SOIL SURVEY OF

Delaware County, Indiana

U.S. Department of Agriculture
Soil Conservation Service
In cooperation with
Purdue University
Agricultural Experiment Station

Issued July 1972

Major fieldwork for this soil survey was done in the period 1961 to 1967. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in this publication refer to conditions in the county at the time the survey was in progress.

This survey was made cooperatively by the Soil Conservation Service and the Purdue University Agricultural Experiment Station. It is part of the technical assistance furnished to the Delaware County Soil and Water Conservation District.

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

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit or any other group in which the soil has been placed.

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

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

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

Community planners and others can read about soil properties that affect the choice of sites for recreation areas in the section "Use of the Soils for Recreation."

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

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

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

Cover: Expanding suburbs in the Blount-Pewamo-Morley soil association encroach on productive cropland and woodland.

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SOIL SURVEY OF DELAWARE COUNTY, INDIANA

BY KELSO K. HUFFMAN, SOIL SCIENTIST, SOIL CONSERVATION SERVICE

FIELDWORK BY KELSO K. HUFFMAN, PAUL McCARTER, JR., AND GORDON K. TANAKA, SOIL SCIENTISTS, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

DELAWARE COUNTY is in the east-central part of Indiana (fig. 1). The county has a total area of 398 square miles, or 254,720 acres. Muncie, the county seat, is the largest city in the county and is known for its industries.

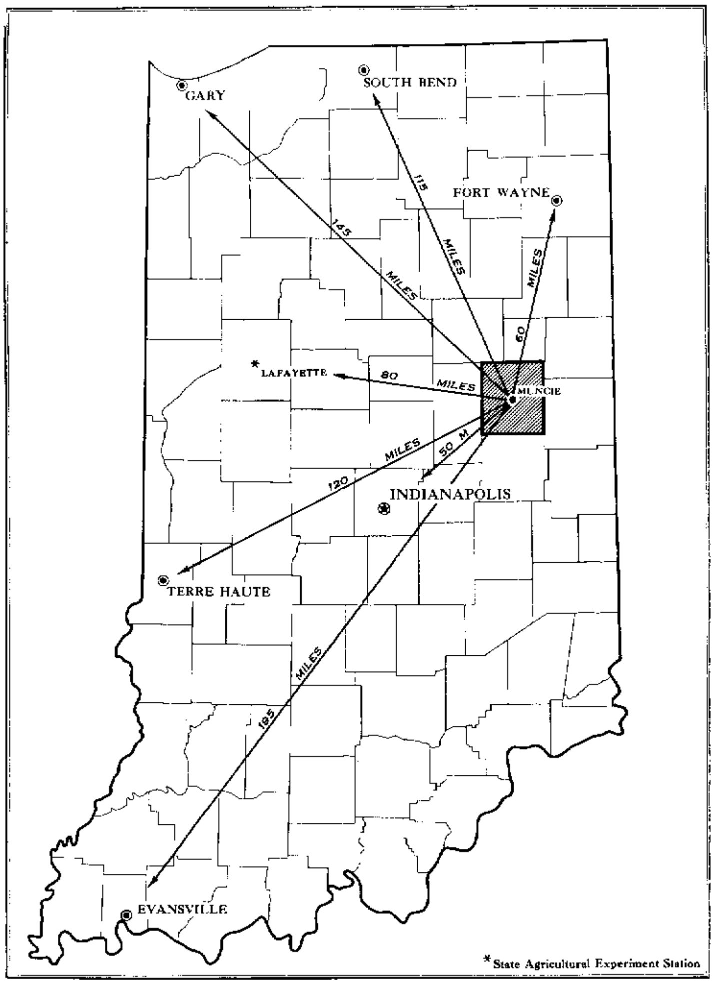

Figure 1.—Location of Delaware County in Indiana.

Farming is the leading occupation in Delaware County, though many people are employed by industry and some of the workers commute to Anderson, Marion, and Indianapolis. About half the farm income comes from the sale of field crops or special crops and half from the sale of livestock and livestock products. Corn, soybeans, wheat, and hay are the dominant crops. Dairy and beef cattle, hogs, chickens, and turkeys are raised extensively.

How This Survey Was Made

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

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

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. Brookston and Blount, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases (*9*).[1] The name of a soil phase indicates a feature that affects management. For example, Miami silt loam, 2 to 6 percent slopes, eroded, is one of several phases within the Miami series.

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

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

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit is shown on the soil map of Delaware County—an undifferentiated group.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Pewamo and Brookston silt loams, overwash, is the only undifferentiated group mapped in Delaware County.

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

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil 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 soil. Yields under defined management are estimated for all the soils.

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

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

[1] Italic numbers in parentheses refer to Literature Cited, p. 64.

General Soil Map

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

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

The six soil associations in Delaware County are discussed in the following pages.

1. Blount-Pewamo-Morley Association

Mainly somewhat poorly drained and very poorly drained, nearly level and gently sloping, medium textured and moderately fine textured soils that have a fine-textured layer in the subsoil; formed in glacial till on uplands

This association is on uplands. The Pewamo soils are in broad depressions and narrow fingerlike areas within areas of Blount soils (fig. 2). The Morley soils occupy

***Figure 2.*—Blount and Pewamo soils in association 1. Blount soils in light areas in foreground, and Pewamo soils in darker areas in background.**

oval-shaped knolls at slightly higher elevations than Blount and Pewamo soils.

The association occupies about 190 square miles, or about 48 percent of the county. Blount soils make up about 44 percent of the association; Pewamo soils, about 41 percent; Morley soils, about 8 percent; and the minor soils, the remaining 7 percent.

Blount soils are somewhat poorly drained. They are mostly nearly level, but in places they have short gentle slopes. Their surface layer is medium textured. The brown subsoil is mottled and contains a layer of fine-textured material. It is underlain by moderately fine textured till at a depth between 20 and 40 inches.

Pewamo soils are deep and very poorly drained. Their surface layer is moderately fine textured. The gray subsoil is mottled and contains a layer of fine-textured material. Moderately fine textured till is at a depth between 36 and 55 inches.

Morley soils are deep, well drained, and gently sloping. Their surface layer is medium textured and moderately fine textured. The subsoil is mainly fine textured and is mottled in places in the lower part. It is underlain by moderately fine textured till at a depth between 20 and 40 inches.

The Carlisle and Kokomo soils are among the minor soils in this association. They are in depressions and are very poorly drained.

Wetness is a major limitation on Blount and Pewamo soils, and artificial drainage is needed for good growth of crops. Erosion is a hazard on the gently sloping Morley soils.

The soils in this association are suited to intensive cropping. Corn, soybeans, and small grains grown for cash are the common crops. A few areas have a cover of hardwoods.

Limitations for urban development and for septic systems are severe on the major soils of this association.

2. Morley-Blount-Fox Association

Well-drained and somewhat poorly drained, nearly level to strongly sloping, medium textured and moderately fine textured soils; formed in glacial till and outwash on uplands and terraces

This association is on uplands and terraces. The Blount soils occur within larger areas of Morley soils in areas 1 to 5 acres in size and in larger continuous areas. The Fox soils are on terraces, kames, and eskers.

The association occupies about 36 square miles, or about 9 percent of the county. Morley soils make up about 45 percent of the association; Blount soils, about 25 percent; and Fox soils, about 25 percent (fig. 3). The remaining 5 percent is minor soils.

Morley soils are deep, well drained, and gently sloping to strongly sloping. They occupy the higher parts of this association. Their surface layer is medium textured and moderately fine textured. The subsoil is mainly fine textured. In some places where slopes are gentle, the subsoil is mottled in the lower part. Moderately fine textured till is at a depth between 20 and 40 inches.

Blount soils are deep, somewhat poorly drained, and nearly level and gently sloping. Their surface layer is medium textured. The brown subsoil is mottled and contains a layer of fine-textured material. It is underlain by moderately fine textured till at a depth between 20 and 40 inches.

Fox soils are moderately deep to sand and gravel. They are nearly level to strongly sloping and well drained. Their surface layer is medium textured and moderately fine textured. The reddish-brown subsoil is moderately fine textured and moderately coarse textured. Loose, stratified gravel and sand are at a depth between 20 and 40 inches.

The Genesee, Ockley, and Pewamo soils are among the minor soils in this association. Genesee soils occupy narrow flood plains, and Ockley soils are in outwash areas. These soils are well drained. The Pewamo soils are in depressions, and they are very poorly drained.

The soils in this association are suited to moderate to heavy cropping. Erosion is the chief hazard on Morley soils, and Blount soils require artificial drainage. Corn, soybeans, and small grains are the dominant crops on the level to moderately sloping soils. On the more strongly sloping soils, farming is more general, the cropping systems include pasture, and the number of livestock on the farms is greater. Hardwoods of poor quality grow on the steeper breaks, many of which are pastured.

The Morley and Blount soils in this association have severe limitations for urban development and septic systems. Also, the shrink-swell potential of soils in wet areas places limitations on the construction of footings and driveways. The well-drained soils that are moderately deep to gravel and sand have slight limitations for septic systems. Shallow wells in these soils, however, are subject to pollution from nearby septic tanks.

3. Brookston-Kokomo-Fox Association

Very poorly drained and well-drained, nearly level and gently sloping, medium textured and moderately fine textured soils; formed in loamy, gravelly, and sandy materials on outwash plains, lakebeds, and terraces

The Brookston soils in this association occupy nearly level areas and broad depressions. Areas of the Kokomo soils are in shallow, isolated lakebeds and valley trains.

This association occupies about 40 square miles, or about 10 percent of the county. Brookston soils make up about 38 percent of the association, Kokomo soils about 35 percent, and Fox soils about 20 percent (fig. 4). The remaining 7 percent is minor soils.

The Brookston soils are deep and are very poorly drained. Their surface layer and subsoil are moderately fine textured. The gray subsoil is stony. It is underlain, at a depth between 30 and 50 inches, by medium textured to moderately coarse textured outwash.

Kokomo soils are deep and are very poorly drained. Their surface layer is moderately fine textured, and in places it is mucky silt loam. The dark-gray subsoil is moderately fine textured and is mottled below a depth of 18 inches. Stratified sand and silt are at a depth between 36 and 50 inches and contain layers of clay and gravel in places.

