. The Pike soils, however, formed in a thicker loess cap (more than 42 inches) than the Parke soils, and the Negley soils in a thinner loess cap (0 to 18 inches). In some places the Parke soils are also associated with the imperfectly drained Taggart soils.

Representative profile of Parke silt loam, 2 to 6 percent slopes (SE¼NW¼ sec. 30, T. 11 N., R. 3 W.):

A0—1 inch to 0, leaf litter; slightly acid.
A1—0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable; strongly acid; abrupt, smooth boundary.
A2—2 to 9 inches, yellowish-brown (10YR 5/4) silt loam; weak, thick, platy structure that breaks to moderate, fine, granular; friable; abundant roots; strongly acid; clear, wavy boundary.
B1t—9 to 18 inches, brown to dark-brown (7.5YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; firm; many roots; light yellowish-brown (10YR 6/4) silt coatings; strongly acid; clear, wavy boundary.
B21t—18 to 30 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; very strongly acid; diffuse, smooth boundary.
IIB22t—30 to 48 inches, reddish-brown (5YR 4/4) sandy clay loam; moderate, medium, subangular blocky structure; friable; very strongly acid; diffuse, smooth boundary.
IIB3t—48 to 80 inches, yellowish-red (5YR 4/6) sandy clay loam; weak, coarse, subangular blocky structure; friable; very strongly acid; gradual, wavy boundary.
IIC1—80 to 120 inches, yellowish-red (5YR 4/6) stratified sand, silt, and some fine gravel; strongly acid, becoming neutral in the lower part.
IIC2—120 inches +, light yellowish-brown (10YR 6/4) stratified fine and coarse sand with minor gravelly layers; calcareous.

The boundary between the loess and the outwash is at a depth of 30 inches. The content of sand in the lower part of the subsoil varies somewhat. In most places, however, the subsoil is friable, reddish-brown to yellowish-red sandy clay loam to loam to a depth of 7 feet or more. In many places soil material below the silty loessal material appears to be the remnants of an old, buried profile. In many deeper cuts where the underlying material can be observed, the calcareous sandy and gravelly outwash is strongly cemented by carbonates. This outwash material is as much as 80 to 100 feet thick in places. The loess cap is generally thickest in the gently sloping areas and thinnest in the steeper areas.

The Parke soils are low in content of organic matter, low in phosphate, and medium in potash. Unless they have been limed, they are strongly acid. They are moderately permeable and have high moisture-holding capacity. The more rolling areas are susceptible to severe accelerated erosion if they are not properly managed. Along many steep breaks, gullies develop and cut rapidly into the friable substratum. The response to lime and fertilizer is good. Roots can penetrate deeply, and as a result, these soils are excellent for alfalfa. The Parke soils are, in fact, well suited to all the crops grown in the county.

Parke silt loam, 2 to 6 percent slopes (PaB).—The profile of this soil is described as representative of the series. This gently sloping soil is not eroded or is only slightly eroded. It is generally on narrow ridges in areas of as much as 10 acres in size and is surrounded by steep soils that are mainly in forest. Moisture-supplying capacity is high, and runoff is medium. Where this soil is cultivated, it is susceptible to moderate erosion if it is not properly managed. (Capability unit IIe–1; woodland suitability group 1)

Parke silt loam, 2 to 6 percent slopes, moderately eroded (PaB2).—This soil has a profile similar to the one described for the series, except that it is moderately eroded. The surface layer is yellowish-brown to dark-brown silt loam. In some places it is dark brown and clayey because it is made up entirely of material that was formerly subsoil. Moisture-supplying capacity is high, and runoff is medium. Included in the mapping of this soil are small areas of loam and sandy loam.

Parke silt loam, 2 to 6 percent slopes, moderately eroded, is mainly in cultivation. It makes excellent cropland. Where it is cultivated, however, it is susceptible to continued erosion if it is not properly managed. (Capability unit IIe–1; woodland suitability group 1)

Parke soils, 2 to 6 percent slopes, severely eroded (PcB3).—These soils have a profile similar to the one described for the series, except that severe erosion has taken place. The surface layer is mainly yellowish-brown to dark-brown light silty clay loam mixed with small areas of silt loam.

These soils are mainly in small areas of 5 acres or less in cultivated fields. The plowed soils are likely to be cloddy, and as a result, they are more difficult to work than the uneroded soils. These soils are susceptible to accelerated erosion if they are cultivated and not properly managed. (Capability unit IIIe–1; woodland suitability group 1)

Parke silt loam, 6 to 12 percent slopes (PaC).—This soil has a profile similar to the one described for the series, but it has stronger slopes. Most of this soil is in trees, along with steeper soils that have not been cleared. The areas of this soil that have been cleared are small, and they are used mainly for pasture. Where the soil is cultivated, it is subject to severe accelerated erosion if it is not properly managed. Included in the mapped areas of this soil are small areas of a Negley loam. (Capability unit IIIe–1; woodland suitability group 1)

Parke silt loam, 6 to 12 percent slopes, moderately eroded (PaC2).—This soil has a profile similar to the one described for the series, but it has stronger slopes and has been moderately eroded. The surface layer is yellowish-brown to dark-brown silt loam. In some places it is dark brown and clayey because it is made up entirely of material that was formerly subsoil. Moisture-supplying capacity is good, and runoff is medium to rapid.

Most of this soil is in cultivation or pasture. Where it is cultivated it is susceptible to continued erosion if it is not properly managed. (Capability unit IIIe–1; woodland suitability group 1)

Parke soils, 6 to 12 percent slopes, severely eroded (PcC3).—These soils have a profile similar to the one described for the series, but they have stronger slopes and have been severely eroded. The surface layer is mostly yellowish-brown to dark-brown silty clay loam.

All of the acreage was once cultivated, but part of it is now in permanent pasture or is idle. Erosion is the major problem in managing these soils. Because of the hazard of further erosion, row crops should not be grown frequently. These soils are better suited to small grains, alfalfa, or grass than to cultivated crops. Plowing makes them cloddy, and as a result, they are more difficult to work than uneroded soils. (Capability unit IVe–1; woodland suitability group 1)

Parke silt loam, 12 to 18 percent slopes (PaD).—This soil has a profile similar to the one described for the series, but it is moderately steep. The upper part of the profile, which formed in loess, is about 20 to 24 inches thick. The B1 and B2 horizons are somewhat thinner than those in gently sloping soils.

This soil occurs with steeper soils, chiefly of the Negley series. It is mainly in forest, and because of its small extent, it will probably remain in forest. The trees make excellent growth and are of good quality. The main problem if the soil is cultivated is erosion. (Capability unit IVe–1; woodland suitability group 1)

Parke silt loam, 12 to 18 percent slopes, moderately eroded (PaD2).—This soil has a profile similar to the one described as representative of the series, but it is steeper and has been moderately eroded. About half of the original surface layer, or about 3 to 6 inches of soil material, has been washed away through erosion, and there are a few gullies. The upper part of the profile, which formed in loess, is about 20 to 24 inches thick. The B1 and B2 horizons are somewhat thinner than those in gently sloping soils. Runoff is rapid.

Most of this soil is cultivated or in pasture, but some areas are idle. This soil can be used effectively for small grains, grasses, and legumes. Where the soil is cultivated, it is susceptible to severe accelerated erosion if it is not properly managed. (Capability unit IVe–1; woodland suitability group 1)

Parke soils, 12 to 18 percent slopes, severely eroded (PcD3).—These soils have a profile similar to the one described for the series, but they are steeper and are severely eroded. Most of the original surface layer has been lost through erosion, and the present surface layer is mainly yellowish-brown to dark-brown silty clay loam. There are a few gullies, some of which cut into the friable substratum. Runoff is very rapid.

Some of the acreage has been abandoned because of low yields. The rest is used for permanent pasture or for crops grown in rotation. The best use for these soils is permanent vegetation, either pasture or forest. Pastures are good if the soils are fertilized, limed, and otherwise managed properly. Where these soils are reforested, the trees grow well and are of good quality. If the soils are cultivated, they are susceptible to severe accelerated erosion. (Capability unit VIe–1; woodland suitability group 1)

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Philo Series

In the Philo series are deep, moderately well drained, brown soils that are strongly acid. These soils developed in alluvium from acid sandstone, Illinoian drift, and shale. There has been little profile development other than some accumulation of organic matter in the uppermost layers.

The Philo soils are on bottom lands along Fish Creek, Lick Creek, and other small streams. They are associated with the poorly drained Atkins, the imperfectly drained Stendal, and the well-drained Pope soils. All of these associated soils formed in the same kind of parent material as the Philo soils. The Philo soils are similar to the Eel soils in drainage, but they are strongly acid rather than neutral or slightly acid like the Eel soils.

Representative profile of Philo silt loam (SE¼NE¼ sec. 2, T. 10 N., R. 6 W.):

- Ap1—0 to 7 inches, brown to dark-brown (10YR 4/3) silt loam; weak, medium, platy structure; friable; neutral; abrupt, smooth boundary.
- Ap2—7 to 10 inches, (traffic pan) brown to dark-brown (10YR 4/3) silt loam; weak, thick, platy structure; friable; neutral; abrupt, smooth boundary.
- C1—10 to 20 inches, dark yellowish-brown (10YR 4/4) silt loam with common, medium, faint mottles of light yellowish brown (10YR 6/4); massive; friable; slightly acid in the upper part of the horizon and medium acid in the lower part; clear, smooth boundary.
- C2—20 to 26 inches, dark yellowish-brown (10YR 4/4) loam with many, fine, distinct, mottles of pale brown (10YR 6/3); massive; friable; medium acid; clear, wavy boundary.
- C3—26 to 39 inches, dark yellowish-brown (10YR 4/4) silt loam with common, fine, faint mottles of grayish brown (10YR 5/2) and brown (10YR 5/3); massive; friable; medium acid; clear, wavy boundary.
- C4—39 inches +, grayish-brown (10YR 5/2) silt loam with common, fine, faint mottles of brown to dark brown (10YR 4/3) and few, fine, distinct mottles of strong brown (7.5YR 5/6); massive; friable; strongly acid.

In places the structure of the Ap1 horizon is weak, fine, granular, and the structure of the Ap2 horizon is weak, thin, platy, or fine, granular. The underlying material ranges from silt loam to loam or sand. There is considerable variation among profiles within a short distance. These soils are strongly acid in most places, but a few minor areas are medium acid. They are low in content of organic matter and in available phosphate. The content of potash is low to medium. Moisture-supplying capacity is high.

These soils are subject to flooding from December to June, and their use is governed by the hazard of flooding. In many of the bottom lands, floods damage the crops and make it impracticable to use a systematic rotation. Corn and soybeans are popular crops because they can be planted in summer and harvested early in fall. In some places the floods are infrequent or last such a short time that a rotation that includes wheat, red clover, alfalfa, or other crops that stand over winter can be used.

Some areas that are too small to be cultivated are in trees or permanent pasture. Originally, these soils were covered by a dense forest of sycamore, soft maple, elm, ash, cottonwood, willow, and tulip-poplar.

Philo silt loam (Ph).—This is the only Philo soil mapped in the county. It is on the flood plains of streams that drain acid soils of the uplands. Generally, the areas of this soil are small.

Included in the mapping of this soil are a few small areas of loam and some small areas of medium acid soils. Also included are some imperfectly drained soils of the bottom lands and some well-drained soils.

Most of the large areas of Philo silt loam are cultivated, but small or irregularly shaped fields on narrow bottom lands or on bottoms dissected by meandering streams are generally kept in timber or in pasture. Excess water, as the result of the seasonally high water table, is generally a problem, as well as overflow. Drainage may be necessary for maximum production of most of the crops grown in the county. The response to lime and fertilizer is good. (Capability unit IIw–7; woodland suitability group 8)

Pike Series

In the Pike series are deep, well-drained, nearly level to gently sloping soils. The surface layer is dark grayish brown to yellowish brown, and the subsoil is brown to reddish brown. The parent material was more than 42 inches of loess underlain by strongly weathered, reddish sandy and gravelly outwash. Stratified, calcareous sand and gravel are generally at a depth of 10 to 15 feet.

The Pike soils are associated with the gently sloping to moderately steep Parke soils and the moderately steep to very steep Negley soils. The parent material of the associated soils is similar to that of the Pike soils. The thickness of the loess in the Pike soils is more than 42 inches, but that in the Parke is 18 to 42 inches, and that in the Negley soils is less than 18 inches. In some places the Pike soils are also associated with the imperfectly drained Taggart soils.

Representative profile of Pike silt loam, 0 to 2 percent slopes (SE¼ sec. 22, T. 10 N., R. 3 W., along new Indiana State Highway 46, west of the entrance to McCormicks Creek State Park):

- Ap—0 to 8 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, thick, platy structure; friable; neutral; abrupt, smooth boundary.
- A2—8 to 10 inches, yellowish-brown (10YR 5/6) silt loam; moderate, medium, subangular blocky structure; friable; neutral; abrupt, smooth boundary.
- B21t—10 to 15 inches, brown to dark-brown (7.5YR 4/4) light silty clay loam; moderate to strong, medium, subangular blocky structure; firm; slightly acid; clear, wavy boundary.
- B22t—15 to 23 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate to strong, medium, subangular blocky structure; firm; yellowish-red (5YR 4/6) clay films cover peds; strongly acid; clear, wavy boundary.
- B23t—23 to 45 inches, brown to dark-brown (7.5YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; pinkish-gray (7.5YR 7/2) silt streaks; reddish-brown (5YR 4/4) clay films; strongly acid; clear, wavy boundary.
- IIB31t—45 to 55 inches, brown to dark-brown (7.5YR 4/4) loam; massive; friable; reddish-brown (5YR 4/4) clay flows; strongly acid; gradual, wavy boundary.
- IIB32t—55 to 70 inches, yellowish-red (5YR 5/6) loam; massive; friable; reddish-brown (5YR 4/3) clay flows; light-brown (7.5YR 6/4) streaks of sand; strongly acid; gradual, wavy boundary.
- IIB33t—70 to 103 inches, dark-red (2.5YR 3/6) sandy clay loam; massive; firm; yellowish-brown (10YR 5/4) loam in streaks and pockets; strongly acid; gradual, wavy boundary.
- IIC1—103 to 144 inches, red (2.5YR 4/6) stratified sandy clay loam, gravelly loam, and sand; medium acid.

IIC2—144 inches +, stratified fine sand, silt, and clay over sandy and gravelly material, and calcareous sand that ranges in depth from 12 to more than 15 feet.

The thickness of the loess ranges from about 42 to 60 inches. The content of sand in the deeper part of the subsoil or underlying material varies somewhat, but in most places it is friable, reddish-brown to yellowish-red sandy clay loam to loam to a depth of 8 to 10 feet.

The Pike soils are low in content of organic matter, low in phosphate, and medium in potash. Unless they have been limed, they are strongly acid. Permeability is moderate, and moisture-supplying capacity is high. Roots penetrate deeply, and therefore these soils are excellent for alfalfa and orchards. These soils are suited to all of the crops commonly grown in the county, and the response to lime and fertilizer is good.

Pike silt loam, 0 to 2 percent slopes (PkA).—The profile of the soil is described as representative of the series. This is among the best soils for agriculture in the county. It is fairly uniform and is generally in small areas of 20 acres or less, surrounded by gently rolling Parke soils.

Some minor areas of Parke soils are included in the mapped areas of this soil. Also, several small areas of nearly level Cincinnati silt loams are included because of their small extent and their similarity in slope and management. The Cincinnati soils have a less permeable subsoil than the Pike, and they are slightly mottled below a depth of 3 feet in places. (Capability unit I–1; woodland suitability group 1)

Pike silt loam, 2 to 6 percent slopes, moderately eroded (PkB2).—This soil has a profile similar to that described for the series, but it is gently sloping and is moderately eroded. Some areas, however, are only slightly eroded. The hazard of further erosion is moderate in cultivated areas.

In some places minor areas of Parke soils are included in the mapped areas of this soil. The areas of included soils are too small to be mapped separately. (Capability unit IIe–1; woodland suitability group 1)

Pope Series

In the Pope series are deep, well-drained, dark-brown soils that are strongly acid. The soils developed in alluvium from uplands of acid sandstone, Illinoian drift, and shale. There has been little soil development other than the accumulation of organic matter in the surface layer.

These soils are on the bottom lands along Fish Creek, Lick Creek, and other small streams. They are associated with the poorly drained Atkins, the imperfectly drained Stendal, and the moderately well drained Philo soils. All of these associated soils formed in the same kind of parent material as the Pope soils. The Pope soils also are associated with the Genesee soils, which formed in neutral or mildly alkaline alluvium from areas of Wisconsin drift.

Representative profile of Pope silt loam (SE¼NW¼ sec. 33, T. 11 N., R. 4 W.):

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; cloddy to weak, medium, granular structure; friable; neutral; abrupt, smooth boundary.

C1—9 to 22 inches, yellowish-brown (10YR 5/4) silt loam; massive; friable; strongly acid; clear, smooth boundary.

C2—22 to 25 inches, dark yellowish-brown (10YR 4/4) silt loam with a band of strong brown (7.5YR 5/8) that is one-eighth inch thick; massive; friable; strongly acid; abrupt, smooth boundary.

C3—25 to 36 inches, yellowish-brown (10YR 5/4) silt loam; massive; friable; strongly acid; clear, wavy boundary.

C4—36 to 42 inches, yellowish-brown (10YR 5/4) silt loam with few, fine, faint, yellowish-brown (10YR 5/8) mottles; massive; friable; strongly acid; clear, wavy boundary.

C5—42 inches +, pale-brown (10YR 6/3) to light yellowish-brown (10YR 6/4) loam with common, medium, faint, yellowish-brown (10YR 5/8) mottles; massive; friable; strongly acid.

There is considerable variation between profiles within short distances. The main variations are in the texture of different horizons, which range from silt loam to sand. The surface layer ranges from silt loam to loam.

These strongly acid soils of the bottom lands are low to medium in content of organic matter. They are low in available phosphate and medium in available potash. Moisture-supplying capacity is high. Good yields of corn and soybeans are obtained.