Fox soils are well drained and nearly level and gently sloping. They are moderately deep to sand and gravel

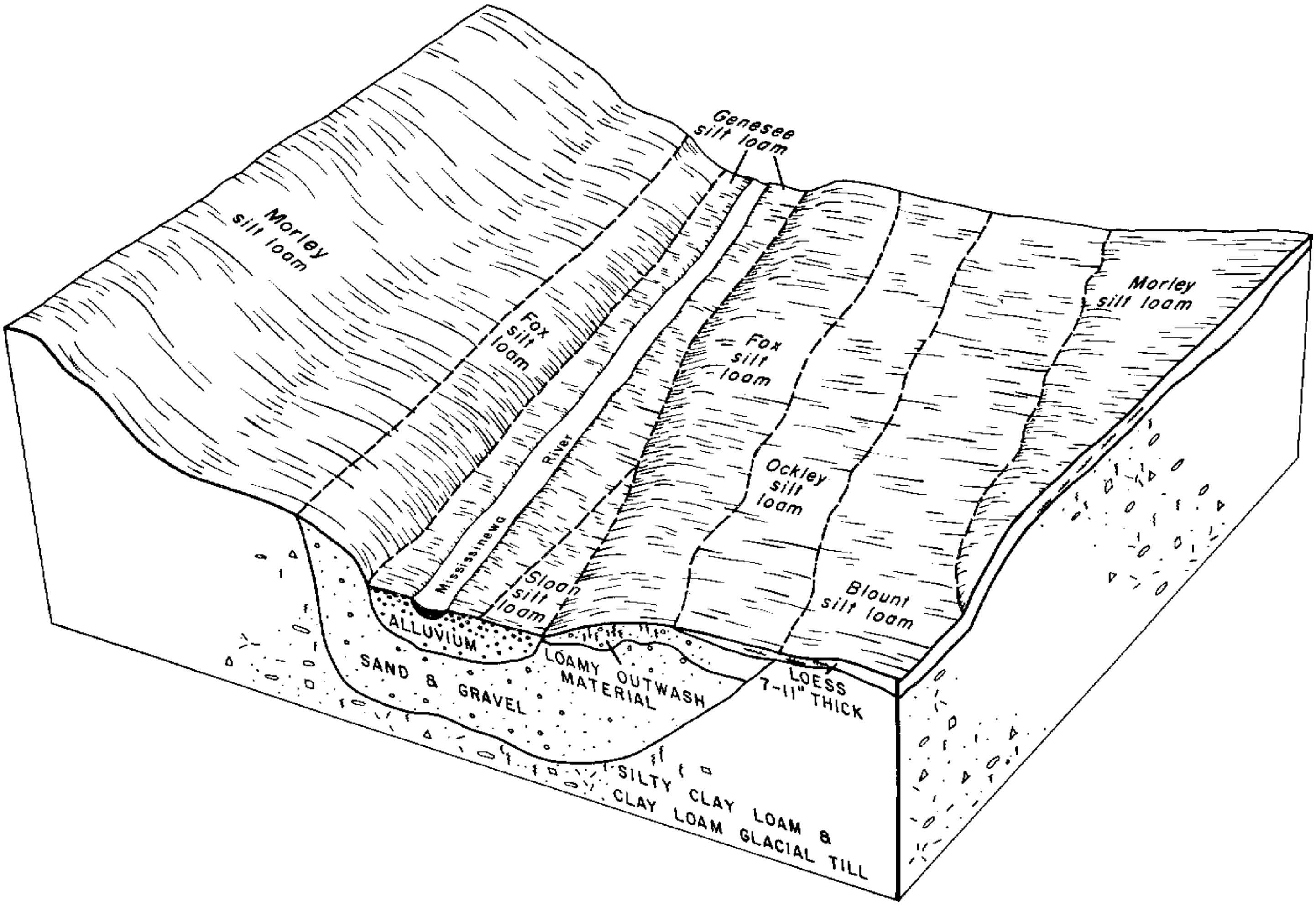

***Figure 3.*—Major soils in association 2 and their relationship to the landscape.**

and have a medium-textured surface layer. The reddish-brown subsoil is moderately fine textured and moderately coarse textured. Loose stratified gravel and sand are at a depth between 20 and 40 inches. In places silt and clayey material are mixed with the gravel and sand.

Crosby and Blount soils are among the minor soils in this association.

Wetness is a major limitation on Brookston and Kokomo soils. In addition cobblestones and boulders on the surface and in the subsoil limit farming and drainage operations on Brookston soils. Fox soils are droughty during dry periods, and they are subject to erosion on slopes.

The soils in this association are suited to intensive cropping. Corn, soybeans, and small grains grown for cash are the common crops. Some small stony areas of Brookston and Fox soils are used as pasture. Hardwoods of poor quality grow in a few places. These areas are used as pasture or to provide shelter for livestock.

The wet soils in this association have severe limitations for urban development and septic systems. The well-drained soils that are moderately deep to gravel and sand have only slight limitations for septic systems. Shallow wells in these soils, however, are subject to pollution from nearby septic systems.

4. Crosby-Brookston-Miami Association

Mainly somewhat poorly drained and very poorly drained, level to moderately sloping, medium textured and moderately fine textured soils; formed in glacial till on uplands

This association is on uplands. The Crosby soils are on low ridges and in areas known locally as "gray flats." Brookston soils occupy level areas and depressions that range from fingerlike draws to broad flats. The Miami soils are on ridges within areas of Crosby and Brookston soils.

The association occupies about 80 square miles, or about 20 percent of the county. Crosby soils make up about 45 percent of the association; Brookston soils, about 40 percent; and Miami soils about 12 percent (fig. 5). The remaining 3 percent is minor soils.

The Crosby soils are deep and are somewhat poorly drained. Their surface layer is medium textured. The brown subsoil is moderately fine textured and is mottled. It is underlain by medium-textured till at a depth between 24 and 40 inches.

Brookston soils are deep and very poorly drained. The surface layer and gray subsoil are moderately fine textured, and the subsoil is mottled. Medium-textured till is at a depth between 36 and 55 inches.

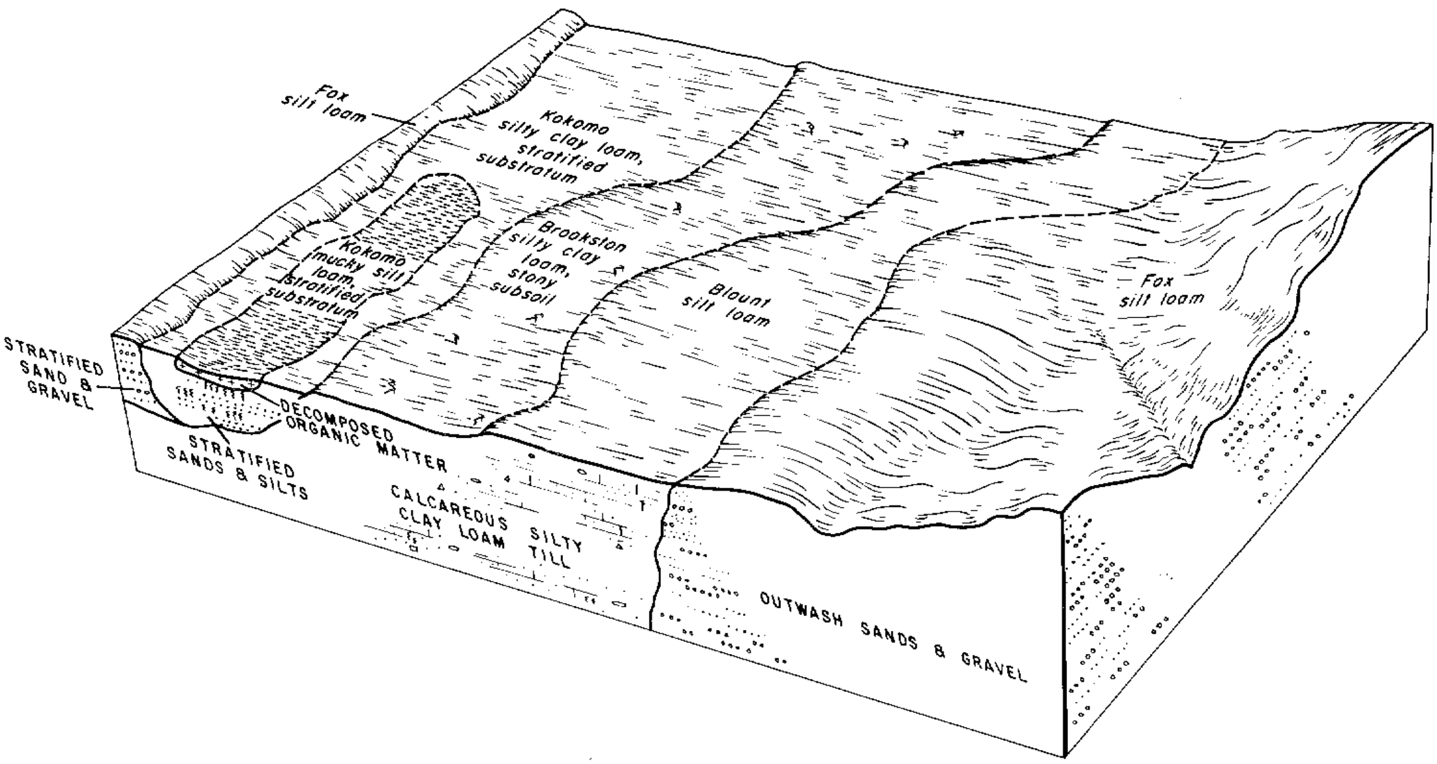

Figure 4.—**Major soils in association 3 and their relationship to the landscape.**

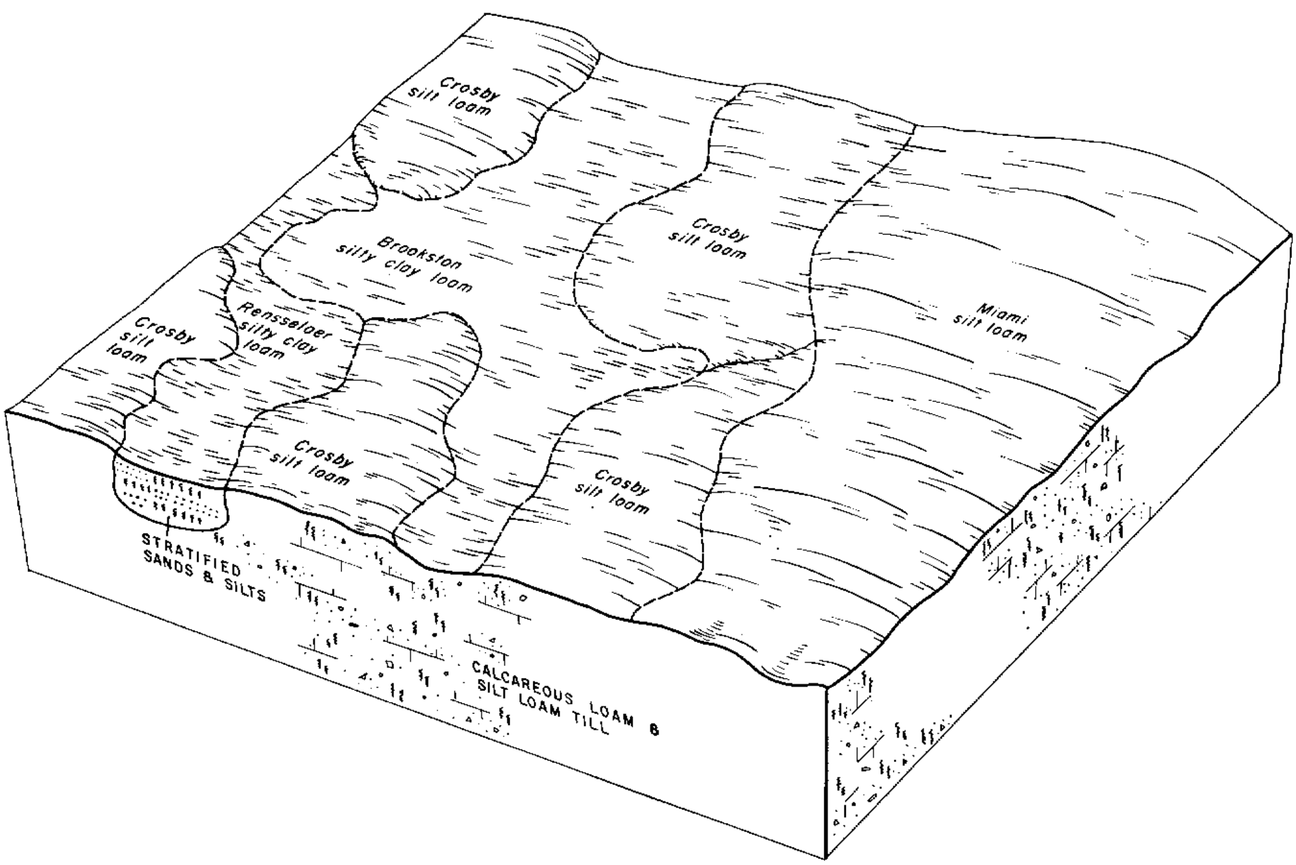

Figure 5.—**Major soils in association 4 and their relationship to the landscape.**

Miami soils are deep, well drained, and nearly level to moderately sloping. The surface layer is medium textured, and the brown subsoil is moderately fine textured. Medium-textured till is at a depth between 20 and 42 inches.

The Fox and Rensselaer soils are among the minor soils in this association. The Fox soils are on gravelly knolls and are well drained. The Rensselaer soils are in depressions in lakebeds and in adjoining valley trains. They are very poorly drained.

Wetness is the major limitation of soils in this association. Artificial drainage is needed for good growth of crops on Crosby and Brookston soils (fig. 6). Erosion is a hazard on the sloping soils.

These soils are suited to intensive cropping. Corn, soybeans, and small grains grown for cash are the common crops. A few areas have a cover of hardwoods.

Limitations for urban development and for septic systems are severe on the major soils of this association. Some of the minor soils, however, have only a moderate limitation for septic tank filter fields.

5. Miami-Fox-Martinsville Association

Well-drained, nearly level to strongly sloping, moderately fine textured to moderately coarse textured soils; formed in glacial till and outwash on uplands and terraces

This association consists of soils on uplands and terraces. The Miami soils are on uplands; the Fox soils are on kames, eskers, and terraces; and the Martinsville soils are on terraces and outwash areas.

The association occupies about 40 square miles, or about 10 percent of the county. Miami soils make up about 50 percent of the association; Fox soils, about 30 percent; Martinsville soils, about 15 percent; and minor soils, the remaining 5 percent.

Miami soils are well drained and nearly level to strongly sloping. Their surface layer is medium textured and moderately fine textured. The brown subsoil is moderately fine textured and is underlain by medium-textured till at a depth between 20 and 42 inches.

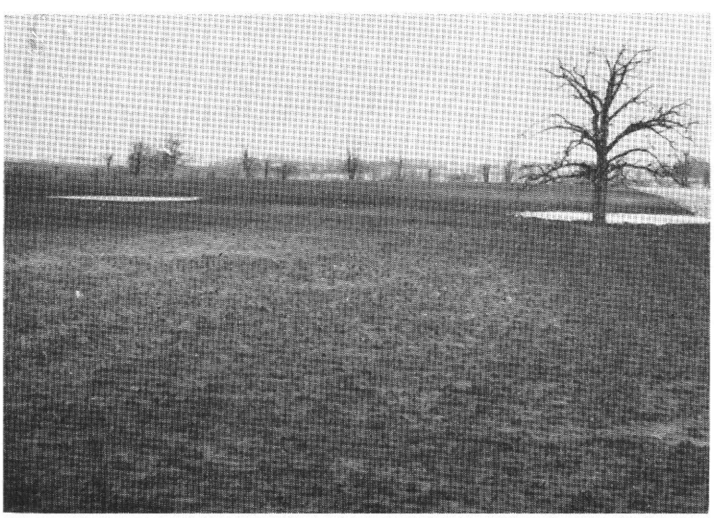

***Figure 6.*—Typical area of Crosby and Brookston soils. Lighter areas are Crosby; darker ponded areas are Brookston.**

Fox soils are well drained and are nearly level and strongly sloping. They are moderately deep to sand and gravel. The surface layer is medium textured and moderately fine textured, and the reddish-brown subsoil is moderately fine textured and moderately coarse textured. Loose, stratified sand and gravel are at a depth between 20 and 40 inches.

Martinsville soils are deep, well drained, and nearly level and gently sloping. The surface layer is moderately coarse textured, and the reddish-brown subsoil is mainly moderately fine textured. Stratified sand, silt, and some fine gravel are at a depth between 40 and 55 inches.

The Brookston, Crosby, and Rensselaer soils are among the minor soils of this association. Brookston and Rensselaer soils are in depressions within areas of Miami and Martinsville soils, and they are very poorly drained. Crosby soils are within areas of Miami soils, and they are somewhat poorly drained.

The nearly level and gently sloping soils in this association are suited to intensive cropping. The sloping and strongly sloping soils are suited to cropping systems that provide hay and pasture in addition to the other crops. Corn, soybeans, and small grains are the common crops. On the sloping soils the trend is toward general farming and the raising of livestock. A few areas have a cover of hardwoods.

The major soils have slight or moderate limitations for urban development and for septic systems. Erosion is the chief hazard affecting grading and other construction work.

6. Carlisle-Linwood-Genesee-Sloan Association

Very poorly drained to well-drained, nearly level soils; formed in organic and alluvial deposits

This association is on first bottoms along major streams and their tributaries, in muck pockets, and in depressions in narrow valleys. The organic Carlisle and Linwood soils are in pocketlike depressions, mostly on uplands and terraces. The alluvial Genesee and Sloan soils are on flood plains.

The association occupies about 12 square miles, or about 3 percent of the county. About 45 percent of the association is Carlisle and Linwood soils, and about 45 percent is Genesee and Sloan soils. The remaining 10 percent is minor soils.

The Carlisle and Linwood soils are deep, and they are very poorly drained. Their surface and subsurface layers are granular muck. These layers in the Carlisle soils are underlain by muck and peat to a depth of 42 inches or more. The granular muck in Linwood soils is underlain by medium-textured material at a depth of 12 to 42 inches.

Genesee and Sloan soils are deep. Genesee soils are well drained, and Sloan soils are very poorly drained. The surface layer of these soils is medium textured. At a depth of 20 to 40 inches Sloan soils are underlain by silt loam, loamy sand, and, in places, clay.

The Kokomo, Ross, Shoals and Wallkill are among the minor soils in this association. The Wallkill and Kokomo soils occur with the organic Carlisle and Linwood soils, and they are very poorly drained. The deep, dark-colored Ross and Shoals soils are on flood plains. Ross soils are well drained, and Shoals soils are somewhat poorly drained.

The soils in this association are suited to intensive cropping. Corn and soybeans are the common crops, but a few idle areas have a cover of hardwoods. The alluvial Genesee, Shoals, and Sloan soils (fig. 7) are subject to seasonal flooding by nearby streams. The organic Carlisle and Linwood soils are subject to ponding during wet seasons.

Limitations for urban development, septic systems, and highway construction are severe on the major soils of this association.

Descriptions of the Soils

In this section the soil series and mapping units of Delaware County are described in alphabetic order. The procedure is to describe first the soil series, and then the mapping units in that series. Thus, to get full information on any mapping unit, it is necessary to read both the description of that unit and the description of the soil series to which the unit belongs.

Each series contains a short description of a representative soil profile and a much more detailed description of the same profile that scientists, engineers, and others can use in making highly technical interpretations. If the profile of a given mapping unit differs from the representative profile, the differences are stated in the description of the mapping unit or they are apparent in the name of the mapping unit. The colors described are for moist soil, unless otherwise noted.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Borrow pits, for example, does not belong to a soil series, but nevertheless, it is listed in alphabetic order along with the soil series.

Many of the terms used in describing the soil series and the mapping units are defined in the Glossary, and some are defined in the section "How This Survey Was Made." Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map, which is at the back of this survey. The approximate acreage and proportionate extent of the mapping units are shown in table 1. All of the mapping units in the county are listed in the "Guide to Mapping Units" at the back of this survey, which also shows the capability unit, wildlife group, and recreational group each mapping unit is in.

***Figure 7.*—Typical area of Genesee, Shoals, and Sloan soils on nearly level flood plains. These soils are well suited to row crops.**

Blount Series

The Blount series consists of deep, nearly level and gently sloping, somewhat poorly drained soils on uplands. These soils formed in glacial till that had a mantle of loess 7 to 11 inches thick. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. Just below is about 2 inches of light brownish-gray silt loam. The subsoil, about 24 inches thick, is brown to dark grayish-brown and is dominantly silty clay. It has yellowish-brown mottles. The underlying material is olive-brown silty clay loam glacial till that is mottled and calcareous.

Blount soils are low in content of organic matter. The supply of phosphorus is low, and the supply of potassium is medium or high. Available moisture capacity is high, and permeability is slow. Runoff is slow on the nearly level soils and medium on the gently sloping ones. The plow layer is medium acid in areas that have not been limed.

These soils are well suited to corn, soybeans, and small grains. Crops on these soils respond well to lime and fertilizer. Wetness is a major limitation in the nearly level soils. On eroded gently sloping soils, erosion is the major hazard.

Representative profile of Blount silt loam, 0 to 2 percent slopes, in a cultivated field; 858 feet south and 125 feet west of the northeast corner of SE¼ sec. 8, T. 22 N., R. 10 E.:

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

A2—7 to 9 inches, light brownish-gray (10YR 6/2) silt loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, thin, platy structure; friable; slightly acid; abrupt, smooth boundary.

B1—9 to 13 inches, grayish-brown (10YR 5/2) silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; medium acid; clear, wavy boundary.

B21t—13 to 18 inches, brown (10YR 4/3) silty clay; many, medium, distinct, grayish-brown (10YR 5/2) mottles; strong, medium, angular blocky structure; firm; thin, faint, dark-gray (10YR 4/1) clay films on most ped faces; a few, soft, round, black (N 2/0) manganese concretions; medium acid; clear, wavy boundary.

B22t—18 to 27 inches, dark grayish-brown (10YR 4/2) silty clay; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure parting to strong, coarse, angular blocky; very firm; thin, distinct, dark-gray (10YR 4/1) clay films on all ped faces; a few, soft, round, black (N 2/0) manganese concretions; strongly acid; abrupt, wavy boundary.

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

Soil	Acres	Percent
Blount silt loam, 0 to 2 percent slopes	52, 898	20. 8
Blount silt loam, 2 to 4 percent slopes	2, 268	. 9
Blount silt loam, 2 to 4 percent slopes, eroded	2, 362	. 9
Borrow pits	975	. 4
Brookston silty clay loam	18, 613	7. 3
Brookston silty clay loam, stony subsoil	6, 233	2. 4
Carlisle muck	1, 242	. 5
Crosby silt loam, 0 to 2 percent slopes	18, 983	7. 5
Crosby silt loam, stony subsoil, 0 to 2 percent slopes	669	. 3
Fox silt loam, 0 to 2 percent slopes	3, 141	1. 2
Fox silt loam, 2 to 6 percent slopes	4, 048	1. 6
Fox gravelly clay loam, 2 to 6 percent slopes, severely eroded	283	. 1
Fox gravelly clay loam, 6 to 12 percent slopes, severely eroded	1, 171	. 5
Fox loam, 6 to 12 percent slopes, eroded	518	. 2
Fox loam, 12 to 18 percent slopes, eroded	642	. 3
Genesee silt loam	1, 563	. 6
Gravel pits and Stone quarries	300	. 1
Hennepin loam, 18 to 50 percent slopes	1, 918	. 8
Kokomo silty clay loam, stratified substratum	4, 078	1. 6
Kokomo mucky silt loam, stratified substratum	1, 207	. 5
Linwood muck	1, 115	. 4
Made land	1, 000	. 4
Martinsville loam, 0 to 2 percent slopes	658	. 3
Martinsville loam, 2 to 6 percent slopes	863	. 3
Martinsville sandy loam, 6 to 12 percent slopes, eroded	304	. 1
Miami silt loam, 0 to 2 percent slopes	8, 300	3. 3
Miami silt loam, 2 to 6 percent slopes, eroded	11, 037	4. 3
Miami silt loam, 6 to 12 percent slopes, eroded	1, 136	. 4
Miami silt loam, 12 to 18 percent slopes	320	. 1
Miami silt loam, gravelly substratum, 0 to 2 percent slopes	1, 940	. 8
Miami silt loam, gravelly substratum, 2 to 6 percent slopes	814	. 3
Miami silt loam, gravelly substratum, 6 to 12 percent slopes, eroded	496	0. 2
Miami silt loam, heavy substratum, 0 to 2 percent slopes	393	. 2
Miami silt loam, heavy substratum, 2 to 6 percent slopes	631	. 2
Miami clay loam, 2 to 6 percent slopes, severely eroded	1, 217	. 5
Miami clay loam, 6 to 12 percent slopes, severely eroded	3, 603	1. 4
Morley silt loam, 2 to 6 percent slopes	4, 042	1. 6
Morley silt loam, 2 to 6 percent slopes, eroded	12, 998	5. 1
Morley silt loam, 6 to 18 percent slopes, eroded	781	. 3
Morley silt loam, gravelly substratum, 2 to 6 percent slopes, eroded	390	. 2
Morley silt loam, gravelly substratum, 6 to 12 percent slopes, eroded	453	. 2
Morley silty clay loam, 2 to 6 percent slopes, severely eroded	2, 089	. 8
Morley silty clay loam, 6 to 12 percent slopes, severely eroded	2, 301	. 9
Ockley silt loam, 0 to 2 percent slopes	440	. 2
Ockley silt loam, 2 to 6 percent slopes	484	. 2
Pewamo silty clay loam	57, 136	22. 4
Pewamo silty clay loam, stratified substratum	2, 744	1. 1
Pewamo and Brookston silt loams, overwash	1, 369	. 5
Rensselaer silty clay loam	7, 981	3. 1
Ross silt loam	380	. 2
Sebewa silty clay loam	872	. 3
Shoals silt loam	574	. 2
Sloan silt loam	810	. 3
Wallkill silt loam	357	. 1
Permanent streams and reservoirs	1, 580	. 6
Total	254, 720	100. 0