The Pope soils are subject to frequent flooding from December to June. Their use is governed by the hazard of flooding. Because of this hazard, it is impracticable to use a systematic cropping system. Corn and soybeans are grown extensively because they can be planted in summer and harvested early in fall. In some of the bottom-land areas, the floods are infrequent enough or of such short duration that a rotation of wheat, red clover, alfalfa, or other crops that stand over winter can be used.

Originally these soils were covered by a dense forest of sycamore, soft maple, elm, ash, cottonwood, willow, and tulip-poplar. Now only areas that are too small to be cultivated are in timber or permanent pasture.

Pope silt loam (Pp).—The profile of this soil is described as representative of the series. This soil is on the flood plains of streams that drain the acid soils of the uplands.

Included in the mapped areas of this soil are small areas of moderately well drained and imperfectly drained soils. Also included in the mapping are small areas of loam that are on the small natural levees.

Pope silt loam in small areas is managed in the same way as the adjoining soils. Most of the large areas are cultivated. Small, irregularly shaped fields on narrow bottom lands or on bottoms dissected by meandering streams are normally kept in timber or pasture because of the difficulty in using machinery. There are a few wet spots that require drainage. Corn responds well to moderate applications of mixed fertilizer and to large applications of nitrogen. (Capability unit I–2; woodland suitability group 8)

Pope loam (Po).—The profile of this soil is similar to the one described for the series, except that the surface layer is loam. Also, the underlying material generally contains more sand. This soil is on the flood plains of streams that drain acid soils of the uplands.

Small areas of imperfectly drained and moderately well drained soils are included in the mapped areas of this soil. Also included are some areas of Pope silt loam.

Pope loam in small areas is managed in the same way as the adjoining soils. Most of the large areas are cultivated. Small, irregularly shaped fields on narrow bottoms dissected by meandering streams are normally kept in timber or pasture because of the difficulty in using machinery. A few wet spots require drainage. Corn responds well to applications of nitrogen. (Capability unit I–2; woodland suitability group 8)

Princeton Series

The Princeton soils are very deep, well drained, and gently undulating to hilly. They have a grayish-brown surface layer and a dark-brown to yellowish-brown subsoil. The parent material is windblown sand and silt. The substratum consists of layers of calcareous sand and coarse silt.

These soils are on the uplands adjacent to the bottom lands of the White River. They are closely associated with the somewhat excessively drained Bloomfield soils. The Princeton soils have a continuous textural B horizon; the Bloomfield soils have a B horizon of fine sand with bands of sandy loam to sandy clay loam at a depth of 30 inches or more.

Representative profile of Princeton fine sandy loam, 6 to 12 percent slopes (SE¼SW¼ sec. 22, T. 9 N., 4 W., in a cultivated field where the slope is 9 percent):

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

A2—8 to 11 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, medium, platy structure; friable; neutral; clear, smooth boundary.

B1t—11 to 14 inches, yellowish-brown (10YR 5/4) sandy clay loam; weak, medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—14 to 30 inches, dark-brown (7.5YR 4/4) sandy clay loam; moderate, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B22t—30 to 44 inches, dark-brown (7.5YR 4/4) fine sandy loam; massive to single grain; friable; medium acid; gradual, smooth boundary.

B3—44 to 72 inches, yellowish-brown (10YR 5/4) fine sandy loam with bands of loamy fine sand; single grain; loose; medium acid, becoming neutral in lower part; gradual, smooth boundary.

C—72 inches +, yellowish-brown (10YR 5/4) fine sand; single grain; loose; calcareous.

Depth to calcareous silt or sand ranges from 36 to 75 inches or more. The thickness of the windblown deposits ranges from 5 to 20 feet or more. The texture and development of the subsoil vary somewhat. Profiles in which the subsoil is clay loam have moderately developed horizons, and profiles in which the subsoil is coarse textured have more weakly developed horizons.

The content of organic matter and the natural fertility are moderate to low. Moisture-supplying capacity is good, and permeability is moderate. These soils have good infiltration, and the rooting zone is deep.

These soils are good for agriculture, and they are especially well suited to alfalfa and to peach and apple orchards. If they are cultivated, the hazard of erosion is moderate. A good seedbed is easy to prepare. The response to lime and fertilizer is good.

Princeton fine sandy loam, 2 to 6 percent slopes (PrB).—The profile of this soil is similar to the one described for the series. The slopes are short and gently undulating, which makes the soil somewhat hummocky. A few areas are moderately eroded. (Capability unit IIe–5; woodland suitability group 1)

Princeton fine sandy loam, 6 to 12 percent slopes (PrC).—The profile of this soil is described as representative of the series. Very little erosion has occurred on this rolling soil. The slopes are short and somewhat hummocky. This soil is in small areas; it is not extensive. (Capability unit IIIe–5; woodland suitability group 1)

Princeton fine sandy loam, 6 to 12 percent slopes, moderately eroded (PrC2).—The profile of this soil is similar to the one described as representative for the series, except that about half of the original surface layer has been lost through erosion. In a few small spots, the surface layer is made up entirely of dark-brown material that was formerly subsoil. A few shallow gullies are throughout. The slopes are short and rolling; and relief is hummocky. This soil is in small areas; it is not extensive. (Capability unit IIIe–5; woodland suitability group 1)

Princeton fine sandy loam, 12 to 18 percent slopes, moderately eroded (PrD2).—This soil has a profile similar to the one described for the series, but it is rolling to hilly and has been moderately eroded. In a few small areas, little erosion has occurred. This soil is well suited to small grains, alfalfa, and grass. It erodes easily if it is used intensively for row crops without regard to the slope. (Capability unit IVe–5; woodland suitability group 1)

Princeton fine sandy loam, 18 to 25 percent slopes, moderately eroded (PrE2).—This soil has a profile similar to the one described, but it is hilly to moderately steep and is moderately eroded. Some minor areas are only slightly eroded. This soil is in small areas and is generally in permanent pasture or trees. There are also areas of steeper slopes, which are mainly in timber. (Capability unit VIe–1; woodland suitability group 2)

Quarries

Stone quarries occur throughout the limestone areas where relatively pure limestone is near the surface. They are shown on the detailed map by a standard symbol. Some of the limestone quarried is crushed fine for agricultural use. Limestone is also crushed and used for surfacing roads, and some is cut into blocks and used for building stone.

A few willows and shrubs grow in many of the crevices at the bottom of the pits and provide habitats for wildlife. Some abandoned pits are suitable to be stocked with fish and developed for wildlife. (Capability unit VIIIs–1; not placed in woodland suitability group)

Riverwash (Ra)

Riverwash occurs as islands or as gravel bars and sandbars on the White River and the larger creeks. It consists of gravel and rocks mixed with a little finer textured material. Most of the areas lie only a few feet above the level of the water when the streams are at normal stage. A single flood may change the size and shape of an area considerably, or may wash it away entirely.

Areas of Riverwash support a scanty growth of willows and shrubs. The vegetation catches fine-textured sediment, which is likely to raise the level of the land enough so that it may eventually become suitable for cultivation.

Most areas of Riverwash are not suited to any agricultural use, but they may provide a habitat for wild animals and birds. (Capability unit VIIIs-1; not placed in woodland suitability group)

Robinson Series

The Robinson soils are moderately deep, poorly drained, and nearly level or in slight depressions. Their surface layer is gray, and their subsoil is gray and mottled. These soils have a pan that is moderately to strongly developed. They formed in water-deposited (lake-formed) silty clay loam and silt. They are strongly acid; the underlying material is leached to a depth of 10 to 12 feet.

These soils are in the old Lake Quincy area in the northeastern part of the county and west along Mill Creek. They are also in the Flat Woods area southeast of Spencer and along many of the small streams.

The Robinson soils are closely associated with the well drained Otwell, the moderately well drained Haubstadt, and the imperfectly drained Dubois soils. All of the associated soils developed from the same type of parent material as the Robinson soils.

Representative profile of Robinson silt loam (SW. corner NW¼ sec. 35, T. 10 N., R. 3 W.):

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.

A21—8 to 14 inches, gray (10YR 6/1) silt loam with common, fine, distinct, brownish-yellow (10YR 6/6) mottles; strong, thin, platy structure; friable; strongly acid; clear, smooth boundary.

A22—14 to 20 inches, gray (10YR 6/1) silt loam with many, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, thin, platy structure that breaks to weak, medium, subangular blocky; friable; very strongly acid; clear, irregular boundary.

B21t—20 to 30 inches, gray (10YR 6/1) silty clay loam with many, medium, distinct, yellowish-brown (10YR 5/8) mottles; strong, medium, prismatic structure that breaks to strong, medium to coarse, angular blocky; firm; light-gray (10YR 7/1) silt coatings on peds; very strongly acid; gradual, smooth boundary.

B22t—30 to 42 inches, gray (10YR 5/1) silty clay loam with many, medium, distinct, yellowish-brown (10YR 5/8) mottles; strong, coarse, prismatic structure; firm; light-gray (10YR 7/1) silt coatings over peds, and some clay flows; very strongly acid; gradual, wavy boundary.

IIC—42 to 70 inches +, gray (10YR 5/1) to light brownish-gray (10YR 6/2) stratified clay loam, silty clay loam, silt loam, and thin layers of sandy loam with many, coarse, distinct, yellowish-brown (10YR 5/8) mottles; massive; firm; very strongly acid.

In some places there are fewer mottles than in the representative profile described, and in some places the mottles are finer. In some areas the A2 horizon extends down as far as 30 inches, and in some the fragipan is weak and thin. In the Lake Quincy area, there is a nearly continuous, buried, gleyed profile at a depth of 50 to 70 inches. This dark, buried profile is normally slightly acid silty clay loam to clay loam and is 20 to 30 inches thick. Buried profiles have not been found in any other area in this county.

The Robinson soils are very slowly permeable, and there is little runoff. They are low in natural fertility, and, unless they have been limed, they are very strongly acid. Roots penetrate to only a moderate depth because of the excess water and the impervious subsoil. The hazard of excess water is even greater on these soils than on the Dubois soils.

Robinson silt loam (Ro).—This is the only Robinson soil mapped in the county. Most of the acreage is used for cultivated crops, but some areas are still in forest or pasture. If this soil is drained adequately, the response to lime and fertilizer is good, and moderately good yields of corn, soybeans, small grains, and shallow-rooted legumes and grasses are obtained.

Shallow surface drains are used in most places instead of tile because of the cost of tiling and the impervious subsoil. Tile have been used in some places, however, and where they are accompained by surface drains, they have given satisfactory results. (Capability unit IIIw-5; woodland suitability group 11)

Shoals Series

In the Shoals series are deep, neutral or mildy alkaline, imperfectly drained soils that formed in alluvium. The surface layer is grayish brown, and the material below the surface layer is mottled light brownish gray to gray. There has been little soil development other than the accumulation of organic matter in the uppermost layers.

These soils are in bayous and on nearly level back bottoms along the White River, the Eel River, and Mill Creek. They are associated with the well drained Genesee and the moderately well drained Eel soils, which were formed in the same kind of neutral alluvium as the Shoals soils. The Shoals soils are neutral or mildly alkaline rather than strongly acid like the Stendal soils, which formed in alluvium washed chiefly from areas of mixed Illinoian drift, shale, and sandstone.

Representative profile of Shoals silt loam (SW¼NW¼ sec. 16, T. 9 N., R. 4 W.):

Ap—0 to 9 inches, light brownish-gray (10YR 6/2) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A12—9 to 12 inches, grayish-brown (10YR 5/2) silt loam with common, coarse, distinct mottles of light yellowish brown (10YR 6/4) and yellow (10YR 7/6); weak, medium, platy structure; friable; neutral; clear, smooth boundary.

C1—12 to 30 inches, gray (10YR 5/1) silt loam with common, coarse, distinct mottles of light yellowish brown (10YR 6/4) and yellow (10YR 7/6); weak, medium, granular structure; friable; neutral; gradual, smooth boundary.

C2—30 to 40 inches +, light brownish-gray (10YR 6/2), stratified silt loam, loam, and fine sandy loam with common, coarse, faint, light yellowish-brown (10YR 6/4) mottles and distinct, yellow (10YR 7/6) mottles; massive; some layers of coarse sand and gravel below a depth of 40 inches; neutral to slightly alkaline.

In many places gravel and sand occur below a depth of 4 or 5 feet. In places in wooded areas or old pastures, the uppermost few inches is slightly darker and contains more organic matter than in cultivated fields.

These soils are medium to high in natural fertility and do not require lime. Flooding and wetness are the main hazards. The soils require drainage for maximum production of cultivated crops. They are generally difficult to drain, however, because much of the acreage is in swales or old bayous and is at a lower elevation than the surrounding soils of bottom lands. These areas are normally left in forest or are used for pasture. Surface drains and tile can be used in some places to overcome the problem of wetness. Small, irregularly shaped fields on the narrow bottom lands of tributaries are generally kept in woods or pasture because of the difficulty in using farm machinery and in draining the soils.

Originally, all of these soils on bottom lands were covered by a dense forest of elms, poplars, sycamores, soft maples, and oaks that tolerate water. If these soils are drained, corn and soybeans are popular crops because they can be planted in summer and harvested early in fall, when flooding is not severe. Small grains and clover are not grown in many places, because of the hazard of flooding. If corn is grown, moderate to large applications of phosphate, potash, and nitrogen are normally profitable. The Shoals soils are very productive if they are drained and managed properly.

Shoals loam (Sh).—The profile of this soil is similar to the one described, except that the surface layer is loam. Shoals loam also has somewhat coarser material throughout the profile than Shoals silt loam. In some wooded areas or old pastures, the uppermost few inches is slightly darker and contains more organic matter than in cultivated fields.

Mapped with this soil are a few areas of fine sandy loam and some minor areas of silt loam. Also included are some medium acid and neutral soils in areas where the alluvium was derived from strongly acid or neutral to calcareous material from uplands adjacent to the bottom lands. (Capability unit IIw–7; woodland suitability group 13)

Shoals silt loam (Sm).—The profile of this soil is the one described as representative of the series. This soil is back from the main streams and is adjacent to the uplands, where seepage from the uplands contributes to the problem of wetness. It is also in many of the shallow swales and old bayous along the West Fork of the White River. Included in the mapping of this soil are some minor areas of loam. (Capability unit IIw–7; woodland suitability group 13)

Shoals silty clay loam (Sn).—The profile of this soil is similar to the one described for the series, except that the surface layer and the layers below the surface layer are silty clay loam. The layers below a depth of 3 to 4 feet are generally very similar to those underlying Shoals silt loam. Included in the mapped areas of this soil are some minor areas of very dark gray bottom-land soils in depressions.

Shoals silty clay loam is in old swales and bayous along the West Fork of the White River. It is at a lower elevation than the surrounding soils, and therefore it is difficult to drain and is unreliable for crops. Some areas can be tiled and surface drained and then used for corn, soybeans, or pasture. Plowing when wet makes this soil cloddy in many places, and a good seedbed is difficult to prepare. (Capability unit IIw–7; woodland suitability group 13)

Stendal Series

In the Stendal series are deep, strongly acid, imperfectly drained soils that have a light-gray surface layer. These soils developed in mixed alluvium from Illinoian drift, acid sandstone, and shale of the uplands. There has been little profile development, other than some accumulation of organic matter in the uppermost layers.

The Stendal soils are on bottom lands along Fish Creek, Lick Creek, and other small streams. They are associated with the poorly drained Atkins, the moderately well drained Philo, and the well drained Pope soils. All of the associated soils formed in the same kind of parent material as the Stendal soils. The Stendal soils are similar to the Shoals soils in color and drainage, but the Shoals soils formed in neutral or mildly alkaline alluvium from Wisconsin drift.

Representative profile of Stendal silt loam (NE. corner NW¼ sec. 21, T. 9 N., R. 5 W.):

A11p—0 to 6 inches, light-gray (10YR 7/2) silt loam with few, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, medium, granular structure; friable; medium to slightly acid; abrupt, smooth boundary.

A12p—6 to 9 inches, light brownish-gray (10YR 6/2) silt loam with common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; cloddy; massive; (appears to be a plowpan); friable; strongly acid; abrupt, smooth boundary.

C1—9 to 18 inches, light brownish-gray (10YR 6/2) silt loam with common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, medium and coarse, subangular blocky structure; friable; strongly acid; clear, smooth boundary.

C2—18 to 48 inches, grayish-brown (10YR 5/2) silt loam with many, medium, faint, yellowish-brown (10YR 5/4) mottles; massive; friable; strongly acid; ground water at a depth of 40 inches.

C3—48 inches +, lenses of sand, silt, and loam; color changes by lenses with variations from dark gray (10YR 4/1) to light brownish gray (10YR 6/2); massive; friable; medium acid at a depth of 74 inches.

There is considerable variation among profiles within short distances. The underlying material ranges from silt loam to loam and sand.

These strongly acid soils are low in available phosphate and potash and in content of organic matter. Excess water, caused by a high water table as well as by overflow, is a problem in managing these soils. Moisture-supplying capacity is high. The response to lime and fertilizer is good, and under proper management production is moderate.

These soils are subject to prolonged wetness and frequent flooding from December to June. Their use is governed by the hazard of flooding. In many places crops are damaged by flooding, and a systematic cropping system is therefore impracticable. Corn and soybeans are popular crops because they can be planted in summer and harvested early in fall. In some of the bottom lands, floods are infrequent enough or of such short duration that a crop rotation can be followed. In addition to corn and soybeans, wheat, red clover, or other crops that stand over winter can be grown.

Originally, all of these bottom lands were covered by a dense forest of sycamore, soft maple, elm, ash, cottonwood, willow, or tulip-poplar. Now, only the areas that are too wet or too small to cultivate are in timber or permanent pasture.

Stendal silt loam (So).—This is the only Stendal soil mapped in the county (fig. 11). It is on the flood plains of streams that drain the acid soils of the uplands.

Included in the mapped areas of this soil are minor areas of moderately well drained and well drained bottom-land soils. Also included are a few small areas of loam.