B3—27 to 33 inches, grayish-brown (10YR 5/2) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, angular blocky structure; firm; thin, distinct, dark-gray (10YR 4/1) clay films on many ped faces; common nodules of secondary lime; calcareous.

C—33 to 60 inches, olive-brown (2.5Y 4/4) silty clay loam till; many, medium, distinct, yellowish-brown (10YR 5/4) and gray (10YR 5/1) mottles; massive; firm; a few, dark-gray (10YR 4/1) organic coatings and clay coatings in root channels and in cracks; a few glacial pebbles that increase in number with depth; calcareous.

The A horizon is 6 to 10 inches thick. The B horizon ranges in texture from silty clay loam to silty clay. The A horizon is lighter colored and finer textured in eroded areas because material from the B horizon has been mixed with the remaining A horizon. Depth to the C horizon is 20 to 40 inches. This horizon ranges from clay loam to silty clay loam in texture and from brown to olive brown in color.

Blount soils have a finer textured, more compact subsoil than Crosby soils but occupy similar positions on the landscape. They lack the cobblestones and boulders in the subsoil typical of the stony subsoil phase of Crosby soils.

Blount silt loam, 0 to 2 percent slopes (BlA).—Most areas of this soil are on broad flats in the northern two-thirds of the county, but small areas occur as islands in large darker colored depressions. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas that have slopes of 2 to 4 percent and some areas that are moderately eroded. Also included are small areas of very poorly drained Pewamo soils.

This Blount soil is used intensively for crops (fig. 8), though wetness is a major limitation. If this soil is

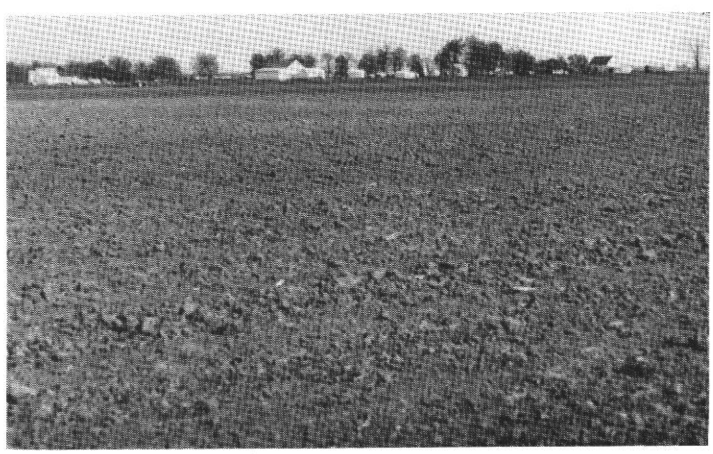

***Figure 8.*—Plowed field mostly of a Blount silt loam prepared for planting corn.**

drained, it is well suited to all crops commonly grown in the county. Capability unit IIw–2.

Blount silt loam, 2 to 4 percent slopes (BlB).—This soil occupies knolls, small ridges, and divides near small drainageways in the northern two-thirds of the county. The combined thickness of the surface layer and subsoil is 4 to 8 inches thinner than in the profile described as representative for the series. The mapped areas generally are 1 to 5 acres in size.

Included with this soil in mapping are small areas of moderately eroded soils. Also included are small narrow drainageways made up of very poorly drained Pewamo soils.

This soil is used intensively for crops, though wetness is a major limitation. The soil also is susceptible to erosion. If this soil is drained, it is well suited to all crops commonly grown in the county. Capability unit IIe–12.

Blount silt loam, 2 to 4 percent slopes, eroded (BlB2).—This soil occupies knolls, ridges, and divides near drainageways in the northern two-thirds of the county. The plow layer is a mixture of the original grayish-brown surface soil and the yellowish-brown clayey subsoil. The combined thickness of the surface layer and subsoil is 8 to 12 inches thinner in this soil than in the profile described as representative of the series. Mottling occurs at a depth of 8 to 18 inches.

Included with this soil in mapping are small areas that are only slightly eroded. Also included are fairly large areas where erosion has removed all of the original surface layer and the clayey subsoil is exposed. Other small areas consist of well-drained Morley soils.

This Blount soil is subject to further erosion, is more difficult to cultivate than the less eroded soils, and becomes cloddy if worked when wet. It is used intensively for crops, and it is suited to all crops commonly grown in the county. If feasible, all farming should be on the contour to help control erosion. Adequate drainage can be provided in many places by use of random tile. Capability unit IIe–12.

Borrow Pits

Borrow pits (Bp) are areas from which the original surface soil and underlying material have been removed by excavation. The depth of the excavations ranges from 1 to 4 feet. Below the deeper excavations, the soil material is medium textured to moderately fine textured, calcareous, glacial till.

Some areas of Borrow pits have been refilled with commercial waste material, stones, or gravel, and some have been filled in with surrounding soil and are now farmed. Commercial or residential buildings have been built on most of the areas, and topsoil has been added in places so that lawn grasses can be established. Idle areas support such vegetation as shrubs, weeds, or native grasses. Water stands in the vacant areas during wet periods. Capability unit VIIe–2.

Brookston Series

The Brookston series consists of deep, nearly level and depressional, very poorly drained soils on uplands. These soils occur mostly in the southern third of the county. They formed in glacial till that has a mantle of loess as much as 18 inches thick. The native vegetation was mixed hardwoods, swamp grasses, and sedges.

In a representative profile the surface layer is about 12 inches of very dark gray silty clay loam. The subsoil, about 38 inches thick, is firm clay loam and silty clay loam that is neutral throughout. It is dark gray mottled with brown in the upper part and olive gray mottled with yellowish brown in the lower part. The underlying material is grayish-brown, mottled, calcareous loam glacial till.

Brookston soils are high in content of organic matter. The supplies of phosphorus and potassium are low. Available moisture capacity is high, and permeability is slow. Runoff is very slow, and water ponds on the surface in places. The plow layer is neutral in areas that have not been limed. The subsoil is neutral.

These soils are well suited to corn, soybeans, and small grains. Crops on these soils respond well to fertilizer. Wetness is the major limitation. Lime is not needed.

Representative profile of Brookston silty clay loam in a cultivated field; 924 feet south and 705 feet west of the northeast corner of SE¼ sec. 7, T. 19 N., R. 10 E.:

Ap—0 to 9 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A12—9 to 12 inches, very dark gray (10YR 3/1) light silty clay loam; weak, fine, subangular blocky structure; firm; neutral; clear, smooth boundary.

B21tg—12 to 25 inches, dark-gray (5Y 4/1) silty clay loam; common, fine, distinct, brown (10YR 4/3) mottles; moderate, fine, angular and subangular blocky structure; firm; thin very dark gray (10YR 3/1) clay films on many ped faces; neutral, clear, wavy boundary.

B22tg—25 to 37 inches, olive-gray (5Y 5/2) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, angular blocky structure; firm; thick dark-gray (5Y 4/1) clay films on all ped faces; neutral; clear, wavy boundary.

B23tg—37 to 50 inches, olive-gray (5Y 5/2) clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure parting to moderate, medium and coarse, angular blocky; firm; thick dark-gray (5Y 4/1) clay films on ped faces; neutral; abrupt, wavy boundary.

Cg—50 to 60 inches, grayish-brown (10YR 5/2) loam till; many, medium, distinct, olive-brown (2.5Y 4/4) and dark yellowish-brown (10YR 5/4) mottles; massive; friable; thin gray (10YR 5/1) coatings and clay films along root channels and in cracks; calcareous.

The Ap horizon is heavy silt loam or silty clay loam. The A horizon ranges from 10 to 15 inches in thickness. The B horizon is clay loam to silty clay loam. Because of its sand content, the material in the B22tg horizon generally feels gritty when rubbed between the fingers. The C horizon is at a depth of 30 to 55 inches. It ranges in texture from loam to light clay loam.

Brookston soils have a coarser textured, less compact subsoil than Pewamo soils, and they lack the silty subsoil and underlying lacustrine silt and clay typical of the stratified substratum of Pewamo soils. Their underlying material lacks the stratified sand, silt, and gravel typical of Rensselaer soils.

Brookston silty clay loam (0 to 2 percent slopes) (Br).—Most areas of this soil are on broad flats and in depressions in the uplands. Some areas, however, are long and narrow and extend into higher areas of surrounding soils. This soil has the profile described as representative of the series. Layers of sandy, gravelly, or silty material 4 to 6 inches thick are immediately above the underlying glacial till in places. The mapped areas generally are 2 to 40 acres or more in size.

Included with this soil in mapping are small areas of very poorly drained Rensselaer soils and somewhat poorly drained Crosby soils. Also included are small areas of a soil that has a medium-textured surface layer.

This Brookston soil is used intensively for crops, though wetness is a major limitation. If this soil is drained, it is well suited to all crops commonly grown in the county. The soil is sticky when wet, and it becomes cloddy if worked when wet. Capability unit IIw–1.

Brookston silty clay loam, stony subsoil (0 to 2 percent slopes) (Bs).—This soil is on flats and in depressions on outwash areas and on terraces throughout the county. Many boulders and cobblestones are in the subsoil. The underlying material is stratified gravelly sandy loam, gravelly loam, and gravelly silt loam. The mapped areas range from 2 to 20 acres or more in size.

Included with this soil in mapping are areas of somewhat poorly drained Crosby silt loam, stony subsoil, 0 to 2 percent slopes, and areas of soils that have a medium-textured surface layer. In many places this soil is adjacent to areas of very poorly drained Pewamo soils and of the somewhat poorly drained Crosby silt loam, stony subsoil, 0 to 2 percent slopes.

Most areas of this Brookston soil are used intensively for crops, though wetness is a major limitation. If this soil is drained and the cobblestones and boulders are removed, it is well suited to all crops commonly grown in the county. The cobblestones and boulders in the subsoil and near the surface hinder the installing of drainage tile and interfere with other farming operations. A few areas can be used only as pasture because the boulders and cobblestones have not been removed. Capability unit IIw–1.

Carlisle Series

The Carlisle series consists of deep, very poorly drained soils on broad flats and in pockets. These soils occur throughout the county. They formed in fibrous plant remains derived from native grasses, sedges, reeds, and woody plants.

In a representative profile the surface layer is black porous muck about 7 inches thick. Below are friable layers of black and dark reddish-brown muck and partly decomposed grasses and sedges. These layers are slightly acid to medium acid. Brownish to dark olive-gray peat and sedimentary peat are at a depth of about 31 inches. The peat is slightly acid to neutral and is very porous.

Carlisle soils are very high in content of organic matter. The supplies of phosphorus and potassium are low. Available moisture capacity is very high, and permeability is moderately rapid. Runoff is very slow, and water ponds on the surface in places. The plow layer is slightly acid to medium acid in areas that have not been limed.

These soils are a good source for peat and humus. If they are drained, they are well suited to corn, soybeans, and tuberous root crops. Crops on these soils respond well to lime and fertilizer. Wetness is the major limitation.

Representative profile of Carlisle muck in a cultivated field; 720 feet east and 990 feet north of the southwest corner of SW1/4 sec. 29, T. 22 N., R. 9 E.:

1—0 to 7 inches, black (N 2/0) muck; moderate, very fine and fine, granular structure; friable; neutral; abrupt, wavy boundary.

2—7 to 13 inches, black (N 2/0) muck; very weak, coarse, subangular blocky structure parting to moderate, fine and medium, granular; friable; neutral; clear, smooth boundary.

3—13 to 17 inches, black (N 2/0) muck; common, medium, dark reddish-brown (5YR 3/2) iron stains; moderate, medium, granular structure; friable; slightly acid; abrupt, smooth boundary.

4—17 to 23 inches, dark reddish-brown (5YR 2/2) muck; moderate, medium and thick, platy structure; friable; small amounts of partly decomposed roots and sedges; slightly acid; abrupt, smooth boundary.

5—23 to 31 inches, dark reddish-brown (5YR 2/2) muck that is 30 percent partly decomposed wood fragments and sedges; weak, thin, platy structure; friable; a few, discontinuous, fine lenses of gray (7.5YR 5/0) silt and clay; slightly acid; abrupt, smooth boundary.

6—31 to 60 inches, dark olive-gray (5Y 3/2) partly decomposed sedges, leaves, stems, and woody material that is about 26 percent fibers; very weak, thin, platy structure; friable; neutral.

The content of partly decomposed reeds, sedges, and woody fragments in the upper 3 feet ranges from 10 to 45 percent. In a few isolated areas the content of woody fragments may be more than 50 percent. At a depth of 17 to 31 inches, the color ranges from black to dark reddish brown. The material below a depth of 30 to 48 inches ranges from herbaceous peaty material to sedimentary peat that seems rubbery.

Carlisle soils lack the underlying layers of medium-textured mineral material typical of Linwood soils. Also, they lack the dark grayish-brown recent alluvium that is 10 to 20 inches thick over the organic layers in Wallkill soils.

Carlisle muck (0 to 1 percent slopes) (Ca).—This is the only Carlisle soil mapped in the county. The areas range from 1 to 40 acres. In a few places thin layers of mineral material are present in the muck, and in many places partly decomposed chunks of wood are common in the lower part.

Included with this soil in mapping are small areas of very poorly drained Linwood and Wallkill soils.

If this soil is drained, it is well suited to row crops and to special crops. Some areas are not used for crops because they are low. Several areas of this soil contain peat of high enough quality to be mined for commercial markets (fig. 9). Capability unit IIIw–8.

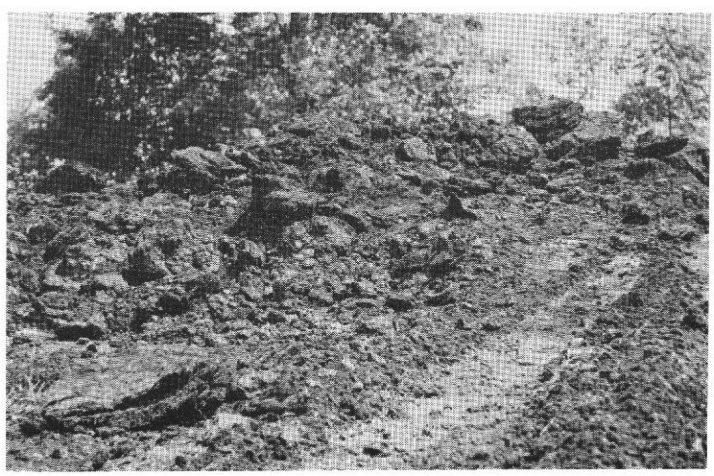

Figure 9.—Chunks of raw peat taken from Carlisle muck.

Crosby Series

The Crosby series consists of deep, nearly level, somewhat poorly drained soils on uplands. These soils are mostly in the southern third of the county. They formed in glacial till that had a mantle of loess 7 to 11 inches thick. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. Just below is about 2 inches of grayish-brown silt loam. The subsoil, about 23 inches thick, is firm and slightly acid. It is dark yellowish-brown silty clay loam in the upper part and yellowish-brown clay loam in the lower part. Grayish-brown mottles occur throughout the subsoil. The underlying material is yellowish-brown calcareous loam glacial till. It has gray and light brownish-gray mottles.

Crosby soils are low in content of organic matter. The supply of phosphorus is low, and the supply of potassium is medium or high. Available moisture capacity is high, and permeability is slow. Runoff is slow on the nearly level soils and medium on the gently sloping ones. The plow layer is medium acid in areas that have not been limed.

These soils are well suited to corn, soybeans, and small grains. Crops on these soils respond well to lime and fertilizer. Wetness is the major limitation.

Representative profile of Crosby silt loam, 0 to 2 percent slopes, in a cultivated field; 594 feet west and 924 feet south of the northeast corner of SE¼ sec. 32, T. 20 N., R. 10 E.:

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

A2—7 to 9 inches, grayish-brown (10YR 5/2) silt loam; common, fine, distinct, yellowish-brown (10YR 5/4 to 5/6) mottles; moderate, fine and medium, granular structure; friable; medium acid; abrupt, smooth boundary.

B1—9 to 12 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; many, medium, distinct, grayish-brown (10YR 5/2) mottles; weak, fine and medium, subangular blocky structure; firm; dark-gray (10YR 4/1) clay films and silt films on all ped faces; medium acid; clear, smooth boundary.

B21tg—12 to 15 inches, dark yellowish-brown (10YR 4/4) silty clay loam; many, medium, distinct, grayish-brown (10YR 5/2) and gray (10YR 5/1) mottles; moderate, medium and coarse, angular and subangular blocky structure; firm; dark-gray (10YR 4/1) clay films on most ped faces; slightly acid; clear, smooth boundary.

B22tg—15 to 24 inches, yellowish-brown (10YR 5/4) clay loam; many, medium, distinct, grayish-brown (10YR 5/2) mottles; moderate, medium and coarse, angular blocky structure; firm; dark-gray (10YR 4/1) and very dark grayish-brown (10YR 3/2) clay films on all ped faces; slightly acid; clear, smooth boundary.

B23tg—24 to 32 inches, yellowish-brown (10YR 5/6) clay loam; many, medium, distinct, grayish-brown (10YR 5/2) mottles; weak, medium, prismatic structure parting to moderate, medium and coarse, angular blocky; firm; dark-gray (10YR 4/1) and very dark grayish-brown (10YR 3/2) clay films on most ped faces, in voids, and penetrating as far as 3 inches into the C horizon; neutral; clear, smooth boundary.

C—32 to 60 inches, yellowish-brown (10YR 5/6) loam till; many, medium, distinct, gray (10YR 6/1) and light brownish-gray (10YR 6/2) mottles; massive; friable; many manganese and secondary lime concretions; calcareous.

The Ap horizon is mainly silt loam, but in places it contains enough sand to feel gritty. The A horizon ranges from 7 to 12 inches in thickness. Texture of the B horizon ranges from clay loam to silty clay loam. The C horizon is at a depth of 28 to 42 inches. It ranges from loam to light clay in texture and from yellowish brown to brown in color. In places on the gentle slopes, material formerly in the subsoil is mixed with the remaining surface layer. As a result, in these places the A horizon is lighter colored and finer textured than that in the representative profile.

Crosby soils have a coarser textured, less compact subsoil than Blount soils but occupy similar positions on the landscape. Their subsoil is not so brown as that in the higher lying Miami soils.

Crosby silt loam, 0 to 2 percent slopes (CrA).—This soil has the profile described as representative of the series. Some areas are large, and others occur as small islands in large dark-colored depressions. The mapped areas generally are 1 to 40 acres in size.

Included with this soil in mapping are small areas of Crosby soils on 2 to 4 percent slopes and small areas of very poorly drained Brookston soils.

This soil is used intensively for crops, though wetness is the major limitation. If drained, this soil is well suited to all crops commonly grown in the county. Capability unit IIw–2.

Crosby silt loam, stony subsoil, 0 to 2 percent slopes (CsA).—This soil occupies terrace and outwash areas. The subsoil is gravelly, and it contains many cobblestones and boulders. The underlying material is stratified gravelly sandy loam, gravelly silt loam, and gravelly loam. Mapped areas of this soil range from 1 to 10 acres or more.

Included with this soil in mapping are small areas of soils that have 2 to 6 percent slopes and small areas of very poorly drained Brookston silty clay loam, stony subsoil. Also included are areas of soils that are adjacent to streams and have loose sand and gravel at a depth of 5 to 6 feet.

This soil is used mostly for crops, though wetness is the major limitation. If this soil is drained and the boulders and cobblestones are removed, it is well suited to all crops commonly grown in the county. Capability unit IIw–2.

Fox Series

The Fox series consists of well-drained, nearly level to strongly sloping soils that are moderately deep to gravel and sand. They formed in loamy outwash and are on terraces, kames, and eskers throughout the county. The native vegetation on these soils was mixed hardwood trees.

In a representative profile the surface layer is about 8 inches of dark grayish-brown silt loam. Just below is about 3 inches of brown silt loam. The subsoil, which is about 28 inches thick, is dominantly brown to reddish-brown, firm clay loam. It is heavy silt loam in the upper several inches and gravelly clay loam below. Loose, stratified, calcareous gravel and sand are at a depth between 20 and 40 inches.

Fox soils are low in content of organic matter. The supply of phosphorus is low in these soils, and the content of potassium is medium. Available moisture capacity and permeability are moderate. Runoff is very slow on the nearly level soils, but it is rapid on the strongly sloping soils. The plow layer is medium acid in areas that have not been limed.

These soils are well suited to fall-seeded small grains and to legumes and hay crops. Corn and soybeans grow well. Crops on these soils respond well to lime and fertilizer. The major hazards are erosion on sloping areas and droughtiness during long dry periods.

Representative profile of Fox silt loam, 0 to 2 percent slopes, in a cultivated field; 726 feet west and 140 feet south of the northeast corner of NW¼ sec. 28, T. 20 N., R. 11 E.:

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

A2—8 to 11 inches, brown (10YR 5/3) silt loam; weak, medium, platy structure parting to moderate, fine and medium, granular; friable; medium acid; abrupt, smooth boundary.

B1—11 to 16 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak, medium, subangular blocky structure; friable; strongly acid; abrupt, wavy boundary.

IIB21t—16 to 23 inches, reddish-brown (5YR 4/4) clay loam; moderate, fine, subangular blocky structure; firm; thin dark-brown (7.5YR 3/2) clay films on many ped faces; strongly acid; clear, wavy boundary.

IIB22t—23 to 34 inches, brown (7.5YR 4/4) clay loam that is 5 percent gravel; moderate, medium and coarse, subangular blocky structure; firm; medium dark-brown (7.5YR 3/2) clay films on most ped faces; strongly acid; clear, wavy boundary.