Figure 11.—**A field of Stendal silt loam. This soil needs drainage if crops are to be grown.**

Small or irregularly shaped fields on narrow bottom lands or on bottoms dissected by meandering streams are generally kept in timber or pasture because of the difficulty in using machinery or in draining the soil. Most of the large areas are cultivated. Drainage is generally necessary for maximum production of most of the field crops commonly grown in the county. Where the soil has been drained, corn responds well if fertilizer that contains a large amount of nitrogen is applied. (Capability unit IIw-7; woodland suitability group 13)

Strip Mines (St)

Strip mines are along the western edge of the county. They are the result of stripping coal from beneath the fairly shallow deposits of till, which overlie the coal-producing layers in the Brazil rock formation.

In strip mining the overburden of soil and rock is moved to one side and is often piled to a depth of 70 feet or more. The soil material, glacial till, shale, sandstone, and siltstone are generally thoroughly mixed. The last cut where coal has been removed is generally left open. After a short time, it fills with water and forms a deep lake or pond (fig. 12). In recent years some of the spoil has been smoothed to some extent, but most of it still remains in steep ridges.

The material in the spoil is predominantly calcareous till. The spoil is planted to trees, which produce cover in a few years. Strongly acid spoil, however, may require several years of leaching before trees can be grown successfully. The lakes are stocked with fish, and the areas around the lakes provide an excellent habitat for birds and other forms of wildlife. (Capability unit VIIe-1; woodland suitability group 16)

Taggart Series

The Taggart soils are deep, imperfectly drained, and nearly level. They have a grayish-brown surface layer and a gray, mottled subsoil. Their parent material is stratified silt, clay, and fine sand, in many places underlain by loose sand and gravel at a depth of 6 to 8 feet.

These soils are within the area of highly leached outwash. The areas where they form appear to have been the bottom of shallow lakes within the outwash area. The Taggart soils are associated with the well-drained Pike, Parke, and Negley soils. They are similar to the Whitaker soils in color and drainage, but they are more acid and are leached to a greater depth.

Representative profile of Taggart silt loam (SE¼ sec. 27, T. 11 N., R. 3 W.):

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.

A2—8 to 10 inches, gray (10YR 6/1) silt loam with common, medium, faint, light yellowish-brown (10YR 6/4) mottles; weak, medium, platy structure; friable; medium acid; clear, irregular boundary.

B21t—10 to 16 inches, gray (10YR 6/1) silty clay loam with common, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky and moderate, fine, angular blocky structure; firm; strongly acid; gradual, wavy boundary.

B22t—16 to 37 inches, gray (10YR 6/1) silty clay loam with many, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium and coarse, prismatic structure that breaks to weak, coarse, subangular blocky; firm; strongly acid; gradual, wavy boundary.

B23t—37 to 50 inches, gray (10YR 6/1) silty clay loam with common, medium, faint mottles of pale brown (10YR 6/3) to yellowish brown (10YR 5/3); massive; firm; strongly acid; clear, wavy boundary.

IIB3—50 to 67 inches, gray (10YR 6/1) stratified silty clay loam, and silt loam with few, medium, faint, pale-brown (10YR 6/3) mottles; massive; friable; strongly acid; abrupt, wavy boundary.

IIC—67 to 86 inches +, gray (10YR 6/1 and 10YR 5/1) stratified loamy sand, fine sandy loam, and minor amounts of sandy clay; single grain to massive; very friable to friable; slightly acid at a depth of 84 inches.

In most places the underlying material at a depth of 40 to 50 inches is silt, clay, and some sandy material. In some places, however, sandy loam is dominant, but there are minor layers of silt and clay. In one area where a deep gully has cut into the soil to a depth of 20 feet or more, the material from a depth of 4 to about 8 feet is sandy loam. It is strongly cemented with iron and has very coarse columnar structure.

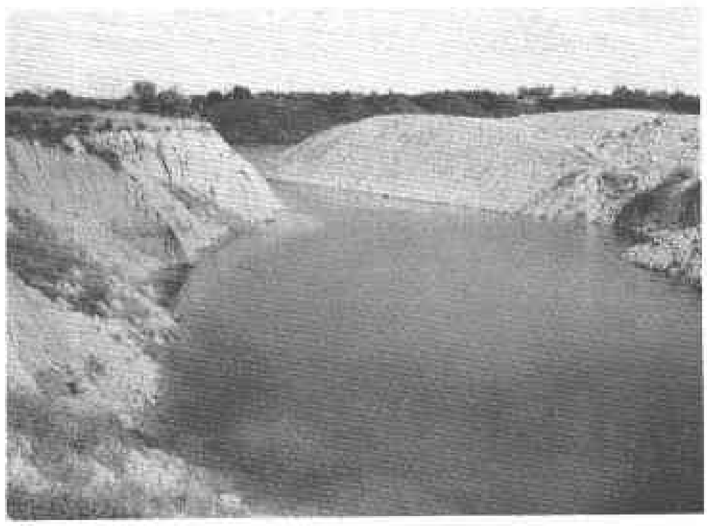

Figure 12.—**An abandoned strip mine pit partly filled with water. The spoil to the right has been leveled somewhat. The cut to the left shows Illinoian glacial till, which is leached of carbonates to a depth of about 12 feet.**

The Taggart soils are low in natural fertility and in content of organic matter. Unless they have been limed, they are strongly acid. Moisture-supplying capacity is high, permeability is low, and runoff is very slow. The depth to which roots penetrate depends mainly on how well the soil has been drained or how far the water table has been lowered.

Taggart silt loam (Ta).—This is the only Taggart soil mapped in the county. The main problem is excess water. Both tile and surface drains are needed in most places. If the soil is properly drained, the response to lime and fertilizer is good. This soil is suited to most of the crops commonly grown in the county, and it is moderately productive. Alfalfa, however, is not suitable, because of the seasonally high water table. (Capability unit IIw-2; woodland suitability group 5)

Tilsit Series

The Tilsit soils are moderately well drained, strongly acid, and gently rolling. Their surface layer is brown to dark brown, and their subsoil is yellowish brown with gray mottles and streaks in the lower part. These soils developed in 18 to 48 inches of leached silt over material weathered from sandstone, siltstone, and shale. They have a moderately compacted layer, or fragipan, at a depth of about 20 inches, and this layer extends to a depth of 40 inches or more.

The Tilsit soils are throughout the sandstone area and are closely associated with the imperfectly drained Johnsburg and the well-drained Zanesville soils. The associated soils formed in the same kind of parent material as the Tilsit soils.

Representative profile of Tilsit silt loam, 2 to 6 percent slopes (NE¼ sec. 16, T. 10 N., R. 4 W., on the north side of Highway 46, on a ridge):

Ap—0 to 7 inches, brown (10YR 5/3) silt loam; moderate, fine, granular structure; friable; numerous fine roots; strongly acid; abrupt, smooth boundary.

A2—7 to 9 inches, brown (10YR 5/3) silt loam; moderate, medium, platy structure; friable; very strongly acid; abrupt, smooth boundary.

B1—9 to 16 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, subangular blocky structure; friable; few fine roots; very strongly acid; clear, smooth boundary.

B21t—16 to 28 inches, yellowish-brown (10YR 5/6) light silty clay loam with many, medium, faint, light yellowish-brown (10YR 6/4) mottles and a few, prominent, red (2.5YR 5/8) mottles; moderate, medium, subangular blocky structure; firm; very few fine roots; very strongly acid; clear, wavy boundary.

B22x—28 to 43 inches, yellowish-brown (10YR 5/6) silt loam with gray silt streaks ¼ to 1 inch in diameter and 2 to 4 inches apart extending downward; weak; coarse and very coarse, prismatic structure that breaks readily to coarse, angular blocky structure; firm fragipan; few to no roots; extremely acid; clear, wavy boundary.

IIB3x—43 to 55 inches, light yellowish-brown (10YR 6/4) loam to gritty silt loam; moderate, coarse, prismatic structure; firm fragipan; gray (10YR 6/1) coating on cleavage planes; gray silt streaks ½ to 1 inch in diameter and 2 to 4 inches apart extend downward; thin clay flows are common on some cleavage surfaces; no roots; extremely acid; gradual, wavy boundary.

IIC—55 to 66 inches, brown (10YR 5/3) loam; massive; friable; many fine iron and manganese concretions; considerable amount of weathered shale and sandstone fragments are present in the lower part; extremely acid; gradual, wavy boundary.

R—66 inches +, consolidated sandstone and shale bedrock.

Depth to bedrock ranges from 45 to 70 inches or more, and depth to mottling ranges from 12 to 20 inches. In most places the silt cap is about 36 to 46 inches thick, but it ranges from about 18 to 48 inches in thickness. In some places there is a shallow layer of silt loam, probably loess, below the main B horizon. The degree of development of the fragipan ranges from weak to moderately strong.

The Tilsit soils are low in content of organic matter and in phosphate. A moderate amount of potash is available if the soil is properly managed. The fragipan restricts the penetration of roots and moisture to a moderate degree. Runoff is medium, and permeability is moderately slow. Erosion is a problem on sloping, cultivated fields. Unless they have been limed, these soils are strongly acid. To maintain good production, moderate to large applications of lime are needed every 5 to 8 years. The response to fertilizer is good.

Tilsit silt loam, 0 to 2 percent slopes (TsA).—This soil has a profile similar to the one described for the series. It is nearly level and is mottled at a depth of about 12 inches. Runoff is slow, and the soil is not subject to erosion. This soil is in small, inextensive areas and is generally not managed as a separate unit. In some places it is on narrow, nearly level ridges and is surrounded by well-drained soils. Included in the mapped areas of this soil are some small areas of Johnsburg soils. (Capability unit IIs-5; woodland suitability group 9)

Tilsit silt loam, 2 to 6 percent slopes (TsB).—The profile of this soil is described as representative of the series. In most places the slopes are between 3 and 4 percent. This soil is in large enough units that it is managed separately. It is subject to moderate erosion if it is cultivated. (Capability unit IIe-7; woodland suitability group 9)

Tilsit silt loam, 2 to 6 percent slopes, moderately eroded (TsB2).—This soil has a profile similar to the one described for the series. However, about half of the surface layer has been lost through erosion, and yellowish-brown subsoil has been mixed into the plow layer. In a few places the present surface layer is made up entirely of yellowish-brown material that was formerly subsoil. This soil is subject to further erosion if it is cultivated and not properly managed. Most of the acreage is used for cultivated crops. (Capability unit IIe-7; woodland suitability group 9)

Tilsit soils, 2 to 6 percent slopes, severely eroded (TtB3).—The profile of these soils is similar to the one described for the series, but most of the original surface layer has been lost through erosion; the present surface layer is mainly yellowish-brown light silty clay loam that was formerly subsoil. In about half of the acreage, the surface layer is made up entirely of yellowish-brown material that was formerly subsoil. The gray, mottled subsoil is 12 inches or less from the surface in most places. In most places the slopes are between 4 and 5 percent.

These soils are inextensive. They are generally in fields with other soils that are less susceptible to erosion and that have been cultivated intensively. If these soils are cultivated, special practices that control further erosion should be used. (Capability unit IIIe–7; woodland suitability group 9)

Tilsit silt loam, 6 to 12 percent slopes, moderately eroded (TsC2).—The profile of this soil is similar to the one described for the series, except that it is generally shallower over bedrock, or only about 50 inches deep. Also, the silty material, or loess cap, is only about 20 to 30 inches thick. About half of the original surface layer has been lost through erosion, and yellowish-brown material that was formerly subsoil is mixed with material from the original surface layer. In some places the present surface layer is made up entirely of material that was formerly subsoil. In most places the slopes are between 7 and 8 percent. A few small areas are only slightly eroded. Erosion is the major problem in managing this soil. (Capability unit IIIe–7; woodland suitability group 9)

Vigo Series

In the Vigo series are moderately deep, imperfectly drained, nearly level to gently sloping soils that have a somewhat impervious layer in the subsoil. The surface layer is dark grayish brown, and the subsoil is light brownish gray to gray and mottled. These soils were developed in 40 to 60 inches of loess over till. They are leached free of carbonates to a depth of 10 feet or more.

The Vigo soils are on broad flats in the southwestern and northern parts of the county, and they are in smaller, nearly level areas throughout the glaciated parts of the county. They are closely associated with the moderately well drained Ava and the well drained Cincinnati soils. The associated soils developed in the same kind of parent material as the Vigo soils.

Representative profile of Vigo silt loam, 0 to 2 percent slopes (SW¼SE¼ sec. 26, T. 10 N., R. 6 W.):

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

A21—8 to 17 inches, gray (10YR 5/1) silt loam with common, fine, distinct mottles of yellowish brown (10YR 5/8) and dark yellowish brown (10YR 4/4); strong, thin, platy structure in upper part and moderate to weak, thick, platy structure in lower part; friable; very strongly acid; clear, smooth boundary.

A22—17 to 23 inches, gray (10YR 6/1) silt loam with common, fine, distinct, yellowish-brown (10YR 5/6 and 5/8) mottles; weak, thick, platy structure in upper part and weak, medium, subangular blocky structure in lower part; friable; (this horizon caps the upper ends of the strongly developed prisms in the B2 horizons; when this horizon is dried in an exposed cut, it becomes nearly white); pellets and fragments of light silty clay loam from a relict B1 horizon are present in many places; very strongly acid; abrupt, irregular boundary.

B21t—23 to 30 inches, gray (10YR 6/1 to 5/1) silty clay loam with many, medium, distinct, yellowish-brown (10YR 5/8) mottles; strong, coarse, prismatic structure that breaks to moderate, medium and coarse, angular blocky; firm; gray silt coatings on peds; very strongly acid; gradual, smooth boundary.

B22t—30 to 42 inches, gray (10YR 6/1 to 5/1) silty clay loam with many, medium, distinct, yellowish-brown (10YR 5/8) mottles; strong, coarse (4 to 8 inches across), prismatic structure; massive inside the prisms; firm; gray silt coatings on prisms, and some crevices filled with thin to thick clay flows; very strongly acid; gradual, smooth boundary.

B31t—42 to 50 inches, light yellowish-brown (10YR 6/4) to yellowish-brown (10YR 5/6) silt loam to light silty clay loam with many, gray (10YR 6/1 and 5/1) streaks and clay flows extending downward; weak, coarse, prismatic structure to massive; friable; strongly acid; gradual, smooth boundary.

IIB32—50 to 144 inches, light yellowish-brown (10YR 6/4) loam till with many gray (10YR 6/1 and 5/1) silt streaks and clay flows; massive; friable; medium acid, becoming slightly acid to neutral in lower part.

IIC—144 inches +, pale-brown (10YR 6/3) loam till, calcareous.

The surface layer ranges from dark gray in wooded areas to dark grayish brown or dark brown in cultivated fields. The thickness of the A2 horizon ranges from 10 to 18 inches. In some places a weak B1 horizon has developed in the profile. The B2 horizon has a strongly developed prismatic structure. The coating of the prism faces in the B2 horizons ranges from silt to clay. The thickness of the clay films that extend into the B3 and C horizons ranges from 1 to 8 millimeters. Many krotovinas, generally crayfish burrows, that are filled with silt extend through the B2 horizon and into the underlying B3 and C horizons. The depth of loess over till ranges from 40 to 60 inches. In most places the profile is leached free of carbonates to a depth of 10 feet or more.

The Vigo soils are low in available phosphate, in potash, and in content of organic matter. Moisture-supplying capacity is good, and permeability is very slow. Roots penetrate to only a moderate depth because of the high water table and a somewhat impervious layer in the subsoil. Unless they have been limed, these soils are very strongly acid. If they are adequately drained, the response to lime and fertilizer is good.

Excessive water is the main problem in managing these soils. Drainage is necessary to maintain good yields of cultivated crops. Because the slopes are long and very gentle, surface drainage is feasible in many places. If they are properly designed and maintained, surface drains will provide good drainage. Smoothing may be necessary to obtain surface drainage in nearly level areas. In slightly depressed areas tile drains may be needed also.

These soils are suited to most of the crops grown in the county, and they are moderately productive. Alfalfa and other plants that have a deep rooting system are not well suited, because of the excessive water and the somewhat impervious subsoil.

Vigo silt loam, 0 to 2 percent slopes (VgA).—The profile of this soil is described as representative of the series. This soil is on broad flats and flat-topped ridges. Runoff is slow.

Included in the mapped areas of this soil are small areas of poorly drained soils in depressions. Also included are a few small areas of moderately well drained Ava soils.

This soil is mainly in cultivation. Excess water is the main problem in managing it, and some kind of drainage is generally necessary for successful production of crops. The broad flats of 20 to 40 acres or more can be managed separately, but the small areas are managed in the same way as the adjoining soils. (Capability unit IIIw–7; woodland suitability group 5)

Vigo silt loam, 2 to 6 percent slopes (VgB).—The profile of this soil is similar to the one described for the series. This soil is on short slopes at the upper ends of drainageways that extend into the Vigo flats. It is also on gently sloping breaks and on ridgetops. The slope is mainly 3 percent, but some areas are nearly level. Runoff is medium. Included in the mapped areas of this soil are some areas of moderately well drained Ava soils.

Most of the acreage is cultivated, but some small areas are in trees or permanent pasture. Erosion and drainage are the problems in managing this soil. The soil is generally in small areas that are managed the same way as the adjoining soils, but there are a few fields of 10 to 20 acres that are managed separately. (Capability unit IIIw–3; woodland suitability group 5)

Vigo silt loam, 2 to 6 percent slopes, moderately eroded (VgB2).—The profile of this soil is similar to the one described for the series, but the surface layer has a moderate amount of silty clay loam that was formerly subsoil mixed in it. In a few places the present surface layer is made up entirely of material that was formerly subsoil, and in places there are a few shallow gullies. This soil is on short slopes of the upper ends of drainageways that extend into the Vigo flats and on gently sloping breaks and ridgetops. The slope is mainly between 3 and 4 percent. Runoff is medium. Included in the mapped areas of this soil are some small areas of moderately well drained Ava soils.