IIB3—34 to 39 inches, dark yellowish-brown (10YR 3/4) gravelly clay loam that is 10 percent cobblestones; weak, medium and coarse, subangular blocky structure; firm; medium very dark grayish-brown (10YR 3/2) clay films on some ped faces and in root channels and cracks; neutral; abrupt, irregular boundary.

IIIC—39 to 60 inches, brown (10YR 5/3) and pale-brown (10YR 6/3) gravel and sand; single grain; loose; calcareous.

The Ap horizon is silt loam, loam, or gravelly clay loam. The B horizon ranges from heavy silt loam to clay loam and sandy loam or gravelly clay loam. In places tongues of material 3 to 10 inches wide extend from this horizon to as deep as 3 feet into the C horizon.

In some eroded areas, much of the original A horizon has been washed away and material formerly in the B horizon has been mixed with the remaining A horizon. In such areas the A horizon is lighter colored and finer textured than that described in the representative profile.

Fox soils are shallower to loose sand and gravel than Ockley soils but occupy similar positions on the landscape. They have more gravel in the lower subsoil than Martinsville soils, but they lack the underlying horizons of stratified sand and silt typical of those soils.

Fox silt loam, 0 to 2 percent slopes (FsA).—This soil occupies terraces and outwash areas throughout the county. It has the profile described as representative for the series. Depth to limy gravel varies within short distances, but it generally is 30 to 40 inches. The mapped areas range from 2 to 30 acres or more in size.

Included in mapping with this soil are small areas of soil that has silty and clayey material in the substratum. Also included are some areas that have boulders in the lower subsoil.

This Fox soil is droughty in summer. It is easy to till and is used intensively for crops. This soil is well suited to fall-seeded small grains and alfalfa, and it is suited to all crops commonly grown in the county. Capability unit IIs–1.

Fox silt loam, 2 to 6 percent slopes (FsB).—This soil occupies knolls and ridges within terraces and outwash areas throughout the county. Slopes are short and are dissected by short drainageways. About one-third of the acreage is moderately eroded. In these areas plowing has mixed material formerly in the subsoil with the remaining surface layer. Depth to limy sand and gravel varies within short distances, but it generally is 28 to 34 inches.

Included with this soil in mapping are small areas of soil that has silty and clayey material in the substratum. Also included are soils that have a surface layer of loam or sandy loam.

This Fox soil is susceptible to erosion and is droughty in summer. It is used intensively for crops, and it is suited to all crops commonly grown in the county. If feasible, all farming should be on the contour to avoid further erosion. Capability unit IIe–9.

Fox gravelly clay loam, 2 to 6 percent slopes, severely eroded (FxB3).—This soil occupies breaks within terraces and outwash areas throughout the county and is adjacent to streams. The slopes are short and in the same area they frequently face different directions. Erosion has removed most of the original surface layer. The plow layer is now dominantly brown to reddish-brown clay loam that formerly was in the subsoil. It is finer textured than that in the profile described for the series. In many places the subsoil and underlying gravelly material are exposed. Depth to loose gravel and sand is about 30 inches.

Included with this soil in mapping are small areas of soil that is moderately eroded.

This soil is droughty most of the year. It is subject to further erosion, and practices that control erosion are needed. Stones on the surface make tillage difficult in places. Capability unit IIIe–9.

Fox gravelly clay loam, 6 to 12 percent slopes, severely eroded (FxC3).—This soil occupies breaks within terraces and outwash areas throughout the county and is adjacent to streams. The slopes are both convex and concave, and in places gravelly material is exposed. Erosion has removed most of the original surface layer. The plow layer is now dominantly brown to reddish-brown gravelly clay loam that formerly was in the subsoil. It is finer textured than that in the profile described for the series. Depth to loose gravel and sand generally is 24 to 30 inches, but it is as little as 18 inches in places.

Included with this soil in mapping are small areas of soil that has 12 to 18 percent slopes and is moderately eroded.

This Fox soil is subject to further erosion and is droughty for several months of the year. In addition gravel and cobblestones on the surface make tillage difficult. The soil is well suited to pasture and hay crops, but practices that control erosion are needed to maintain crop growth. Capability unit IVe–9.

Fox loam, 6 to 12 percent slopes, eroded (FoC2).—This soil occupies breaks and short slopes on terraces, kames, and eskers throughout the county. The plow layer is a mixture of grayish-brown material from the original surface layer and of yellowish-brown material formerly in the subsoil. In places the dark reddish-brown subsoil is exposed. Depth to gravel and sand generally is 24 to 30 inches, but in places it is as little as 20 inches.

This soil is subject to further erosion and is droughty in summer. It is more difficult to cultivate than the less eroded soils and it becomes cloddy if worked when too wet. If erosion is controlled, the soil is suited to the crops commonly grown in the county. Crops on this soil respond well to lime and fertilizer. This soil is commonly used as a source of gravel and sand. Capability unit IIIe–9.

Fox loam, 12 to 18 percent slopes, eroded (FoD2).—This soil occupies breaks and ridges throughout the county near eskers and near large streams. The plow layer is a mixture of the grayish-brown material of the original surface layer and of reddish-brown material formerly in the subsoil. Reddish subsoil material and gravelly material are exposed in places. Depth to gravel and sand generally is 24 to 30 inches, but in places depth to gravel is 20 to 24 inches.

Included with this soil in mapping are small areas of soil that are slightly eroded and severely eroded.

This soil is subject to further erosion, and stones and gravel on the surface make cultivation difficult in places. It is well suited to pasture and hay crops. The areas are small and generally are used and managed the same as the surrounding soils. Crops respond well to lime and fertilizer. Capability unit IVe–9.

Genesee Series

The Genesee series consists of deep, nearly level, well-drained soils on flood plains of streams throughout the county. These soils formed in recent loamy and silty stream sediment. The native vegetation was mainly hardwood trees.

In a representative profile the surface layer is about 8 inches of dark-brown calcareous silt loam. The subsoil, about 18 inches thick, is dark-brown friable silt loam. The underlying material is brown friable silt loam.

Genesee soils are low to medium in content of organic matter. They are calcareous and have high natural fertility. Available moisture capacity is high, and permeability is moderate. Runoff is slow.

These soils are better suited to corn and soybeans than to fall-seeded small grains. They have few limitations for crops, but they are subject to annual flooding for short periods. Crops on these soils respond well to fertilizer. Lime is not needed.

Representative profile of Genesee silt loam in a cultivated field; 462 feet east and 990 feet north of southwest corner of SW¼ sec. 30, T. 20 N., R. 9 E.:

Ap—0 to 8 inches, dark-brown (10YR 3/3) silt loam, gray (10YR 6/1) when dry; weak, medium and coarse, granular structure; friable; thin, very dark gray (10YR 3/1) organic coatings on many ped faces; moderately alkaline (calcareous); abrupt, smooth boundary.

B—8 to 26 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; thin, very dark grayish-brown (10YR 3/2) organic coatings in cracks and root channels; moderately alkaline (calcareous); clear, smooth boundary.

C—26 to 60 inches, brown (10YR 4/3) silt loam; massive; friable; moderately alkaline (calcareous).

The Ap horizon is dark-brown or brown silt loam or loam. In places this horizon contains enough sand to make it feel gritty. The surface layer ranges from mildly alkaline to strongly alkaline. The underlying horizons range to heavy silt loam, sandy loam, or loam and extend to a depth of 36 to 55 inches.

These soils are outside the defined range of the Genesee series in that they are slightly calcareous. They are enough alike the Genesee series in composition and behavior that a new series is not warranted.

Genesee soils are lighter colored throughout than Ross soils. They are not so gray as Shoals soils, and they lack the brown and gray mottles below the surface layer that is typical of those soils.

Genesee silt loam (0 to 2 percent slopes) (Ge).—This is the only Genesee soil mapped in the county. Thin lenses of loam, sandy loam, or silty clay loam are common throughout the lower layers.

Included with this soil in mapping are small areas of soils that have a surface layer of loam and silty clay loam. Also included are small areas of soils that have mottles below a depth of 18 inches. In other small areas loose sand and gravel are at a depth of 40 inches.

This soil has few limitations for crops, though it is subject to occasional flooding. It is well suited to such row crops as corn and soybeans. Late planting or replanting is sometimes necessary because of flooding in spring. Capability unit I–2.

Gravel Pits and Stone Quarries

Gravel pits and Stone quarries (Gp) are widely distributed throughout the county, but they occur mostly along streams and around eskers or kames. In places most of the sand and gravel has been removed and both limestone and gravel are being quarried from the same pit (fig. 10).

The deposits of gravel and sand in the pits range from 10 to 50 feet in thickness. The stone in the quarries is excavated to a depth of 50 feet or more from the top of the bedrock. Areas of Gravel pits and Stone quarries are shown on the map by a symbol.

The limestone removed from the quarries is used for roads and for agricultural lime and concrete. The gravel and sand are used for concrete, roads, and construction work. Abandoned pits are used for various purposes. In some of the pits, willows and woody shrubs are growing and there are permanent pools of water. These areas provide cover and food for wildlife. Other pits are being used for disposal of garbage. One pit that had been abandoned is now used as a source of flagstones and colored stones for decorative use. Capability unit VIIIs–2.

Hennepin Series

In the Hennepin series are deep, well-drained soils. These steep soils occur throughout the county on breaks along the major streams and between the uplands and the low terraces. They formed in glacial till under mixed hardwoods.

In a representative profile the surface layer is very dark gray loam about 3 inches thick. The yellowish-brown and brown subsoil is neutral and calcareous, firm clay loam that is about 11 inches thick. It is underlain by brown calcareous clay loam glacial till.

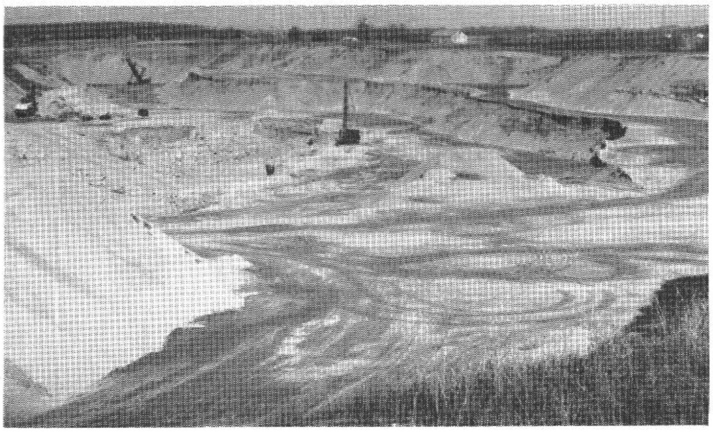

Figure 10.—**Pit formerly used as source of gravel and sand, but that is now used as a source of limestone. Limestone quarry is left of derrick in center.**

In the Hennepin soils the surface layer is high in content of organic matter. Available moisture capacity is high. Runoff is very rapid, and permeability is moderate or moderately slow. The supplies of phosphorus and potassium are low.

Hennepin soils are suited to limited grazing, to woodland, and to wildlife. Steep slopes and susceptibility to erosion are the major limitations.

Representative profile of Hennepin loam, 18 to 50 percent slopes, in a wooded field; 660 feet west and 700 feet north of the center of sec. 12, T. 22 N., R. 9 E.:

- A1—0 to 3 inches, very dark gray (10YR 3/1) loam; weak, medium, granular structure; friable; 2 percent gravel; slightly acid; abrupt, smooth boundary.
- B21—3 to 8 inches, yellowish-brown (10YR 5/4) light clay loam; weak, fine, subangular blocky structure; firm; thin very dark gray (10YR 3/1) organic films and clay films on all ped faces and in root channels; 15 percent gravel; neutral; abrupt, wavy boundary.
- B22—8 to 14 inches, brown (10YR 5/3) clay loam; weak, medium, subangular blocky structure; firm; thin, very dark gray (10YR 3/1) organic films and clay films in root channels and cracks; 7 percent gravel; moderately alkaline (calcareous).
- C—14 to 60 inches, brown (10YR 5/3) clay loam; massive; firm; moderately alkaline (calcareous).

The A horizon is very dark brown to very dark gray silt loam or loam. The B horizon ranges in texture from heavy silt loam to light clay loam. The C horizon, which is at a depth of 14 to 20 inches, is clay loam to loam. In eroded areas that have been pastured, much of the original surface layer has been washed away and material formerly in the B horizon has been mixed with the remaining A horizon. In these areas the A horizon is lighter colored and finer textured than that in the representative profile.

Hennepin soils have a coarser textured B horizon than the sloping Miami and Morley soils and are less deep to the C horizon.

Hennepin loam, 18 to 50 percent slopes (HeE).—This is the only Hennepin soil mapped in the county. In places the soil material on the upper part of the slopes contains gravel. Escarpments make up the narrowest breaks. All areas of this soil are long, winding, and narrow, and they range from 3 to 8 acres.

Included with this soil in mapping are small areas that have a substratum of loose gravel and sand. Also included are small areas of severely eroded and moderately eroded soils and many areas where calcareous material is exposed.

Steep slopes and the hazard of erosion make it difficult to use farm machinery on this soil. Keeping a cover of vegetation on the areas helps to control erosion. Under good management, this soil is well suited to trees. Most areas are used as woodland, and native hardwoods are the dominant trees. Some areas are pastured along with surrounding areas of less steep soils. Capability unit VIIe-2.

Kokomo Series

The Kokomo series consists of deep, nearly level, very poorly drained soils in lakebeds and valley trains throughout the county. These soils formed in silty and sandy lacustrine sediment that had a mantle of loess as much as 18 inches thick. The native vegetation was hardwoods, grasses, and sedges that could tolerate wetness.

In a representative profile the surface layer is very dark gray silty clay loam about 16 inches thick. The subsoil, about 21 inches thick, is firm silty clay loam that is neutral throughout. It is dark gray in the upper part and gray with dark yellowish-brown mottles in the lower part. The underlying material is gray to dark-gray, stratified, calcareous sand and silt.

Kokomo soils are high in content of organic matter. The supplies of phosphorus and potassium are low. Available moisture capacity is high, and permeability is slow. Runoff is very slow, and in places water ponds on the surface. The plow layer is neutral in areas that have not been limed.

These soils are well suited to corn and soybeans, though wetness is a major limitation. Small grains seeded in fall frequently are winterkilled. Seeding small grains early in spring is difficult, however, because the soils occupy low areas where the water table is high. Crops on these soils respond well to fertilizer.

Representative profile of Kokomo silty clay loam, stratified substratum, in a cultivated field; 240 feet north and 100 feet west of the southeast corner of sec. 9, T. 21 N., R. 10 E.:

- Ap—0 to 6 inches, very dark gray (10YR 3/1) silty clay loam; strong, medium and coarse, granular structure; friable; neutral; abrupt, smooth boundary.
- A12—6 to 11 inches, very dark gray (10YR 3/1) silty clay loam; moderate, coarse, angular and subangular blocky structure; firm; neutral; abrupt, smooth boundary.
- A13—11 to 16 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, angular blocky structure; firm; a few, dark-brown (7.5YR 4/4), iron stains; neutral; clear, wavy boundary.
- B21tg—16 to 30 inches, dark-gray (10YR 4/1) heavy silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, coarse, prismatic structure parting to strong, coarse, angular blocky; firm; thick black (10YR 2/1) clay films and organic films on most ped faces and in root channels; neutral; clear, wavy boundary.
- B22tg—30 to 37 inches, gray (10YR 5/1) silty clay loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, coarse, angular and subangular blocky structure; firm; medium very dark gray (10YR 3/1) clay films and organic films on some ped faces and in cracks and root channels; neutral; abrupt, wavy boundary.

C1g—37 to 42 inches, dark grayish-brown (10YR 4/2) silt; many, medium, distinct, dark-brown (7.5YR 4/4) mottles; massive; friable; a few gray (10YR 5/1) clay flows in root channels; calcareous; abrupt, smooth boundary.

C2g—42 to 46 inches, dark-gray (10YR 4/1) stratified silt and fine sand; many, medium, distinct, dark-brown (7.5YR 4/4) mottles; massive to single grain; loose; a few gray (10YR 5/1) clay flows in root channels and in voids; calcareous; abrupt, smooth boundary.

C3g—46 to 60 inches, gray (10YR 5/1), fine and medium sand; thin silt lenses; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; single grain; loose; calcareous.

The Ap horizon is silty clay loam or mucky silt loam. The A horizon is 15 to 18 inches thick. The B horizon ranges in texture from clay loam to silty clay loam or silty clay. The C horizon is mainly stratified sand and silt, but in places it includes gravel. It is at a depth of 30 to 50 inches. The sequence of stratification varies within short distances. In places usable deposits of gravel and sand are at a depth below 60 inches.

Kokomo soils lack the underlying glacial till typical of Pewamo soils, and their B and C horizons are coarser textured. They occupy lower positions on the landscape than Rensselaer soils and are darker colored to a greater depth.

Kokomo silty clay loam, stratified substratum (0 to 2 percent slopes) (Ko).—This soil occupies low lacustrine and outwash areas throughout the county. Many of the areas are long and narrow and occur in the center of small stream valleys. This soil has the profile described as representative of the series. In places gravel and sand are at a depth of 5 to 7 feet. In about 10 percent of the areas, the underlying material is loam to clay loam till. The mapped areas are 2 to 20 acres in size.

Included with this soil in mapping are small areas that have a surface layer of silt loam and small areas underlain by loam glacial till. Also included are small areas of Rensselaer soils.

This soil is used intensively for crops, though wetness is a major limitation. It is sticky when wet and becomes cloddy if worked when too wet. If drained, this soil is well suited to all crops commonly grown in the county. In places, however, drainage outlets are difficult to establish. Also, excess water in winter is likely to severely damage or to destroy crops seeded in fall. Capability unit IIw–1.

Kokomo mucky silt loam, stratified substratum (0 to 2 percent slopes) (Km).—This soil occupies pockets in lakebeds and in outwash throughout the county. The surface layer ranges from 6 to 12 inches in thickness. The subsoil ranges from clay loam to silty clay, and the underlying mineral material ranges from silt to clay and is gravelly in places. The areas range from 1 to 8 acres and are adjacent to areas of Linwood and Carlisle mucks in places.

Included with this soil in mapping are small areas of Kokomo silty clay loam. Also included are small areas of Linwood and Carlisle mucks.

Most areas of this soil are used intensively for crops, though wetness is a major limitation. If drained, this soil is well suited to most crops commonly grown in the county. In places, however, drainage outlets are difficult to establish. Also, excess water in winter is likely to severely damage or to destroy crops seeded in fall. This soil is easier to till than Kokomo silty clay loam, stratified substratum, and preparing a seedbed in it also is easier. Capability unit IIw–1.

Linwood Series

The Linwood series consists of deep, very poorly drained, organic soils on uplands. These soils are in pockets in depressions and in sluiceways. They formed in fibrous remains of grasses, sedges, reeds, and woody materials underlain by medium-textured lacustrine sediment. The native vegetation was grasses, sedges, and reeds.

In a representative profile black porous muck about 26 inches thick is underlain by friable, gray, calcareous silty material.

Linwood soils are very high in content of organic matter. Supplies of phosphorus and potassium are low. Available moisture capacity is very high, and permeability is moderate. Runoff is very slow, and water ponds on the surface in places.

If drained, these soils are well suited to corn, soybeans, and crops that have tuberous roots. Crops on these soils respond well to lime and fertilizer. Wetness is a major limitation. The plow layer is slightly acid if not limed.

Representative profile of Linwood muck in a cultivated field; 925 feet west and 100 feet south of the northwest corner of SW¼ sec. 10, T. 19 N., R. 9 E.:

1—0 to 8 inches, black (N 2/0) muck; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.

2—8 to 26 inches, black (10YR 2/1) muck and partly decomposed fibers and a few woody fragments; moderate, fine and medium, granular structure; neutral; abrupt, wavy boundary.

IIC1g—26 to 37 inches, gray (5Y 5/1) silt loam; massive; friable; common strands and pockets of partly decomposed, dark reddish-brown (5YR 3/3) organic fibers; neutral; abrupt, wavy boundary.

IIC2g—37 to 60 inches, gray (10YR 6/1) silt; a few, medium, distinct, brown (10YR 5/3) mottles; massive; friable; many fine shells; calcareous.

The total thickness of the organic layers ranges from 12 to 40 inches. In places the 8- to 26-inch layer is partly decomposed peat and muck. The underlying material, at a depth of 12 to 40 inches, ranges from loam to silt loam or silt. It contains discontinuous strata of sandy loam material in places.

Linwood soils occupy similar positions on the landscape as Carlisle soils, but the organic material is only 12 to 40 inches thick in Linwood soils. They lack the recent alluvium over the organic layers typical of Wallkill soils.

Linwood muck (0 to 2 percent slopes) (Lm).—This is the only Linwood soil mapped in the county. The areas are mostly long and narrow and follow natural drainageways. They are adjacent to areas of higher lying mineral soils. In many places the underlying material contains lenses of sand and clay. Mapped areas of this soil range from 1 to 15 acres in size.

Included with this soil in mapping are small areas of very poorly drained Carlisle soils and of very poorly drained Kokomo mucky silt loam, stratified substratum. Also included are small areas where the underlying material is silty clay loam.

If drained, this soil is well suited to row crops and to special crops. Wetness is a major limitation, and some areas are not used for crops because drainage outlets are difficult to establish. Capability unit IIw–10.

Made Land

Made land (Ma) consists of soil, rock, and manmade materials that have been used to fill low areas or pits. The fill ranges from 3 to 20 feet in thickness. It ranges from combinations of soil and garbage to combinations of soil and concrete or stone. Below the fill are first bottoms, glacial till, or sand and gravel.

In places areas of this land type have been smoothed over and covered with soil material. Depending on the soil material used, some of the areas are suitable only for limited grazing or for wildlife habitat, and others are suitable for building sites. Capability unit VIIIs-2.

Martinsville Series

Martinsville soils are deep, nearly level and gently sloping, and well drained. These soils are on terraces and outwash areas throughout the county. They formed in loamy and silty outwash underlain by stratified silt and sand that contained some gravel. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is about 7 inches of dark grayish-brown loam. Just below is about 3 inches of brown loam. The subsoil, which is about 33 inches thick, is mainly yellowish-brown silty clay loam and clay loam. In many places, however, it contains enough sand to feel gritty. The underlying material is yellowish-brown, calcareous, stratified silt and sand that in places contains fine gravel.

Martinsville soils are low in content of organic matter. The supplies of potassium and phosphorus are low. Available moisture capacity is high, and permeability is moderate. Runoff is very slow on the nearly level soils, slow on the gently sloping soils, and medium on the moderately sloping soils. The plow layer is medium acid in areas that have not been limed.

These soils are well suited to corn, soybeans, and small grains. Erosion is a hazard on the sloping soils. Crops on these soils respond well to lime and fertilizer.

Representative profile of Martinsville loam, 0 to 2 percent slopes, in a cultivated field; 198 feet east and 125 feet north of the southwest corner of SE¼SW¼ sec. 9, T. 19 N., R. 11 E.:

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

A2—7 to 10 inches, brown (10YR 4/3) loam; weak, medium, platy structure parting to moderate, medium and coarse, granular; friable; neutral; abrupt, smooth boundary.