This soil is mainly in cultivation. Erosion and excess water are the major problems in managing it. This soil is generally in small areas that are managed the same way as the adjoining soils, but an occasional field is large enough to be managed separately. (Capability unit IIIw–3; woodland suitability group 5)

Vincennes Series

In the Vincennes series are deep, poorly drained, dark-gray soils that have gray subsoil. These soils developed on stream terraces in stratified silt, clay, and fine sand. The parent material was mixed alluvium washed principally from areas of sandstone, siltstone, shale, Illinoian till, and Wisconsin drift.

The Vincennes soils occur in slight depressions in association with the imperfectly drained Bartle soils. The soils of both series developed from similar material.

Representative profile of Vincennes silt loam (SW¼SE¼SW¼ sec. 2, T. 10 N., R. 6 W.):

Ap—0 to 9 inches, dark-gray (10YR 4/1) silt loam; weak, medium, granular structure; friable; abundant roots; neutral; abrupt, smooth boundary.

B1g—9 to 15 inches, gray (10YR 5/1) silt loam with common, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; friable; few roots; neutral; clear, smooth boundary.

B21gt—15 to 28 inches, gray (10YR 5/1) light silty clay loam with many, medium, distinct, yellowish-brown (10YR 5/6) mottles and faint, gray (10YR 6/1) mottles; weak, medium and coarse, prismatic structure that breaks to weak, medium, subangular blocky; friable; medium acid; clear, wavy boundary.

B22gt—28 to 40 inches, gray (10YR 5/1) silty clay loam with many, coarse, distinct, yellowish-brown (10YR 5/6) mottles; massive; sticky; gray (10YR 6/1) clay flows; medium acid; clear, wavy boundary.

C—40 to 70 inches +, gray (N 6/0), stratified clay loam, silty clay loam, and loam; massive; sticky; medium acid becoming neutral at a depth of 70 inches.

These soils are fairly uniform, but there are minor differences in acidity and in the color of the layers. The surface layer ranges from 9 to 18 inches in thickness and from silt loam to silty clay loam in texture.

The Vincennes soils are low in available phosphate and potassium and medium in content of organic matter. They are slowly permeable and have high moisture-supplying capacity. Unless they have been limed, they are medium acid. If the soils are drained and limed, crops grown on them respond well to large applications of fertilizer. Applying large amounts of nitrogen to corn generally gives good results.

The chief problem in managing these soils is excess water; water tends to accumulate on the soils because they are lower than the surrounding soils. Drainage is, therefore, necessary to maintain good yields of cultivated crops. Tile drains and surface drains generally give good results.

These soils are suited to most of the crops grown in the county, and they are moderately productive. Shallow-rooted legumes, rather than alfalfa, are grown because of the excess water in the subsoil in spring.

Vincennes silt loam (Vn).—This is the only Vincennes soil mapped in the county. It occupies less than 200 acres and is mainly in an area about 5 miles west of Patricksburg, in the valley of the Eel River. (Capability unit IIw–2; woodland suitability group 11)

Wellston Series

In the Wellston series are moderately deep, well-drained, sloping to very steep soils whose slopes are generally smooth. The surface layer is dark grayish brown to yellowish brown, and the subsoil is dark brown to yellowish brown. The parent material is interbedded, noncalcareous sandstone, siltstone, and shale with a thin loess cap that is 24 inches or less thick. Bedrock is generally 24 to 36 inches from the surface.

These soils are associated with the excessively drained Muskingum, the well drained Zanesville, the moderately well drained Tilsit, and the imperfectly drained Johnsburg soils.

Representative profile of Wellston silt loam, 12 to 18 percent slopes (NE¼NE¼ sec. 27, T. 9 N., R. 4 W., where the slope is 16 percent and faces the southwest):

A0—½ inch to 0, leaf litter; slightly acid.

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) to dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2—2 to 9 inches, yellowish-brown (10YR 5/4) silt loam; weak, thin and medium, platy structure; friable; abundant roots; strongly acid; clear, wavy boundary.

B1t—9 to 14 inches, brown to dark-brown (7.5YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; firm; few roots; strongly acid; clear, wavy boundary.

B2t—14 to 28 inches, brown to dark-brown (7.5YR 4/4) silty clay loam; moderate, medium and coarse, subangular blocky structure with some moderate, medium, angular blocky structure; firm; strongly acid; clear, wavy boundary.

IIBC—28 to 35 inches, light brownish-gray (10YR 6/2) and grayish-brown (10YR 5/2) heavy silt loam to loam; moderate, coarse, subangular blocky structure; friable; variable colors and texture are due to the weathering of the shale and sandstone parent material; in places there are numerous sandstone fragments; strongly acid; clear, wavy boundary.

R—35 inches +, shale and sandstone bedrock.

The surface layer ranges from very dark grayish brown in forested areas to dark brown or yellowish brown in cultivated areas. The subsoil ranges from heavy silt loam to silty clay loam. The deeper profiles, or those that are about 36 inches deep over bedrock, generally have a finer textured subsoil in them than the shallow profiles that are about 24 inches deep. The horizon just above bedrock ranges from 4 to 10 inches in thickness, and the number of sandstone fragments varies. In some small areas shale lies directly below the profile. In those places the horizons just above the shale are generally finer textured than those in other places, but the texture depends on the kind of parent material.

The Wellston soils are low in content of organic matter and in phosphate, and they are medium in potash. Permeability is moderate, and moisture-supplying capacity is only fair. Runoff is medium to very rapid. Unless the soils have been limed, they are strongly acid. They are moderately productive if they are managed correctly and if medium to large amounts of fertilizer are applied. These soils erode very easily if they are cleared or cultivated.

Most of the acreage is in forest or pasture. Many areas that were once cultivated have been abandoned. In those areas sassafras and the sprouts of other trees are growing up as the first step in natural reforestation.

Wellston silt loam, 6 to 12 percent slopes (WmC).—This soil has a profile similar to the one described for the series, but the slopes are smooth and rolling. This soil is generally in areas that surround the gently sloping ridges of Tilsit and Zanesville soils. It is in forest or pasture. It has not been cultivated to any extent. Erosion is a major problem if the soil is cleared or cultivated. (Capability unit IVe–8; woodland suitability group 10)

Wellston silt loam, 6 to 12 percent slopes, moderately eroded (WmC2).—This soil has a profile similar to the one described for the series, but the slopes are smooth and rolling and moderate erosion has occurred. The present surface layer is a mixture of yellowish-brown material that was formerly subsoil, and of part of the original surface layer. In a few places all of the original surface layer was lost through erosion, and the present surface layer is made up entirely of material that was formerly subsoil. This soil is generally in cultivated fields or pasture with the deeper Zanesville soils. Erosion is the main problem in cultivated areas. (Capability unit IVe–8; woodland suitability group 10)

Wellston soils, 6 to 12 percent slopes, severely eroded (WnC3).—These soils have a profile similar to the one described for the series, but they are not so steep and they are severely eroded. The present surface layer is mostly yellowish-brown light silty clay loam mixed with a little of the original surface layer.

These soils are mainly cultivated or idle. They are more difficult to work than the uneroded soils, and a good seedbed is harder to prepare. Runoff is rapid, and erosion is a major problem in the cultivated areas. The best use of these soils is probably for permanent pasture or forest. (Capability unit VIe–1; woodland suitability group 10)

Wellston silt loam, 12 to 18 percent slopes (WmD).—The profile of this soil is described as representative of the series. This soil is mainly in uneroded, forested areas. Runoff is rapid, and the soil would erode easily if it were cleared and cultivated. It can be used for pasture, however, if practices that help control erosion are used properly. Included in the mapped areas of this soil are some small areas of deep Zanesville soils. (Capability unit VIe–1; woodland suitability group 10)

Wellston silt loam, 12 to 18 percent slopes, moderately eroded (WmD2).—The profile of this soil is similar to the one described as representative for the series, except that moderate erosion has taken place. The present surface layer is a mixture of yellowish-brown material that was formerly subsoil, and part of the original surface layer. In a few places all of the original surface layer was lost through erosion, and the present surface layer is made up entirely of material that was formerly subsoil.

Most of the acreage has been cleared and is cultivated or in pasture. Runoff is rapid, and the soil erodes easily if it is cultivated. The best use is probably for permanent pasture or forest. (Capability unit VIe–1; woodland suitability group 10)

Wellston soils, 12 to 18 percent slopes, severely eroded (WnD3).—The profile of these soils is similar to the one described for the series, except that these soils are severely eroded. The present surface layer is mainly yellowish-brown light silty clay loam mixed with a little of the original surface layer.

These soils are mainly cultivated or idle. They are more difficult to work than the uneroded soils, and a good seedbed is harder to prepare. Runoff is rapid, and erosion is a major problem in cultivated areas. The best use of these soils is probably for permanent pasture or forest. Renovation is necessary to improve the carrying capacity of most pastures. (Capability unit VIIe–1; woodland suitability group 10)

Wellston silt loam, 18 to 25 percent slopes (WmE).—This soil has a profile similar to the one described for the series, but it is moderately steep. In most places the profile is 24 to 30 inches deep over bedrock. The subsoil is heavy silt loam in many places, rather than silty clay loam like that in less steep areas. This soil is mainly in forest. Included in the mapped areas of this soil are small areas of Muskingum and Zanesville soils. (Capability unit VIe–1; woodland suitability group 10)

Wellston silt loam, 18 to 25 percent slopes, moderately eroded (WmE2).—The profile of this soil is similar to the one described for the series, except that moderate erosion has occurred since the forest was cleared. In most places the profile is 24 to 30 inches deep over bedrock. The subsoil is heavy silt loam in many places, rather than silty clay loam like that in less steep areas. Included in the mapped areas of this soil are small areas of Muskingum and Zanesville soils.

Most of this soil has been cleared and is now in permanent pasture or is idle. Permanent pasture or forest are the best uses. (Capability unit VIe–1; woodland suitability group 10)

Wellston soils, 18 to 25 percent slopes, severely eroded (WnE3).—These soils have a profile similar to that of Wellston silt loam, 18 to 25 percent slopes, except that they have been severely eroded. The present surface layer is mainly yellowish-brown heavy silt loam mixed with a little of the original surface layer. The subsoil is heavy silt loam, rather than silty clay loam like that in less steep areas.

These soils are minor in extent and are mainly in pasture or are idle. They are probably best suited to pasture or trees. (Capability unit VIIe–1; woodland suitability group 10)

Wellston and Muskingum soils, 25 to 35 percent slopes (WoF).—This undifferentiated mapping unit consists of about 60 percent Wellston soils and 40 percent Muskingum soils. The soils in many areas are so intricately mixed that it is difficult to map them separately. These soils are generally in forested areas where there are thick beds of shale, interspersed with outcrops of harder sandstone. Some areas are very steep, and some are moderately steep. These soils are probably best suited to trees. (Capability unit VIIe–1; woodland suitability group 10)

Wellston and Muskingum soils, 25 to 35 percent slopes, moderately eroded (WoF2).—This undifferentiated mapping unit consists of about 60 percent Wellston soils and 40 percent Muskingum soils. These soils occupy only a few acres in the county. They are mainly in forested areas that have been trampled by livestock or in small areas that have been cleared and are used for pasture. These soils are probably best suited to trees. (Capability unit VIIe–1; woodland suitability group 10)

Wellston and Muskingum soils, 35 to 70 percent slopes (WoG).—This undifferentiated mapping unit consists of about 60 percent Wellston soils and 40 percent Muskingum soils. The soils in many areas are so intricately mixed that it is difficult to map them separately. There are some steep and moderately steep areas. These soils are in large areas of forest, which is probably the best use for them. (Capability unit VIIe–1; woodland suitability group 12)

Whitaker Series

The Whitaker soils are deep, nearly level, and imperfectly drained. Their surface layer is grayish brown, and their subsoil is gray and mottled. These soils developed in stratified silt and fine sand and are underlain by calcareous silt and sand at a depth of about 60 inches.

The Whitaker soils are on low-lying benches or terraces along the West Fork of the White River. In most places these low terraces are less than 5 feet above the adjoining stream bottoms. These soils are associated with the well-drained Martinsville soils, and in some places they are associated with the well-drained Ockley soils.

(Representative profile of Whitaker silt loam (NE. corner sec. 28, T. 11 N., R. 2 W.):

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A2—8 to 10 inches, light brownish-gray (10YR 6/2) silt loam with many, coarse, distinct, yellowish-brown (10YR 5/4) mottles and faint, gray (10YR 6/1) mottles; weak, medium and thick, platy structure; friable; medium acid; clear, smooth boundary.

B1—10 to 15 inches, light brownish-gray (10YR 6/2) heavy silt loam with many, medium, faint, gray (10YR 6/1) mottles and distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—15 to 40 inches, light brownish-gray (10YR 6/2) silty clay loam with many, medium, faint, gray (10YR 6/1) mottles and distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium and coarse, subangular blocky structure; firm; few, fine, rounded pebbles are present; medium acid; clear, smooth boundary.

B22t—40 to 60 inches, light yellowish-brown (10YR 6/4) silty clay loam to light clay loam with many, medium, distinct mottles of gray (10YR 6/1) and yellowish brown (10YR 5/6); moderate, coarse, subangular blocky structure; firm; medium acid in the upper part, grading to neutral in the lower part; gradual, wavy boundary.

IIC—60 to 80 inches +, light yellowish-brown (10YR 6/4) and gray (10YR 6/1), stratified, calcareous silt and fine sand with small quantities of gravel and clay.

Depth to calcareous material ranges from 42 to 60 inches or more. There is considerable variation in the stratified material in the C horizon. In some areas the layers are predominantly silt, but in other areas they are mainly fine sand. In some places near the Ockley soils, there is more fine gravel in the underlying material than in places near the Martinsville soils.

The Whitaker soils are low in natural fertility. Moisture-supplying capacity is high, and permeability is slow. Because the soils are nearly level, there is very little runoff. The penetration of roots is only moderately deep because of the high water table and excess water.

The original vegetation was a mixed forest, mainly of beech and maple, but also of other kinds of trees that tolerate water. Most of the areas have been cleared, artificially drained, and cultivated.

Whitaker silt loam (Wt).—This is the only Whitaker soil mapped in the county. Included in the mapping are sizable areas where the surface layer is loam. In the areas of loam, the profile is generally a little coarser in texture than in the areas of silt loam.

The main problem in managing Whitaker silt loam is excess water. Tile and surface drains are used to provide drainage. If this soil is properly drained and limed, the response to large applications of fertilizer is good. Corn responds especially well if nitrogen is applied to the soil. This soil is suited to most of the crops grown in the county, and it is moderately productive. Alfalfa is not well suited, however, because of a high water table in spring. (Capability unit IIw–2; woodland suitability group 5)

Zanesville Series

In the Zanesville series are moderately deep and deep, well-drained, gently sloping to moderately steep soils. The surface layer is dark grayish brown, and the subsoil is yellowish brown. The parent material is 18 to 48 inches of silt over material weathered from stratified sandstone, siltstone, and shale. In most places bedrock is about 60 inches from the surface (fig. 13).

The Zanesville soils are closely associated with the imperfectly drained Johnsburg, the moderately well drained Tilsit, and the well drained Wellston and Muskingum soils. The associated soils formed in the same kind of material as the Zanesville soils.

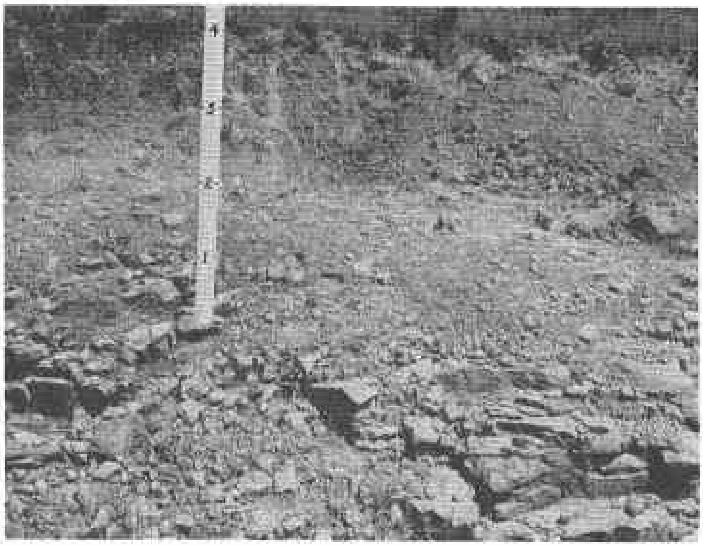

Figure 13.—**A typical profile of a Zanesville soil underlain by bedrock of sandstone and shale.**

Representative profile of Zanesville silt loam, 2 to 6 percent slopes (NE. corner NW¼ sec. 6, T. 10 N., R. 4 W., in a road cut on the south side of Highway 46):

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam; weak, very fine, granular structure; friable; strongly acid; abrupt, smooth boundary.

A21—2 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, very thin and thin, platy structure; friable; very strongly acid; abrupt, smooth boundary.

A22—7 to 12 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, platy structure; friable; roots abundant; very strongly acid; clear, smooth boundary.

B1—12 to 17 inches, dark yellowish-brown (10YR 4/4) to yellowish-brown (10YR 5/4) silt loam; moderate, medium, subangular blocky structure; firm; plentiful roots; very strongly acid; clear, smooth boundary.

B21t—17 to 22 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate, medium, subangular blocky structure, plentiful roots; very strongly acid; firm; clear, smooth boundary.

B22x—22 to 26 inches, pale-brown (10YR 6/3) to light yellowish brown (10YR 6/4) heavy silt loam with light brownish-gray (10YR 6/2) coatings; moderate, medium, prismatic structure that breaks to moderate, medium, subangular blocky; weak fragipan; firm; very few roots; very strongly acid; clear, smooth boundary.

B23x—26 to 34 inches, yellowish-brown (10YR 5/8) silty clay loam with many, coarse, distinct, light brownish-gray (10YR 6/2) mottles; moderately developed, medium and coarse, columnar structure that breaks to moderate, medium, subangular blocky; fragipan; firm; very strongly acid; gray (10YR 6/1) silt coatings; clear, smooth boundary.

IIB31x—34 to 52 inches, dark-brown (10YR 4/3) silt loam with many, medium, distinct, grayish-brown (10YR 5/2) mottles; weak, coarse, columnar structure to massive; firm; very strongly acid; clear, irregular boundary.

IIB32x—52 to 62 inches, yellowish-brown (10YR 5/8) loam to gritty silt loam with common, medium, distinct, gray (10YR 6/1) mottles; weak, coarse, prismatic structure to massive; friable; very strongly acid; clear, irregular boundary.

IIC—62 to 66 inches, yellowish-brown (10YR 5/6) sandy loam with common, medium, distinct, grayish-brown (10YR 5/2) mottles; massive: weathered shale and sandstone with numerous sandstone fragments; very strongly acid.

R—66 inches +, consolidated sandstone and shale.

Depth to bedrock ranges from about 40 inches to 8 feet or more. The gently sloping areas have thicker horizons than the steeper areas. The degree of fragipan development is moderate to moderately strong. The thickness of the loess cap ranges from about 18 inches in the steeper soils to 48 inches or more in the gently sloping soils. The B2 horizon ranges from heavy silt loam to light silty clay loam.

The Zanesville soils are medium in potash and low in content of organic matter and in phosphate. The moisture-supplying capacity is limited somewhat by the fragipan, which not only restricts percolation of water, but also restricts the penetration of roots. Unless these soils have been limed, they are strongly acid. Moderate amounts of lime need to be applied every 5 to 8 years to maintain good production. These soils are moderately productive if they are managed correctly and fertilized properly. A large acreage that was once cultivated has been severely eroded and is now idle.

Zanesville silt loam, 2 to 6 percent slopes (ZaB).—The profile of this soil is described as representative of the series. Much of this soil is on long, narrow ridges that extend into the steeper areas that are in trees or pasture and have not been cultivated. The acreage that is cultivated is small and is generally farmed in the same way as the adjoining soils. (Capability unit IIe-7; woodland suitability group 9)

Zanesville silt loam, 2 to 6 percent slopes, moderately eroded (ZaB2).—The profile of this soil is similar to the one described for the series, except that the present surface layer consists of a moderate amount of yellowish-brown material that was formerly subsoil, mixed with the original surface layer. In some places the surface layer is made up entirely of material that was formerly subsoil. Included in the mapped areas of this soil are a few areas where bedrock is only 40 inches from the surface.

This soil is generally on broad ridges, surrounded by steeper areas. All of the acreage has been cleared, and most of it is cultivated. (Capability unit IIe-7; woodland suitability group 9)

Zanesville soils, 2 to 6 percent slopes, severely eroded (ZnB3).—The profile of these soils is similar to the one described for the series, but most of the original surface layer was lost through erosion. The present surface layer is mainly yellowish-brown light silty clay loam that was formerly subsoil. In most places the slope is between 4 and 6 percent. Erosion is the major problem in cultivating these soils. A few areas of severely eroded, gently sloping Wellston soils are included in the mapped areas of these soils. (Capability unit IIIe-7; woodland suitability group 9)

Zanesville silt loam, 6 to 12 percent slopes (ZaC).—The profile of this soil is similar to the one described for the series, except that the cap of silty material is generally 30 to 40 inches thick. Most of this soil is in small areas of 10 acres or less and is in forest or pasture. In most places this soil is surrounded by steep Wellston and Muskingum soils, which are not suited to cultivated crops. (Capability unit IIIe-7; woodland suitability group 9)

Zanesville silt loam, 6 to 12 percent slopes, moderately eroded (ZaC2).—The profile of this soil is similar to the one described for the series, except that the silty material is generally 30 to 40 inches thick, and moderate erosion has taken place. The present surface layer consists of a mixture of yellowish-brown material that was formerly subsoil, and of part of the original surface layer. In a few places the surface layer is made up entirely of material that was formerly subsoil.

Most of the acreage is cultivated or in pasture. Practices that help control erosion should be used in cultivated areas. (Capability unit IIIe-7; woodland suitability group 9)

Zanesville soils, 6 to 12 percent slopes, severely eroded (ZnC3).—The profile of these soils is similar to the one described for the series, except that the surface layer is predominantly yellowish-brown heavy silt loam to silty clay loam mixed with part of the original surface layer. In as much as half of the acreage, the surface layer is made up entirely of yellowish-brown material that was formerly subsoil. Gray, silty streaks and some mottles are 20 inches below the surface.

Much of the acreage is cultivated, but some areas are idle or in pasture. These soils are best suited to permanent vegetation. If they are cultivated, practices that help control erosion should be used. Grasses and legumes grow well if the soils are treated properly. (Capability unit IVe-7; woodland suitability group 9)

Zanesville silt loam, 12 to 18 percent slopes (ZaD).—The profile of this soil is similar to the one described for the series, but all the horizons are somewhat thinner. The silty material is generally about 30 inches thick, and depth to bedrock is 40 to 50 inches. Fragipan development is moderate. In a few areas there are sinkholes.

Most of the acreage is in forest or pasture with steeper areas of Wellston and Muskingum soils. Erosion is the major hazard, and if the soil is cultivated, major precautions should be taken to help control erosion. Grasses and legumes grow well if the soil is properly treated. (Capability unit IVe-7; woodland suitability group 9)

Zanesville silt loam, 12 to 18 percent slopes, moderately eroded (ZaD2).—The profile of this soil is similar to the one described for the series, but all the horizons are somewhat thinner. The present surface layer consists of a mixture of yellowish-brown material that was formerly subsoil and of material from the original surface layer. In a few places the surface layer is made up entirely of material that was formerly subsoil. The silty material is generally about 30 inches thick, and depth to bedrock is 40 to 50 inches. Fragipan development is moderate.

Most of the acreage is cultivated or in pasture of poor quality. If the soil is cultivated, major precautions should be taken to help control erosion. Grasses and legumes grow well if the soil is properly treated. (Capability unit IVe-7; woodland suitability group 9)

Zanesville soils, 12 to 18 percent slopes, severely eroded (ZnD3).—The profile of these soils is similar to the one described as representative of the series, but all the horizons are thinner. In addition, most of the original surface layer has been lost through erosion. The present surface layer consists mainly of yellowish-brown heavy silt loam to silty clay loam that was formerly subsoil, and of part of the original surface layer. The loess is only about 20 inches thick, and depth to bedrock is 40 to 50 inches. Fragipan development is moderate.

About half of the acreage is cultivated, and the rest is idle or in pasture of poor quality. The best use is probably for permanent vegetation. Moderately good pastures are obtained under proper management. (Capability unit VIe-1; woodland suitability group 9)

Zanesville silt loam, 18 to 25 percent slopes (ZaE).—The profile of this soil differs from that of Zanesville silt loam, 2 to 6 percent slopes, in having thinner horizons, a loess cap only about 18 inches thick, and a weak fragipan. Depth to bedrock is generally about 40 inches. In a few areas there are sinkholes. This soil is surrounded by steeper areas of Wellston and Muskingum soils. It is also adjacent to the ridges of gently sloping to moderately steep areas.

This soil is mainly in trees, but a small acreage is idle or in permanent pasture. If the soil is cleared and cultivated, the hazard of erosion is severe. The best use is probably for permanent pasture or trees. Moderately good pastures are produced under proper management. (Capability unit VIe-1; woodland suitability group 9)

Zanesville silt loam, 18 to 25 percent slopes, moderately eroded (ZaE2).—The profile of this soil differs from that of Zanesville silt loam, 2 to 6 percent slopes, in having thinner horizons, a loess cap only about 18 inches thick, and a weak fragipan. The uppermost 6 to 8 inches consists of a mixture of material from the original surface layer and of yellowish-brown material that was formerly subsoil. In a few places the surface layer is made up entirely of material that was formerly subsoil. A few small areas are severely eroded.

Most of the acreage has been cleared and is now idle or in permanent pasture. The soil is best suited to permanent pasture or forest. Moderately good pastures can be produced under proper management. (Capability unit VIe-1; woodland suitability group 9)

Zipp Series

The Zipp series consists of deep, very poorly drained soils that are in nearly level areas or in slight depressions. The surface layer is very dark grayish brown, and the subsoil is gray to dark gray. The parent material is slackwater calcareous clay and silty clay with thin layers of silt and fine sand. The Zipp soils developed under a mixed deciduous swamp forest and marsh grasses.

These soils are mainly along the Eel River in the southwestern part of the county, where they are associated with the soils of first bottoms that formed in alluvium. The Zipp soils are closely associated with the well-drained Markland, the imperfectly drained McGary, and the very poorly drained, dark-colored Montgomery soils. The associated soils formed in the same kind of material as the Zipp soils.

Representative profile of Zipp silty clay loam (SE¼ SW¼ sec. 25, T. 9 N., R. 6 W., 1 mile west of Hubbell):

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silty clay loam; cloddy and massive; firm; neutral; abrupt, smooth boundary.

B1g—9 to 15 inches, dark-gray (5YR 4/1) silty clay loam with common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, medium, prismatic structure that breaks to moderate, coarse, angular blocky; firm; neutral; clear, wavy boundary.

B2g—15 to 36 inches, gray (5Y 5/1) silty clay with common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, coarse, angular blocky structure; firm; very thin clay films and few concretions; neutral; clear, wavy boundary.

C1—36 to 68 inches, gray (N 5/0), stratified silty clay and silt with many, medium, prominent, dark-brown (10YR 4/3) mottles; massive; firm; neutral.

C2—68 inches +, dark gray (N 4/0) to very dark gray (5Y 3/1) silty clay with common, fine, faint, dark-brown (10YR 4/3) mottles; massive; firm; neutral.

The surface layer ranges from very dark gray to black and from light silty clay loam to heavy silty clay loam. Its thickness ranges from 6 to 12 inches. The lighter textured surface layer is in areas that are flooded occasionally and where alluvium was deposited recently and mixed into the surface layer by plowing. These areas are also lighter colored than others. The surface layer is slightly acid or neutral. In some places there are layers predominantly of sand and silt in the underlying material below a depth of 60 inches.

The Zipp soils are medium in natural fertility; they do not require lime. Permeability is very slow, and moisture-supplying capacity is good. Roots penetrate to only a moderate depth because of excess water and the clayey texture of the subsoil.

Zipp silty clay loam (Zp).—This is the only Zipp soil mapped in the county. Water tends to accumulate on this soil, and therefore wetness is the major problem in managing it. The soil is difficult to work. It becomes cloddy if it is plowed when it is too wet or too dry, and as a result, a seedbed is difficult to prepare. Tile are not reliable for drainage. Shallow surface drains and ditches are probably the best system.

This soil is used mainly for corn, soybeans, and meadow crops. It is only moderately productive. Small grains are not generally grown, because of the flooding early in spring. Alfalfa is not well suited, because of the high water table in spring. (Capability unit IIIw-2; woodland suitability group 11)

Soil Formation and Classification

This section is intended for soil scientists and others interested in the nature and origin of the soils in Owen County. The first part discusses the five major factors of soil formation and their degree of importance in the formation of the soils in the county. The second part points out soil-forming processes that were influential in the development of the soils. Finally, the classification of the soils in the county is discussed.

Factors of Soil Formation

The factors of soil formation are climate, plant and animal life, parent material, relief, and time. The nature of any soil depends upon the combination of these five major factors. All five of these factors come into play in the formation of every soil, but the relative importance of each differs from place to place.

In extreme cases one factor may dominate the formation of the soil and fix most of its properties, as is common if the parent material consists chiefly of pure quartz sand. Little can happen to quartz sand, and the soils derived from it generally have faint horizons. Even in quartz sand, a distinct profile can be formed under certain types of vegetation, where the topography is low and flat and a high water table is present.

Climate

The climate is midcontinental, and great contrasts in temperature occur. The average daily maximum temperature is 88.5° F. in July, and the average daily minimum temperature is 22.1° F. in January.

Rainfall is moderately heavy; it averages 44.13 inches annually. It is well distributed throughout the year, but is slightly greater in spring and summer than in fall and winter. The large amount of rainfall has leached plant nutrients from the surface layer and has kept free calcium carbonate from accumulating.

The climate is so nearly uniform throughout Owen County that differences among the soils cannot be explained on the basis of differences in climate alone. Climatic forces act upon rocks to form the parent material from which soils are formed, but many of the more important soil characteristics would not develop except for the activity of plant and animal life. Without the changes brought about by the presence of plants and animals, the soils would consist merely of residual or transported material derived from weathered rock, though some might have definite layers formed by additions of alluvial or colluvial material by differential weathering or leaching.

Climate, acting alone on the parent material, would be largely destructive. It would cause the soluble material to be washed out of the soils. When combined with the activities of plants and animals, however, the processes of climate become constructive. A reversible cycle is established between the intake and outgo of plant nutrients. Plants draw nutrients from the lower part of the soil profile. When the plants die, the surface soil is renewed by the plant nutrients that are returned to the upper part of the soil. In this county the climate is such that plant nutrients are leached out faster than they are replaced. For this reason, most of the soils are strongly weathered, leached, acid, and low in fertility.

Plant and animal life

Before this county was settled, the native vegetation was most important in the complex of living organisms that affect soil development. Plants, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to its morphology. Bacteria and fungi are micro-organisms that affect the soils. They cause raw plant waste to decompose into organic matter and to be incorporated into the soil. The higher forms of plants return organic matter to the soil and bring moisture and plant nutrients from the lower part of the profile to the upper part.

The native vegetation in this county is largely hardwood trees. The most common species are tulip-poplar, oak, hickory, elm, maple, and ash. A comparatively small amount of organic matter from the forest becomes incorporated in the soils while they are forming. In forested areas of uplands that have never been cleared, thin layers of forest litter and leaf mold cover the soils. A small amount of organic matter from decayed leaves and twigs is mixed throughout the topmost 1 or 2 inches of the surface soil.

In minor areas of Montgomery and Zipp soils, the native vegetation included swamp grasses and sedges as well as water-tolerant trees. These soils were covered with water much of the time, and, as the organic material fell into the water, it decayed slowly and some of it accumulated.

The vegetation is fairly uniform throughout the county. Major differences in the soils, therefore, cannot be explained on the basis of differences in vegetation. Though some comparatively minor variations in the vegetation are associated with different soils, these variations are probably chiefly the result, and not the cause, of the differences in soils.

Parent material

The parent material from which the soils of this county developed consists of glacial till and outwash of Illinoian age; glacial outwash of Wisconsin age; lacustrine deposits, or lakebed material, of Illinoian and Wisconsin ages; loess; and residuum from limestone, sandstone, and shale.

Figure 14 shows the major rock formations that outcrop or are near the surface, alluvial deposits, valley outwash, lake deposits, unglaciated areas, and lakes.

Before the Illinoian glaciers arrived, this area was cut by streams. A major part of the county was invaded by glacial ice from the north. The preglacial topography still determines the most important features of the present land surface. Ice erosion acting on this landscape rounded the existing hills, deepened the valleys, and steepened the valley walls.

As the ice receded from the uplands, a mantle of mixed stones, sand, silt, and clay, known as glacial till, was left over the bedrock. The melting ice produced a large volume of water, which carried large amounts of sand and gravel. Sand and gravel were deposited in stratified layers called glacial outwash. Both the till and the outwash are called glacial drift.

The till on the ridges and slopes ranges from a few inches to 15 feet or more in depth. In contrast the till in the valleys is 50 feet or more deep. Stratified deposits of outwash left by glacial streams also occur in preglacial valleys. Good examples of valleys filled with outwash are north and east of Spencer and extend toward Gosport, but sizable areas also occur near Cataract Lake. In parts of the county where glacial ice carried the debris only short distances, the mantle of till is thin and came mostly from the underlying rock. The deeper areas of drift consist of material that was carried mainly from hundreds of miles to the north.

When the ice receded, lakes were formed in many of the valleys that were blocked by glacial drift or rock divides. In these temporary glacial lakes, for example the Lake Quincy area in the northeastern part of the county and the Flat Woods area southeast of Spencer, sand and silt were first deposited by fairly fast-moving water that came from the melting ice. As the ice receded and the water backed in slowly, only the finer material of clay and silt size was carried into these lakes to settle out.

In unglaciated areas (fig. 15), predominantly in the southeastern part of the county and in an area around Arney and extending north toward Jordan, the soils developed in material weathered from the underlying rock.

Outwash and lacustrine soils in the valley of the West Fork of the White River formed in material deposited by drift of Wisconsin age. This material was carried down the existing valley by melt water.

Sometime after the Illinoian glacial period, loess (consisting of silt) was deposited over the entire area. This mantle of loess, which ranged from a few inches to 5 feet or more in thickness, has contributed much toward the profiles of soils now in the county. Most of the silt was washed away in the steeper areas, but in nearly level to sloping areas, it remained and is a part of the soil profiles.

It is believed that a considerable amount of time elapsed after the Illinoian glacial period before the silt was deposited to any extent. This is thought to be true because many buried profiles have been identified at the point of contact between the mantle of silt and the drift.

A coarser textured (sand and silt) deposit on the uplands adjacent to the West Fork of the White River was blown up out of the valley of the White River. This material is of Wisconsin glacial age and was first deposited in the valley by glacial melt water. It ranges from a few feet to 20 feet or more in thickness. The Princeton and Bloomfield soils developed in this material.

Relief

The relief of this county ranges from nearly level on the bottom lands, terraces, and upland flats to very steep on the breaks. Most of the county has been dissected greatly by weathering and by streams. The lowest point in the county is 500 feet above sea level, where Eel River leaves the county just south of Hubbell. The highest point is 925 feet above sea level and is southeast of Cataract, in section 12, R. 4 W., T. 11 N. The elevation of the flats in the old Lake Quincy area in the northeastern part of the county is 800 feet. The elevation of the Flat Woods area is 740 feet.

The variations in relief have affected the drainage and development of the soils in the county. The influence of relief upon soil formation comes from its controlling effect upon drainage, runoff, and other water effects, including normal and accelerated erosion.

In this county differences in relief have radically affected moisture and air conditions within the soils. The profiles of soils developed in the same type of parent material in steep areas are less strongly developed than those in nearly level to sloping areas. This difference in soil development is caused by (1) rapid normal erosion, (2) reduced percolation of water through the soil material, and (3) lack of water in the soil for the vigorous growth of plants that influence soil formation. The degree of profile development 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.

Because of the variation of relief in this county, several different soils have developed from the same kind of parent material. The topographic relationships of selected soil types are illustrated in figures 16 and 17.

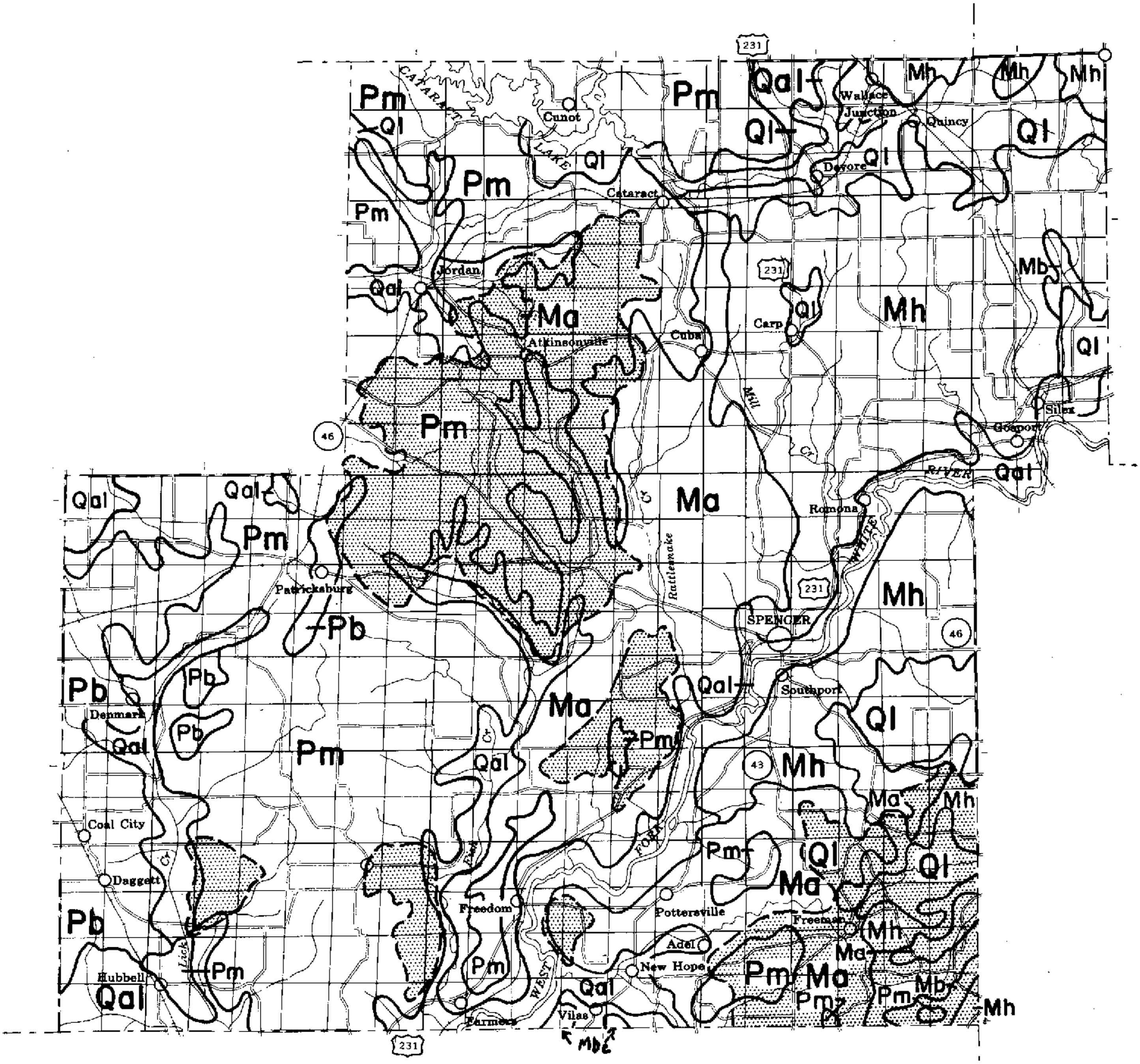

Figure 14.—Geologic map of Owen County.

Qal Alluvial and valley deposits: Silt and clay with some sand and gravel overlain by a veneer of alluvial deposits.

Ql Lake deposits: Silt and clay, underlain by some sand and gravel.

Pb Brazil formation: Clay, coal, shale, and limestone.

Pm Mansfield formation: Sandstone quartz conglomerate, shale, and some limestone, clay, and coal.

Mbc Big Clifty formation: Sandstone.

Ma Aux Vases through Beech Creek formations: Limestone, shale, and sandstone.

Mh Harrodsburg, Salem, St. Louis, and Ste. Genevieve formations: Limestone and some shale.

Mb Borden group: Sandstone, siltstone, and shale.

Broken lines enclose areas little affected by glaciation.

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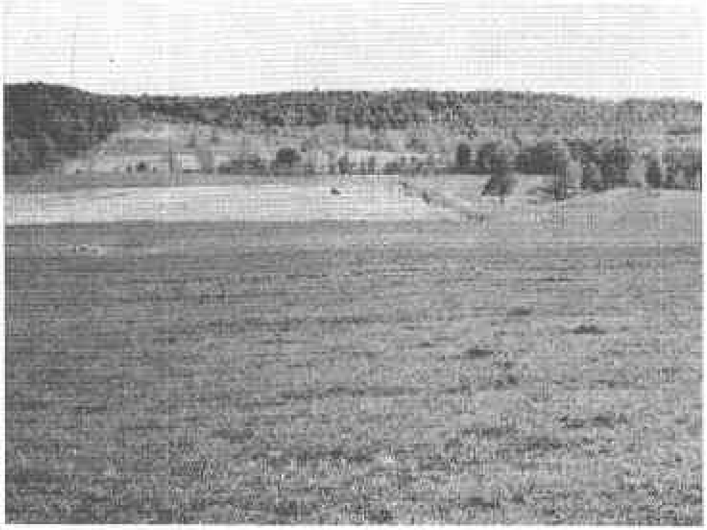

Figure 15.—**Landscape of an unglaciated area that extends across the bottom lands of a creek. In the foreground are the Otwell and Dubois soils of lakebeds. The cleared areas of pasture below the forest are Bewleyville soils, which developed in silt and material weathered from cherty limestone. The forested areas in the background are soils formed in material weathered from sandstone and shale.**

A good example of the way relief has affected soils that developed in the same kind of parent material is the Cincinnati catena of soils formed in loess-capped till. The Vigo soils are nearly level and are imperfectly drained. They are gray and mottled and are very slow in permeability. The Ava soils are gently sloping and are moderately well drained. They are yellowish brown with some mottling in the subsoil, and they are moderately slow in permeability. The Cincinnati soils are sloping to strongly sloping and are well drained, brown to dark brown, and moderate in permeability. The Hickory soils, which are very steep, have a less strongly developed profile than the sloping to strongly sloping soils.

Time

Generally, the longer the parent material has remained in place, the more fully developed the soil profile is. Because of differences in parent material, relief, and climate, some soils mature more slowly than others. For example, soils formed in alluvium or colluvium are immature, because the parent material is young and new material is deposited periodically. Steep soils are also likely to be immature, because geological erosion removes the soil material as fast as it accumulates. Also, runoff is greater on steep soils and less water percolates down through the soil material. Some kinds of parent rock are so resistant to weathering that soil development is very slow, even though other conditions are favorable. A mature soil is one that has well-developed A and B horizons that were produced by the natural processes of soil formation. A young soil has little or no horizon differentiation.

In Owen County the oldest soils have developed in material weathered from residual limestone, sandstone, shale, and siltstone. Many of these soils are not so deep as those developed in Illinoian glacial drift, because natural erosion is rapid and has not allowed the soil material to accumulate to a great depth. The soils that developed in glacial drift and old lacustrine material of Illinoian age (about 300,000 years ago) have a well-developed profile and are considered to be mature or nearly mature. The material in which the terrace and lacustrine soils, for example the soils of the Ockley, Martinsville, Whitaker, McGary, Montgomery, and Nineveh series, developed are deposits of the Wisconsin age drift. These deposits were laid down 20,000 to 30,000 years ago. The terrace and lacustrine soils are along the West Fork of the White River. These soils are less thoroughly or deeply leached than those developed in Illinoian drift, and they have a less strongly developed profile.

The young soils of the Corydon and Muskingum series, which are shallow and generally steep, formed in residuum. They are in areas where natural erosion is nearly as rapid as soil formation. The other young soils are those of the bottom lands, where new material is deposited periodically.

Sandy, windblown material, generally in the uplands adjacent to the West Fork of the White River, was deposited during or after the time of the Wisconsin glacial period. Soils developed in this material are less thoroughly or deeply leached than those developed in Illinoian drift. They have an immature profile.

Processes of Soil Formation

Podzolization.—Most of the soils in this county were developed through the process known as podzolization. They developed under deciduous forest in a moist, temperate climate.

While the process of podzolization is taking place, silicate clays move from an upper to a lower layer. The layer immediately below the shallow, organic surface layer becomes leached and lighter colored than the rest of the profile. The clay is carried in suspension by percolating waters until it is deposited as films along channels or on the faces of the structural aggregates of the B horizon. The organic acids formed in the decomposition of the organic matter in the surface layer move down through the soil and remove manganese, iron, and other soluble minerals. This action produces the lighter colored, leached layer known as the A2 horizon or layer of eluviation. The minerals and the clay are deposited in the B horizon by the movement of water downward.

The soils that developed through the process of podzolization are classified as Gray-Brown Podzolic soils, Planosols, and Red-Yellow Podzolic soils. Characteristics of soils in these great soil groups are discussed under the classification of soils.

Gleization.—Gleization is a process that takes place where the parent material is nearly impervious to water or is located in such a way that water continually stands at or slightly below the surface of the soil.

An abundance of water encourages the luxuriant growth of plants. The organic matter from the plants decays slowly because it is moist or wet. The plant remains are deposited faster than they decay, so that a large amount of organic matter builds up.

Alternating wet and moist conditions prevail, and organic matter is present. Consequently, iron compounds are reduced to soluble forms and the solubility of calcium,

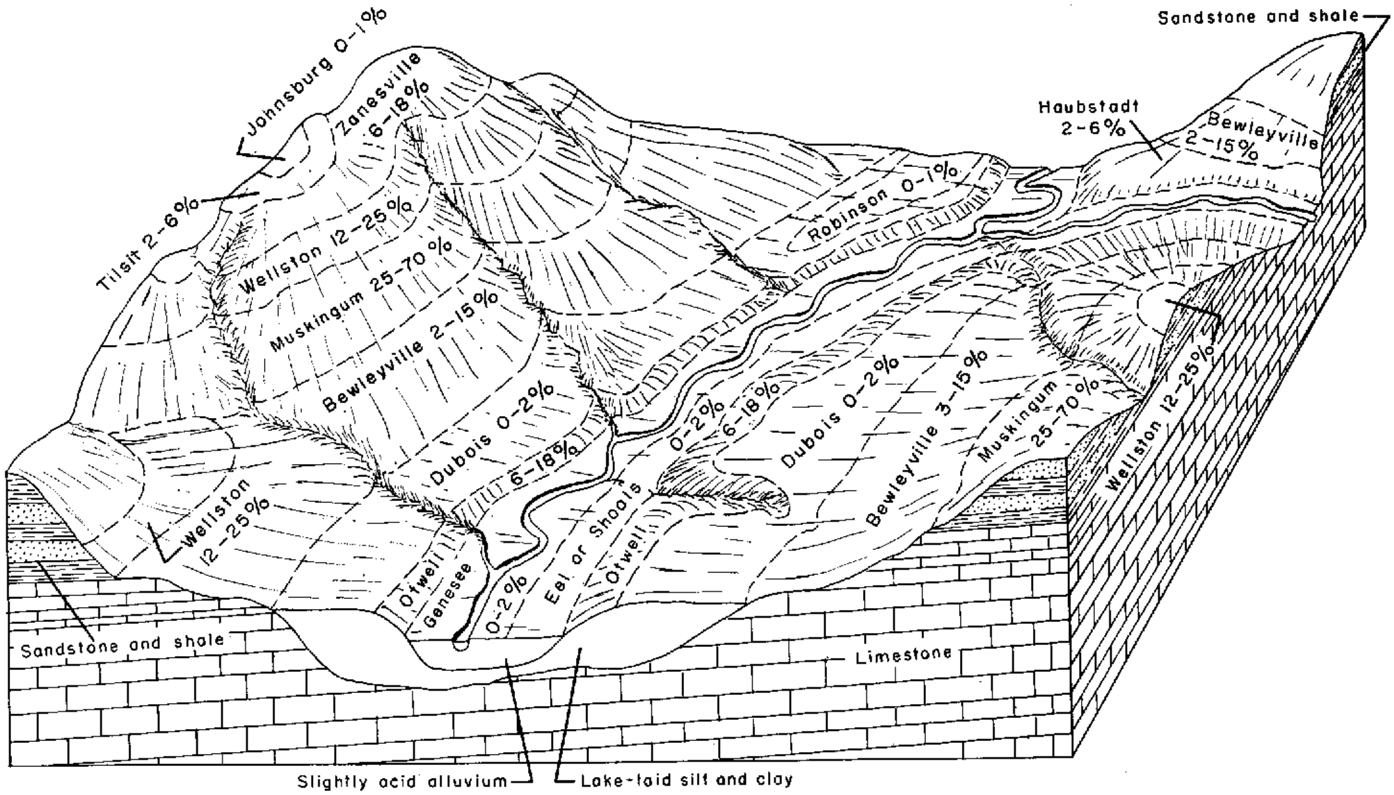

Figure 16.—Schematic cross-section of a valley along Little Raccoon Creek in southeastern Owen County. It shows soils of flood plains, slack-water (lake-laid) terraces, areas of limestone, and areas of sandstone and shale. The areas underlain by rock are covered by windblown silt.

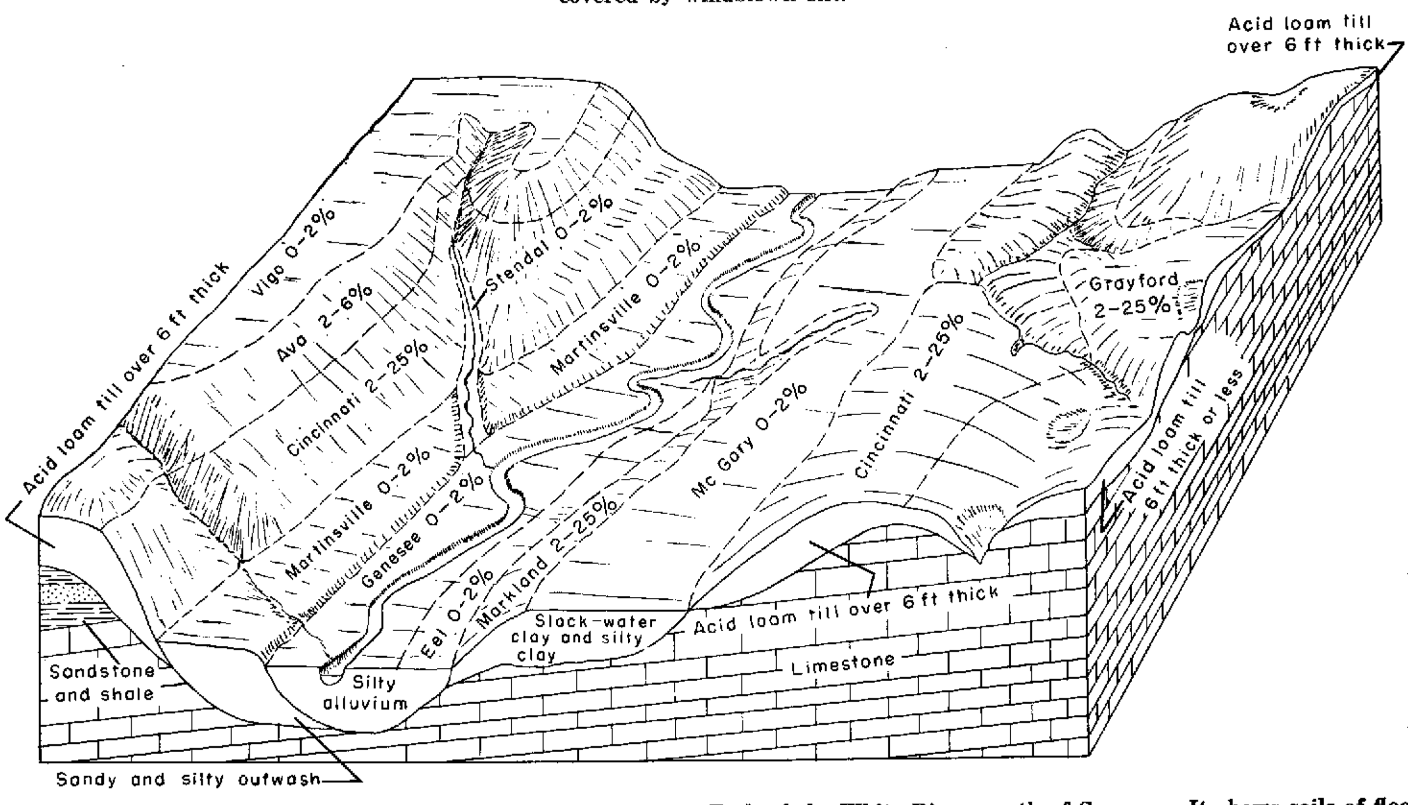

Figure 17.—Schematic cross-section of the area around the West Fork of the White River, north of Spencer. It shows soils of flood plains, low terraces, lakebeds, thick deposits of Illinoisan till, and thin deposits of till over limestone. The sinkhole (karst) topography is that of the Grayford soils.

magnesium, and manganese is increased. The usual result is a grayish or bluish layer deep in the soil horizons and mottlings of olive, yellow, brown, and gray along the root channels and cracks in the upper horizons. The bluish or olive, waterlogged horizons are called gley, and the process forming them is called gleization. The gleization process is evident in the Montgomery, Zipp, and Vincennes soils.

Imperfectly drained and poorly drained soils in which the ground water is constantly drained away tend to become gray instead of bluish or greenish in the deep part of the substratum. The development of these soils has been affected by both the processes of podzolization and gleization.

Classification of Soils

Soil series are classified into great soil groups. The soils of a great soil group have similar major characteristics. They have similar horizons that are arranged in the same sequence, but they may differ in such features as thickness of profile and degree of development of the different horizons.

The great soil groups in the county are (1) Gray-Brown Podzolic, (2) Red-Yellow Podzolic, (3) Planosol, (4) Humic Gley, (5) Brown Forest, (6) Sols Bruns Acides, (7) Alluvial, and (8) Low-Humic Gley. The miscellaneous land types are not classified by great soil groups.

In the following paragraphs each great soil group is discussed, and the soil series in each are listed. Some soils in some of the great soil groups are intergrading toward other great soil groups. That is, they have characteristics of two groups. Also, the morphology of the soils of each series in the county is discussed. A detailed profile of each series is given in the section "Descriptions of Soils." The classification of the soils in the county is based largely on characteristics observed in the field. It may be revised as more laboratory data are obtained and other knowledge about the soil series and their relationships increases.

Gray-Brown Podzolic soils

The Gray-Brown Podzolic soils formed under deciduous trees in a temperate, humid continental climate. In virgin areas they have a rather thin organic covering (A0) underlain by an organic-mineral layer (A1) that is 1 to 3 inches thick. The next horizon, the A2, is leached and light colored, generally grayish brown. The A2 horizon rests upon an illuvial, brown B horizon that is generally finer textured than the A, C, or D horizons. The accumulation of clay in the B horizon probably represents both downward movement from the A horizon and development of clay in place. The thin A0 horizon is high in content of organic matter and soluble bases, especially calcium, because of the decaying leaves and other organic material it contains. It is less acid than either the A1 or A2 horizons.

The A2 horizon of these soils is lighter colored, coarser textured, higher in silica, and lower in sesquioxides than the B horizon. The A2 horizon has been leached of soluble bases and is acid.

The base saturation of the B horizon is 50 to 70 percent, and the ratio of calcium to magnesium is 2 to 1 or higher. Soils in this group developed in loess, outwash, and lake-laid sediments of Wisconsin glacial age. The profiles of these soils are not so completely developed nor so strongly leached as those of soils classified as intergrading toward Red-Yellow Podzolic soils.

The well-drained, typical Gray-Brown Podzolic soils in this county are of the Princeton, Bloomfield, Martinsville, Ockley, Negley, and Markland series. They all have profiles well defined in texture and color, except for the Bloomfield soils, which have less accumulation of clay in the B horizon and are more weakly developed. The Gray-Brown Podzolic soils range from nearly level to steep and are developed from various parent materials. The thickness of the A and B horizons varies, but it is rarely more than 4 feet. The C horizon contains less clay and less colloidal material than the B horizon.

The Gray-Brown Podzolic soils that are intergrading toward Low-Humic Gley soils are the imperfectly drained soils of the Ayrshire, McGary, Bartle, and Whitaker series. The chief characteristics cause them to be classified as Gray-Brown Podzolic soils, but because they are somewhat gleyed, they are considered to be intergrading toward Low-Humic Gley soils. These soils developed under deciduous forest, where relief is fairly smooth and where natural erosion is slow and surface drainage is slow or very slow. They developed in areas where their profile was saturated with water during much of the year.

These soils have a light-colored, leached A2 horizon underlain by a mottled, grayish and yellowish-brown B2 horizon. The B2 horizon is much higher in clay than the overlying horizons.

The Gray-Brown Podzolic soils that are intergrading toward Red-Yellow Podzolic soils were formed under deciduous trees in a temperate, humid, continental climate. Although their chief characteristics cause them to be classified as Gray-Brown Podzolic soils, they have some characteristics like those of the Red-Yellow Podzolic soils. The well-drained soils of this group are of the Cincinnati, Hickory, Wellston, Grayford, Parke, Pike, and Otwell series. The Ava and Haubstadt soils are the moderately well drained soils of this group. The Taggart soils, which are imperfectly drained, are classified as Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils, but they also intergrade toward Low-Humic Gley soils because they have a somewhat gleyed, mottled profile.

The Gray-Brown Podzolic soils that are intergrading toward Lithosols formed under deciduous trees in a temperate, humid, continental climate. Although their chief characteristics cause them to be classified as Gray-Brown Podzolic soils, they have some characteristics like those of the Lithosol great soil group. The Corydon soils are classified in this group.

Like the Lithosols, the Corydon soils have no clearly expressed soil morphology. They consist of a freshly or imperfectly weathered mass of soil fragments and are mainly in hilly or steep areas. In addition, these soils are very shallow over bedrock and have a very weakly developed profile. Geologic erosion almost keeps pace with the weathering of the rock.

In some places these soils have such steep slopes that a large part of the soil material formed through the processes of soil development has been removed by geologic erosion. Much of the rainfall has run off instead of percolating downward through the soil profile. The normal or maximum effects of the action of climate and vegetation have been modified or overcome by the influence of relief.

These soils, therefore, do not have a well-developed profile. They have few of the characteristics of normal soils, but they have reached the stage where soil-forming processes are in equilibrium with natural erosion.

The Corydon soils formed in residuum from high-grade, cherty limestone that has a very thin silt cap in places. The depth to bedrock is 6 to 18 inches. These soils are moderately steep to very steep.

In virgin areas the Corydon soils have thin, neutral organic layers that are underlain by 2 to 3 inches of a very dark grayish-brown, neutral A1 layer of mixed organic and mineral material. In some places this horizon directly overlies limestone bedrock, and in other places there is a weakly developed A2 horizon, 2 to 8 inches thick, which is dark brown and neutral. This horizon may lie directly on bedrock or on a weathered, brown, clayey horizon that is neutral to calcareous and contains numerous fragments of chert or limestone. In many places the underlying bedrock contains cracks filled with soil material.

In the Gray-Brown Podzolic soils that are intergrading toward Red-Yellow Podzolic soils, the A1 horizon is thinner and generally acid, and the A2 and B1 horizons generally have higher color value than those of typical Gray-Brown Podzolic soils. In addition, the base saturation is generally lower than in the typical Gray-Brown Podzolic soils; it ranges from 20 to 40 percent, as compared to 40 to 70 percent in the B horizon of those soils. The calcium-magnesium ratio is about 1 to 1, as compared to 2 to 1 and higher in the typical Gray-Brown Podzolic soils.

Red-Yellow Podzolic soils

A Red-Yellow Podzolic soil of the central concept is strongly leached, acid, low in exchangeable cations and base saturation, and low in organic matter and in mineral plant nutrients. The surface layer is generally light colored, except for a thin A1 horizon. The subsoil is finer textured than the surface layer, and it is more highly oxidized. It is red or yellow in places and is somewhat mottled in the lower part. An undisturbed Red-Yellow Podzolic soil has a thin, organic A0 horizon and an organic-mineral A1 horizon. Just below the A1 horizon is a light-colored, somewhat bleached but yellowish A2 horizon. The A2 horizon, in turn, overlies a red, yellowish-red, or yellow, more clayey B horizon. Coarse, reticulate streaks or mottles of red, yellow, brown, and light gray occur in deep horizons where the parent material is thick. The Bewleyville soils [11] are the only Red-Yellow Podzolic soils in this county.

The Red-Yellow Podzolic soils that are intergrading toward the Gray-Brown Podzolic great soil group are the Zanesville soils, which are well drained, and the Tilsit soils, which are moderately well drained. They formed under deciduous trees in a temperate, humid continental climate. Although their chief characteristics caused them to be classified as Red-Yellow Podzolic soils, they have some characteristics like those of the Gray-Brown Podzolic soils. They have the sequence of horizons and the degree of structural development characteristic of Gray-Brown Podzolic soils.

[11] After this report and the soil map had been prepared for publication, the soils in this county that were called Bewleyville were classified as Crider.

Planosols

Planosols have one or more horizons abruptly separated from and sharply contrasting to an adjacent horizon because of cementation, compaction, or high content of clay. They have an eluviated surface and subsurface horizon underlain abruptly by a B horizon that is compacted and either strongly illuviated or moderately illuviated. The Planosols in this county are the Dubois, Johnsburg, Robinson, and Vigo soils. There are two general kinds of Planosols: those that have a claypan and those that have a fragipan. Both kinds occur in Owen County.

The Planosols that have a claypan developed under a cover of timber. They have a thick A2 horizon that separates abruptly from a highly illuviated B2 horizon, which has moderate to strongly developed, prismatic structure. The tops of prisms and the faces of peds are capped and coated with light-gray silt. An increase of 100 percent is common in the content of clay within 1 to 2 inches between the A2 and B horizons.

In this county the Planosols that have a claypan are the Vigo and Dubois soils, which are imperfectly drained, and the Robinson soils, which are poorly drained. They are polygenetic. The Vigo soils developed in a thin mantle of loess over loam to coarse clay loam till, and the Dubois and Robinson soils developed in a thin mantle of loess over lacustrine lake-laid deposits of silty clay loam, clay, and silt. The Robinson soils are similar to the imperfectly drained Dubois soils, but they are grayer, more strongly mottled, and generally have a slightly thicker A2 horizon. In many places in the Dubois and Robinson soils, the boundary between the A horizon and the B horizon of silty clay loam is not abrupt, and these soils either have a fragipan or a fragipan is developing.

The Planosols that have a fragipan commonly developed under a cover of timber. Above the pan, they may have either a thick, light-gray A2 horizon or a weakly developed textural and structural B horizon. The tops of prisms and the faces of peds are capped and coated with light-gray silt. A fragipan is relatively low in clay. When it is dry, it is somewhat cemented and brittle.

In this county the Johnsburg soils, which are imperfectly drained, are the Planosols that have a fragipan. They developed in 30 to 48 inches of loess and in underlying material weathered from sandstone, siltstone, and shale. They are strongly acid, and their fragipan is moderately to strongly developed. The dense, compacted pan generally starts at a depth of about 20 inches and extends to a depth of about 40 inches. Bedrock is normally 50 to 70 inches from the surface.

Humic Gley soils

Humic Gley soils are poorly drained or very poorly drained and have a dark-colored, moderately thick surface layer of mixed organic and mineral materials. The surface layer is underlain by mineral layers that show the effects of poor aeration. Humic Gley soils were developed under swamp or marsh vegetation.

The development of soils in this group is dominated by the gleization process. Under natural conditions, the soils were covered with water for long periods. They developed in nearly level to depressed areas, and both internal and external drainage are very slow. Runoff and seepage water from nearby higher areas collects on these soils. The added water carries colloidal material in solution and fine sediments, most of which are high in organic matter and in bases. Anaerobic conditions in the wet soils slow the decay of accumulating organic matter and cause the organic matter to be retained in the surface layer. These conditions also cause reduction of iron compounds to soluble, or ferrous, forms. Mottled yellowish and grayish or drab, gray colors are common, if the soils are not covered by dark organic matter.

The Humic Gley soils in Owen County are the Zipp and Montgomery soils of the terraces. The Montgomery and Zipp soils formed in calcareous, slack-water clay and silty clay that has thin lenses of silt and fine sand. They are generally neutral throughout the profile and calcareous at a depth of about 4 feet. The Zipp soils are not so dark colored as the Montgomery soils, nor is the dark surface layer so deep. The Montgomery soils are probably the most nearly representative of the Humic Gley soils in the county. The upper horizon is neutral and is very dark gray to black. It is 12 inches or more thick. The layers beneath the upper horizon are highly gleyed and somewhat mottled.

Brown Forest soils

Brown Forest soils have a very dark brown A horizon that is rich in organic matter, and a dark-brown, weakly developed B horizon. They are neutral and have a moderately high amount of exchangeable calcium.

The Nineveh soils are classified in the Brown Forest great soil group. They are well drained or somewhat excessively drained. They developed in loamy or silty outwash, underlain by stratified, calcareous gravel and sand at a depth ranging from 25 to 40 inches. The A1 horizon is dark grayish brown to very dark grayish brown and is moderately high in content of organic matter. The B horizon is dark brown and has some accumulation of clay. The entire profile is neutral. The dark color of the A1 horizon and the accumulation of clay in the B horizon indicate that the Nineveh soils are intergrades between the typical Brown Forest soils and the Brunizem, or Prairie, soils.

Sols Bruns Acides

In the central concept of Sols Bruns Acides, the soils have a distinct A1 and A2 horizon, but they do not have a distinct concentration of clay in the B horizon. They do have color in the B horizon and weak structural development. The base saturation is lower than that of the Gray-Brown Podzolic soils. There are no Sols Bruns Acides of the central concept in the county, but there are Sols Bruns Acides that integrade toward Lithosols. These are the Muskingum soils.

The Muskingum soils are rolling to steep and are mostly in the unglaciated uplands. Some are in glaciated areas that received either no deposits of drift or very thin deposits that were later removed by erosion.

The Muskingum soils are shallow over bedrock. Their parent material is variable. It ranges from weathered, coarse-textured, loosely banded, acid sandstone and shale to weathered, relatively dense shale, siltstone, and sandstone. In some places it is material from unconsolidated bedrock that has moved downslope. Some of the Muskingum soils have a thin capping of loess.

In the steeper and more rocky areas of Muskingum soils, rapid runoff, slow infiltration, and rapid removal of soil material are more pronounced. Also, the formation of soil horizons is at a minimum.

Alluvial soils

The Alluvial great soil group consists of soils that are developed in transported and recently deposited alluvial material. The soils have little or no profile development other than an accumulation of organic matter in the topmost layer. They receive fresh deposits of sediments during each flood. The profile characteristics of these soils are determined largely by the kinds of sediments.

In Owen County the soils that have been classified in the Alluvial great soil group belong to the Genesee, Eel, Landes, Pope, and Philo series. Their differences are caused largely by differences in natural drainage and by differences in the sources of the alluvium. Differences in the kind of alluvium cause these soils to vary in acidity.

The well-drained soils of this group are the Genesee, Landes, and Pope. They have a dark yellowish-brown to dark-brown profile. The Genesee soils are slightly acid to neutral throughout the profile, and they are medium textured. The Landes soils are slightly acid to neutral and are moderately coarse textured. The Pope soils are strongly acid and are medium textured.

The moderately well drained soils of this group are of the Philo and Eel series. The Philo soils are strongly acid, and the Eel soils are neutral to slightly calcareous.

Alluvial soils that are intergrading toward Low–Humic Gley soils are the imperfectly drained soils of the Shoals and Stendal series. These soils have a gray, mottled profile. The Shoals soils are normally neutral to slightly acid, and the Stendal are strongly acid.

Low-Humic Gley soils

The Low-Humic Gley soils are poorly drained and have a thin, moderately dark surface layer and a gray, highly mottled subsurface layer. They were formed in slight depressions and on broad, nearly level areas where water tends to pond and where internal drainage or surface drainage is very poor.

The Atkins and the Vincennes are the only soils in Owen County in this group. They are classified as Low-Humic Gley soils, but because they have some characteristics of the Alluvial soils, they are considered to be intergrading toward that group. They developed in wet positions on flood plains, where soil material is deposited each year. The Atkins soils developed in strongly acid, silty alluvial material washed from soils of the uplands. The Vincennes soils developed on old alluvial stream benches or fans. They are strongly acid and weakly developed.

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

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. See Texture, soil.

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.

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

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; will 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.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

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 by streams and lakes associated with them.

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

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

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, has a hard or very hard consistency, 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.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major soil horizons:

A horizon. The mineral horizon at the surface. It has an accumulation of organic matter, has been leached of soluble minerals and clay, or shows the effects of both.

B horizon. The horizon in which clay minerals or other material has accumulated, that has developed a characteristic blocky or prismatic structure, or that shows the effects of both processes.

C horizon. The unconsolidated material immediately under the true soil. In chemical, physical, and mineral composition it is presumed to be similar to the material from which at least part of the overlying solum has developed.

R horizon. Underlying consolidated bedrock, such as granite, sandstone, or limestone. If presumed to be like the parent rock from which the adjacent overlying layer or horizon was formed, the symbol R is used alone. If presumed to be unlike the overlying material, the R is preceded by a Roman numeral denoting lithologic discontinuity.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from the horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

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

Intercrop. A crop seeded with a small grain and plowed under the following spring as green manure.

Internal soil drainage. The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by the height of the water table, either permanent or perched. Relative terms for expressing internal drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Lacustrine deposit (geology). Material deposited in lake water and exposed by lowering of the water level or elevation of the land.

Leaching. The removal of soluble material from soils or other material by percolating water.

Loess. A fine-grained eolian deposit consisting dominantly of silt-sized particles.

Mulch. A natural or artificially applied layer of plant residue or other material on the surface of the soil. Mulches are generally used to help conserve moisture, control temperature, prevent surface compaction or crusting, reduce runoff and erosion, improve soil structure, or control weeds. Common mulching materials are wood chips, plant residue, sawdust, and compost.

Natural drainage. Refers to the conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable, and they have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and C horizons.

Imperfectly or somewhat poorly drained soils are wet for significant periods but not all the time, and the podzolic soils commonly have mottlings below 6 to 16 inches in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent, or nearly so, in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Parent material. The horizon of weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil profile.

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.*

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. In words the degree of acidity or alkalinity is 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. Individual rock or mineral fragments in soils having diameters ranging from 0.05 millimeter to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay. See Texture, soil.

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

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a 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.

Stripcropping. Growing crops in a systematic arrangement of strips, or bands, to serve as vegetative barriers to wind and water erosion.

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 profile below plow depth.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

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." See Clay, Sand, and Silt.

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND WOODLAND SUITABILITY GROUPS

[See table 10, p. 67, for approximate acreage and proportionate extent of the soils; see table 4, p. 24, for estimated average acre yields of field crops. For information about woodland, see p. 28, and for information significant to engineering, see p. 38]

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
At	Atkins silt loam	69	Vw-1	22	11	35
AyA	Ayrshire loam, 0 to 2 percent slopes	71	IIw-2	14	5	33
BaA	Bartle silt loam, 0 to 2 percent slopes	72	IIw-2	14	5	33
BvB2	Bewleyville silt loam, 2 to 6 percent slopes, moderately eroded	72	IIe-1	13	1	32
BvC2	Bewleyville silt loam, 6 to 12 percent slopes, moderately eroded	72	IIIe-1	16	1	32
BvD2	Bewleyville silt loam, 12 to 18 percent slopes, moderately eroded	73	IVe-1	20	1	32
BvE	Bewleyville silt loam, 18 to 25 percent slopes	73	VIe-1	22	6	34
BwC3	Bewleyville soils, 6 to 12 percent slopes, severely eroded	72	IVe-1	20	1	32
BwD3	Bewleyville soils, 12 to 18 percent slopes, severely eroded	73	VIe-1	22	1	32
ByC	Bloomfield loamy fine sand, 6 to 12 percent slopes	73	IVe-9	21	15	36
ByD	Bloomfield loamy fine sand, 12 to 18 percent slopes	73	IVe-9	21	15	36
ByE	Bloomfield loamy fine sand, 18 to 35 percent slopes	73	VIIe-1	22	15	36
CcB	Cincinnati silt loam, 2 to 6 percent slopes	74	IIe-7	14	1	32
CcB2	Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded	74	IIe-7	14	1	32
CcC	Cincinnati silt loam, 6 to 12 percent slopes	74	IIIe-7	17	1	32
CcC2	Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded	75	IIIe-7	17	1	32
CcD	Cincinnati silt loam, 12 to 18 percent slopes	75	IVe-7	20	1	32
CcD2	Cincinnati silt loam, 12 to 18 percent slopes, moderately eroded	75	IVe-7	20	1	32
CfB3	Cincinnati soils, 2 to 6 percent slopes, severely eroded	74	IIIe-7	17	1	32
CfC3	Cincinnati soils, 6 to 12 percent slopes, severely eroded	75	IVe-7	20	1	32
CfD3	Cincinnati soils, 12 to 18 percent slopes, severely eroded	75	VIe-1	22	1	32
ChE	Cincinnati and Hickory silt loams, 18 to 25 percent slopes	75	VIe-1	22	2	32
ChE2	Cincinnati and Hickory silt loams, 18 to 25 percent slopes, moderately eroded	76	VIe-1	22	2	32
CoD	Corydon stony silt loam, 12 to 18 percent slopes	76	VIe-1	22	7	34
CoG	Corydon stony silt loam, 35 to 70 percent slopes	76	VIIe-1	22	7	34
DbA	Dubois silt loam, 0 to 2 percent slopes	77	IIIw-7	19	5	33
DbB	Dubois silt loam, 2 to 6 percent slopes	77	IIIw-3	18	5	33
DbB2	Dubois silt loam, 2 to 6 percent slopes, moderately eroded	77	IIIw-3	18	5	33
Em	Eel loam	78	IIw-7	15	8	34
Es	Eel silt loam	78	IIw-7	15	8	34
Et	Eel silty clay loam	78	IIw-7	15	8	34
Gg	Genesee loam	79	I-2	12	8	34
Gm	Genesee silt loam	79	I-2	12	8	34
GnA	Ava silt loam, 0 to 2 percent slopes	70	IIs-5	16	9	34
GnB	Ava silt loam, 2 to 6 percent slopes	70	IIe-7	14	9	34
GnB2	Ava silt loam, 2 to 6 percent slopes, moderately eroded	70	IIe-7	14	9	34
GnC	Ava silt loam, 6 to 12 percent slopes	70	IIIe-7	17	9	34
GnC2	Ava silt loam, 6 to 12 percent slopes, moderately eroded	70	IIIe-7	17	9	34
GoB3	Ava soils, 2 to 6 percent slopes, severely eroded	70	IIIe-7	17	9	34
GoC3	Ava soils, 6 to 12 percent slopes, severely eroded	70	IVe-7	20	9	34
	Gravel pits[1]	79	VIIIs-1	23	-----	-----
GrA	Grayford silt loam, 0 to 2 percent slopes	80	I-1	12	1	32
GrB	Grayford silt loam, 2 to 6 percent slopes	80	IIe-1	13	1	32
GrB2	Grayford silt loam, 2 to 6 percent slopes, moderately eroded	80	IIe-1	13	1	32
GrC	Grayford silt loam, 6 to 12 percent slopes	80	IIIe-1	16	1	32
GrC2	Grayford silt loam, 6 to 12 percent slopes, moderately eroded	80	IIIe-1	16	1	32
GrD	Grayford silt loam, 12 to 18 percent slopes	81	IVe-1	20	1	32
GrD2	Grayford silt loam, 12 to 18 percent slopes, moderately eroded	81	IVe-1	20	1	32
GrE	Grayford silt loam, 18 to 25 percent slopes	81	VIe-1	22	6	34
GrE2	Grayford silt loam, 18 to 25 percent slopes, moderately eroded	81	VIe-1	22	6	34
GrF	Grayford silt loam, 25 to 35 percent slopes	82	VIe-1	22	6	34
GsB3	Grayford soils, 2 to 6 percent slopes, severely eroded	80	IIIe-1	16	1	32
GsC3	Grayford soils, 6 to 12 percent slopes, severely eroded	81	IVe-1	20	1	32
GsD3	Grayford soils, 12 to 18 percent slopes, severely eroded	81	VIe-1	22	1	32
GsE3	Grayford soils, 18 to 25 percent slopes, severely eroded	82	VIe-1	22	6	34
Gt	Gullied land, glacial drift	82	VIIe-1	22	3	33
Gu	Gullied land, residuum	82	VIIe-1	22	14	36
HaA	Haubstadt silt loam, 0 to 2 percent slopes	83	IIs-5	16	9	34
HaB	Haubstadt silt loam, 2 to 6 percent slopes	83	IIe-7	14	9	34
HaB2	Haubstadt silt loam, 2 to 6 percent slopes, moderately eroded	83	IIe-7	14	9	34
HaC2	Haubstadt silt loam, 6 to 12 percent slopes, moderately eroded	83	IIIe-7	17	9	34
HbB3	Haubstadt soils, 2 to 6 percent slopes, severely eroded	83	IIIe-7	17	9	34
HbC3	Haubstadt soils, 6 to 12 percent slopes, severely eroded	83	IVe-7	20	9	34
HcF	Hickory silt loam, 25 to 35 percent slopes	84	VIe-1	22	2	32
HcF2	Hickory silt loam, 25 to 35 percent slopes, moderately eroded	84	VIe-1	22	2	32
HcG	Hickory silt loam, 35 to 70 percent slopes	84	VIIe-1	22	4	33
HkE3	Hickory soils, 18 to 25 percent slopes, severely eroded	84	VIIe-1	22	2	32

See footnote at end of table.

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND WOODLAND SUITABILITY GROUPS—Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
JoA	Johnsburg silt loam, 0 to 2 percent slopes	85	IIIw-7	19	5	33
JoB	Johnsburg silt loam, 2 to 6 percent slopes	85	IIIw-3	18	5	33
JoB2	Johnsburg silt loam, 2 to 6 percent slopes, moderately eroded	85	IIIw-3	18	5	33
La	Landes fine sandy loam	86	I-2	12	8	34
MaB2	Markland silt loam, 2 to 6 percent slopes, moderately eroded	86	IIIe-7	17	1	32
MaC2	Markland silt loam, 6 to 12 percent slopes, moderately eroded	86	IVe-1	20	1	32
MaD2	Markland silt loam, 12 to 18 percent slopes, moderately eroded	87	VIe-1	22	1	32
MaE2	Markland silt loam, 18 to 25 percent slopes, moderately eroded	87	VIIe-1	22	2	32
MdC3	Markland soils, 6 to 12 percent slopes, severely eroded	86	VIe-1	22	1	32
MeA	Martinsville loam, 0 to 2 percent slopes	87	I-1	12	1	32
MeB2	Martinsville loam, 2 to 6 percent slopes, moderately eroded	87	IIe-1	13	1	32
MfA	Martinsville silt loam, 0 to 2 percent slopes	87	I-1	12	1	32
MgA	McGary silt loam, 0 to 2 percent slopes	88	IIIw-6	19	5	33
MgB2	McGary silt loam, 2 to 6 percent slopes, moderately eroded	88	IIIw-6	19	5	33
Mh	Montgomery silty clay loam	88	IIIw-2	18	11	35
Mk	Muck	89	IIw-10	15		
MmD	Muskingum stony silt loam, 12 to 18 percent slopes	89	VIe-1	22	10	35
MmE	Muskingum stony silt loam, 18 to 25 percent slopes	90	VIIe-1	22	10	35
MmF	Muskingum stony silt loam, 25 to 35 percent slopes	90	VIIe-1	22	12	35
MmG	Muskingum stony silt loam, 35 to 70 percent slopes	90	VIIe-1	22	12	35
NgE	Negley loam, 18 to 25 percent slopes	90	VIe-1	22	2	32
NgF	Negley loam, 25 to 35 percent slopes	91	VIe-1	22	2	32
NgG	Negley loam, 35 to 70 percent slopes	91	VIIe-1	22	4	33
NmE	Negley silt loam, 18 to 25 percent slopes	91	VIe-1	22	2	32
NmE2	Negley silt loam, 18 to 25 percent slopes, moderately eroded	91	VIe-1	22	2	32
NsE3	Negley soils, 18 to 25 percent slopes, severely eroded	90	VIIe-1	22	2	32
Nv	Nineveh loam	91	IIs-1	16	1	32
OcA	Ockley loam, 0 to 2 percent slopes	92	I-1	12	1	32
OkA	Ockley silt loam, 0 to 2 percent slopes	92	I-1	12	1	32
OmA	Otwell silt loam, 0 to 2 percent slopes	92	IIs-5	16	1	32
OmB	Otwell silt loam, 2 to 6 percent slopes	92	IIe-7	14	1	32
OmB2	Otwell silt loam, 2 to 6 percent slopes, moderately eroded	93	IIe-7	14	1	32
OmC	Otwell silt loam, 6 to 12 percent slopes	93	IIIe-7	17	1	32
OmC2	Otwell silt loam, 6 to 12 percent slopes, moderately eroded	93	IIIe-7	17	1	32
OmD	Otwell silt loam, 12 to 18 percent slopes	93	IVe-7	20	1	32
OmD2	Otwell silt loam, 12 to 18 percent slopes, moderately eroded	93	IVe-7	20	1	32
OmE	Otwell silt loam, 18 to 25 percent slopes	93	VIe-1	22	2	32
OmE2	Otwell silt loam, 18 to 25 percent slopes, moderately eroded	93	VIe-1	22	2	32
OtF	Otwell silt loam, calcareous substratum, 25 to 35 percent slopes	94	VIe-1	22	2	32
OtG	Otwell silt loam, calcareous substratum, 35 to 70 percent slopes	94	VIIe-1	22	4	33
OwC3	Otwell soils, 6 to 12 percent slopes, severely eroded	93	IVe-7	20	1	32
OwD3	Otwell soils, 12 to 18 percent slopes, severely eroded	93	VIe-1	22	1	32
OwE3	Otwell soils, 18 to 25 percent slopes, severely eroded	93	VIIe-1	22	2	32
PaB	Parke silt loam, 2 to 6 percent slopes	95	IIe-1	13	1	32
PaB2	Parke silt loam, 2 to 6 percent slopes, moderately eroded	95	IIe-1	13	1	32
PaC	Parke silt loam, 6 to 12 percent slopes	95	IIIe-1	16	1	32
PaC2	Parke silt loam, 6 to 12 percent slopes, moderately eroded	95	IIIe-1	16	1	32
PaD	Parke silt loam, 12 to 18 percent slopes	95	IVe-1	20	1	32
PaD2	Parke silt loam, 12 to 18 percent slopes, moderately eroded	95	IVe-1	20	1	32
PcB3	Parke soils, 2 to 6 percent slopes, severely eroded	95	IIIe-1	16	1	32
PcC3	Parke soils, 6 to 12 percent slopes, severely eroded	95	IVe-1	20	1	32
PcD3	Parke soils, 12 to 18 percent slopes, severely eroded	95	VIe-1	22	1	32
Ph	Philo silt loam	96	IIw-7	15	8	34
PkA	Pike silt loam, 0 to 2 percent slopes	97	I-1	12	1	32
PkB2	Pike silt loam, 2 to 6 percent slopes, moderately eroded	97	IIe-1	13	1	32
Po	Pope loam	97	I-2	12	8	34
Pp	Pope silt loam	97	I-2	12	8	34
PrB	Princeton fine sandy loam, 2 to 6 percent slopes	98	IIe-5	13	1	32
PrC	Princeton fine sandy loam, 6 to 12 percent slopes	98	IIIe-5	17	1	32
PrC2	Princeton fine sandy loam, 6 to 12 percent slopes, moderately eroded	98	IIIe-5	17	1	32
PrD2	Princeton fine sandy loam, 12 to 18 percent slopes, moderately eroded	98	IVe-5	20	1	32
PrE2	Princeton fine sandy loam, 18 to 25 percent slopes, moderately eroded	98	VIe-1	22	2	32
	Quarries [1]	98	VIIIs-1	23		
Ra	Riverwash	98	VIIIs-1	23		
Ro	Robinson silt loam	99	IIIw-5	18	11	35
Sh	Shoals loam	100	IIw-7	15	13	36
Sm	Shoals silt loam	100	IIw-7	15	13	36
Sn	Shoals silty clay loam	100	IIw-7	15	13	36
So	Stendal silt loam	100	IIw-7	15	13	36
St	Strip mines	101	VIIe-1	22	16	36

See footnote at end of table.

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND WOODLAND SUITABILITY GROUPS—Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
Ta	Taggart silt loam	102	IIw-2	14	5	33
TsA	Tilsit silt loam, 0 to 2 percent slopes	102	IIs-5	16	9	34
TsB	Tilsit silt loam, 2 to 6 percent slopes	102	IIe-7	14	9	34
TsB2	Tilsit silt loam, 2 to 6 percent slopes, moderately eroded	102	IIe-7	14	9	34
TsC2	Tilsit silt loam, 6 to 12 percent slopes, moderately eroded	103	IIIe-7	17	9	34
TtB3	Tilsit soils, 2 to 6 percent slopes, severely eroded	102	IIIe-7	17	9	34
VgA	Vigo silt loam, 0 to 2 percent slopes	103	IIIw-7	19	5	33
VgB	Vigo silt loam, 2 to 6 percent slopes	103	IIIw-3	18	5	33
VgB2	Vigo silt loam, 2 to 6 percent slopes, moderately eroded	104	IIIw-3	18	5	33
Vn	Vincennes silt loam	104	IIw-2	14	11	35
WmC	Wellston silt loam, 6 to 12 percent slopes	105	IVe-8	21	10	35
WmC2	Wellston silt loam, 6 to 12 percent slopes, moderately eroded	105	IVe-8	21	10	35
WmD	Wellston silt loam, 12 to 18 percent slopes	105	VIe-1	22	10	35
WmD2	Wellston silt loam, 12 to 18 percent slopes, moderately eroded	105	VIe-1	22	10	35
WmE	Wellston silt loam, 18 to 25 percent slopes	105	VIe-1	22	10	35
WmE2	Wellston silt loam, 18 to 25 percent slopes, moderately eroded	105	VIe-1	22	10	35
WnC3	Wellston soils, 6 to 12 percent slopes, severely eroded	105	VIe-1	22	10	35
WnD3	Wellston soils, 12 to 18 percent slopes, severely eroded	105	VIIe-1	22	10	35
WnE3	Wellston soils, 18 to 25 percent slopes, severely eroded	106	VIIe-1	22	10	35
WoF	Wellston and Muskingum soils, 25 to 35 percent slopes	106	VIIe-1	22	10	35
WoF2	Wellston and Muskingum soils, 25 to 35 percent slopes, moderately eroded	106	VIIe-1	22	10	35
WoG	Wellston and Muskingum soils, 35 to 70 percent slopes	106	VIIe-1	22	12	35
Wt	Whitaker silt loam	106	IIw-2	14	5	33
ZaB	Zanesville silt loam, 2 to 6 percent slopes	107	IIe-7	14	9	34
ZaB2	Zanesville silt loam, 2 to 6 percent slopes, moderately eroded	107	IIe-7	14	9	34
ZaC	Zanesville silt loam, 6 to 12 percent slopes	107	IIIe-7	17	9	34
ZaC2	Zanesville silt loam, 6 to 12 percent slopes, moderately eroded	108	IIIe-7	17	9	34
ZaD	Zanesville silt loam, 12 to 18 percent slopes	108	IVe-7	20	9	34
ZaD2	Zanesville silt loam, 12 to 18 percent slopes, moderately eroded	108	IVe-7	20	9	34
ZaE	Zanesville silt loam, 18 to 25 percent slopes	108	VIe-1	22	9	34
ZaE2	Zanesville silt loam, 18 to 25 percent slopes, moderately eroded	108	VIe-1	22	9	34
ZnB3	Zanesville soils, 2 to 6 percent slopes, severely eroded	107	IIIe-7	17	9	34
ZnC3	Zanesville soils, 6 to 12 percent slopes, severely eroded	108	IVe-7	20	9	34
ZnD3	Zanesville soils, 12 to 18 percent slopes, severely eroded	108	VIe-1	22	9	34
Zp	Zipp silty clay loam	109	IIIw-2	18	11	35

[1] Gravel pits and quarries are shown on the detailed soil map by the conventional sign.

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