B1—10 to 16 inches, yellowish-brown (10YR 5/4) loam; weak, fine and medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

IIB21t—16 to 22 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; thin, brown (10YR 5/3) films of silt and clay on some ped faces and in root channels; strongly acid; clear, smooth boundary.

IIB22t—22 to 29 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium and coarse, subangular blocky structure; firm; medium dark yellowish-brown (10YR 4/4) clay films on many ped faces and in cracks; medium acid; clear, wavy boundary.

IIB23t—29 to 38 inches, yellowish-brown (10YR 5/4) clay loam; medium, coarse, subangular blocky structure; firm; medium dark-brown (10YR 3/3) clay films on all ped faces and in root channels; slightly acid; abrupt, smooth boundary.

IIIB3—38 to 43 inches, yellowish-brown (10YR 5/4) heavy sandy loam; weak, medium, subangular blocky structure; friable; thin very dark grayish-brown (10YR 3/2) clay films in root channels and on some ped faces; neutral; abrupt, wavy boundary.

IIIC1—43 to 45 inches, yellowish-brown (10YR 5/6) loam; many, medium, distinct, grayish-brown (10YR 5/2) mottles; massive; friable; calcareous.

IVC2—45 to 60 inches, yellowish-brown (10YR 5/4) stratified coarse silt and very fine sand; many, large, distinct, gray (10YR 6/1) and light brownish-gray (10YR 6/2) mottles; massive to single grain; friable; 5 percent gravel; calcareous.

The Ap horizon is loam, silt loam, or sandy loam. The material in this horizon contains enough sand to make it feel gritty when rubbed between the fingers. Color of the Ap horizon ranges from dark grayish brown to brown. The A horizon is 8 to 12 inches in thickness. This horizon is lighter colored and finer textured in sloping areas because material formerly in the subsoil has been mixed with the remaining surface layer. The B horizon is dominantly sandy clay loam to silty clay loam that contains enough sand to feel gritty. The C horizon, which is 40 to 55 inches below the surface, is stratified lacustrine sand and silt that contains gravel in places. The sequence of stratification in this horizon varies within short distances.

Martinsville soils are not so shallow to loose gravel and sand as Fox soils. They have more sand in the subsoil than Miami soils, which are underlain by glacial till. Martinsville soils lack the stratified gravel and sand in the C horizon that is typical of Ockley soils, but they occupy similar positions on the landscape.

Martinsville loam, 0 to 2 percent slopes (MeA).—This soil is on terraces and on outwash areas throughout the county. It has the profile described as representative for the series. Calcareous glacial till is present at a depth below 55 to 60 inches in places. The areas range from 1 to 20 acres.

Included with this soil in mapping are small areas of soil that has a surface layer of silt loam. Also included are areas of soil that has 2 to 6 percent slopes.

This Martinsville soil is well suited to all crops commonly grown in the county. The crops can be grown intensively. Capability unit I-1.

Martinsville loam, 2 to 6 percent slopes (MeB).—This soil occupies ridges and knolls of terraces and outwash areas throughout the county. Slopes are short and hummocky. Limy glacial till is at a depth of 55 to 60 inches in some areas. The mapped areas range from 1 to 10 acres.

Included with this soil in mapping are small areas of moderately eroded soils and small areas of soils that have a surface layer of sandy loam. Also included are small areas of soil that has slopes of 0 to 2 percent.

This Martinsville soil is susceptible to erosion. It generally is farmed the same as larger areas of surrounding soils, and it is well suited to all crops commonly grown in the county. Practices that help to control erosion are needed. Capability unit IIe-3.

Martinsville sandy loam, 6 to 12 percent slopes, eroded (MdC2).—This soil is on outwash in an area of 14 square miles, south and southeast of the Delaware Country Club. The profile is sandier throughout than that described as representative of the series. Also, the plow layer is a mixture of grayish-brown material from the original surface layer and of yellowish-brown material formerly in the subsoil. The mapped areas range from 1 to 10 acres.

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

This Martinsville soil is subject to further erosion and is droughty in dry periods. If practices are used for control of erosion, this soil is well suited to all crops commonly grown in the county. It is especially suited to truck crops and to small grains seeded in fall. Capability unit IIIe-15.

Miami Series

The Miami series consists of deep, nearly level to strongly sloping, well-drained soils. These soils are on uplands mainly in the southern third of the county. They formed in glacial till that had a mantle of loess 7 to 11 inches thick. The native vegetation was mainly mixed hardwoods.

In a representative profile the surface layer is about 8 inches of dark grayish-brown silt loam. Just below is about 4 inches of grayish-brown silt loam. The firm subsoil is about 24 inches of mainly yellowish-brown silty clay loam and clay loam. The underlying glacial till is light olive-brown calcareous loam.

Miami soils are low in content of organic matter. The supplies of phosphorus and potassium are low. Available moisture capacity is high, and permeability is moderate. Runoff is very slow on the nearly level soils and rapid on the strongly sloping soils. The plow layer is medium acid if not limed.

These soils are well suited to corn, soybeans, and small grains. Erosion is a hazard on the sloping soils, but the nearly level soils have no important limitations. Crops on these soils respond well to lime and fertilizer.

Representative profile of Miami silt loam, 0 to 2 percent slopes, in a cultivated field; 285 feet west and 70 feet north of the southeast corner of SE¼ sec. 21, T. 20 N., R. 11 E.:

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

A2—8 to 12 inches, grayish-brown (10YR 5/2) silt loam; weak, medium, granular structure; friable; slightly acid; abrupt, smooth boundary.

B1—12 to 16 inches, brown (10YR 5/3) heavy silt loam; weak, fine, subangular blocky structure; friable to firm; 1 percent glacial pebbles; medium acid; clear, wavy boundary.

IIB21t—16 to 20 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, subangular blocky structure; firm; thin dark yellowish-brown (10YR 3/4) clay films on some ped faces and in root channels; 1 percent glacial pebbles; medium acid; clear, wavy boundary.

IIB22t—20 to 33 inches, yellowish-brown (10YR 5/4) clay loam; strong, medium and coarse, angular and subangular blocky structure; firm; thick dark yellowish-brown (10YR 3/4) clay films on all ped faces and in root channels; 1 percent glacial pebbles; medium acid; abrupt, wavy boundary.

IIB23t—33 to 36 inches, yellowish-brown (10YR 5/4) clay loam; moderate, coarse, subangular blocky structure; firm; thin dark yellowish-brown (10YR 3/4) clay films on some ped faces and in root channels; 1 percent glacial pebbles; slightly acid; abrupt, wavy boundary.

IIC—36 to 60 inches, light olive-brown (2.5Y 5/4) loam till; massive; friable; 2 percent glacial pebbles; calcareous.

The Ap horizon is silt loam, clay loam, or silty clay loam and ranges from dark grayish brown to brown in color. In uneroded areas the A horizon ranges from 9 to 13 inches in thickness. In eroded areas this horizon is lighter colored and finer textured than described because material formerly in the upper part of the subsoil has been mixed with the remaining surface layer. The B horizon ranges from light silty clay loam to loam in texture. Its upper part is dominantly silty clay loam in the nearly level and gently sloping Miami soils and clay loam in the sloping and strongly sloping ones. In places the B horizon contains enough sand to feel gritty when rubbed between the fingers. The C horizon, which is at a depth of 24 to 40 inches, is loam, silt loam, or light clay loam.

Miami soils have a coarser textured, less compact subsoil than Morley soils but occupy similar positions on the landscape. Their B horizon is not so sandy as that in Martinsville soils, and they lack the underlying stratified sand and silt typical of those soils. Unlike Ockley soils, Miami soils lack cobblestones in the lower part of their B horizon and their underlying material is not so coarse textured.

Miami silt loam, 0 to 2 percent slopes (MmA).—This soil occupies upland areas in the southern third of the county. It has the profile described as representative of the series. In places large continuous areas of this soil are on outwash plains near major streams. The subsoil is reddish brown in these areas, and the lower part of it is sandy and somewhat gravelly. Other areas have loose gravel and sand at a depth of 4 to 10 feet. The mapped areas of this soil range from 1 to 80 acres.

Included with this soil in mapping are small areas on 2 to 6 percent slopes and areas in which the soil is mottled below a depth of 18 inches. Also included are small areas of Crosby soils. A few small areas along outwash plains and streams have loose sand and gravel at a depth of 36 to 50 inches.

This Miami soil is well suited to intensive cropping. All crops commonly grown in the county are suited. Capability unit I-1.

Miami silt loam, 2 to 6 percent slopes, eroded (MmB2).—This soil occupies knolls and ridges on uplands in the southern third of the county. Slopes are short and hummocky. The plow layer is a mixture of grayish-brown material from the original surface layer and of yellowish-brown material formerly in the subsoil. In places this soil is mottled at a depth below 18 inches. In other areas calcareous till is at a depth of 18 to 24 inches.

Included with this soil in mapping are small areas of soils that are slightly eroded and severely eroded. Also included are soils that have gravelly and sandy material in the subsoil.

This Miami soil is subject to further erosion. If practices that control erosion are applied, the soil is well suited to all crops commonly grown in the county. Capability unit IIe-1.

Miami silt loam, 6 to 12 percent slopes, eroded (MmC2).—This soil occupies breaks and ridges on uplands throughout the southern third of the county. The plow layer is a mixture of grayish-brown material from the original surface layer and of yellowish-brown material formerly in the subsoil. The upper part of the subsoil is mostly clay loam. In places brownish, clayey subsoil material is exposed. Calcareous till is at a depth of 24 to 30 inches.

Included with this soil in mapping are small areas of soils that are slightly eroded and severely eroded. Also included are small areas of soils that have gravelly and sandy material in the subsoil.

This Miami soil is subject to further erosion. It is sticky when wet, and hard clods that are difficult to break are likely to form if the soil is worked when too wet. If practices that help to control erosion are applied, this soil is suited to all crops commonly grown in the county. Capability unit IIIe–1.

Miami silt loam, 12 to 18 percent slopes (MmD).—This soil occupies upland breaks and ridges in the southern third of the county. Depth to calcareous till is about 24 inches. Brownish clayey subsoil is exposed in places. The mapped areas of this soil range from 1 to 40 acres.

Included with this soil in mapping are small areas of soils that are moderately eroded. Also included are small areas of Miami soils that have 6 to 12 percent slopes.

The slopes and the erosion hazard limit use of this Miami soil. The areas are small, and the soil generally is farmed the same as larger areas of surrounding soils. Hay and pasture crops are well suited. Practices that help to control erosion are needed. Capability unit IVe–1.

Miami silt loam, gravelly substratum, 0 to 2 percent slopes (MnA).—This soil occupies high flat areas on uplands in the southern part of the county. Depth to underlying loose gravel and sand in this soil is dominantly 4 to 6 feet, but it ranges from 3½ to 10 feet. The gravel and sand may be as much as 40 feet thick. The mapped areas range from 4 to 100 acres or more in size.

Included with this soil in mapping are small areas of soils that have 2 to 6 percent slopes. Also included are small areas of moderately eroded soils and small areas of poorly drained Crosby soils.

This Miami soil is well suited to all crops commonly grown in the county. Capability unit I–1.

Miami silt loam, gravelly substratum, 2 to 6 percent slopes (MnB).—This soil occupies ridges and knolls on uplands in the southern third of the county. Slopes are short, and the relief is hummocky. Depth to underlying loose gravel and sand is dominantly 4 to 6 feet, but it ranges from 3½ to 10 feet.

Included with this soil in mapping are small areas of soils that are moderately eroded and severely eroded.

This Miami soil is well suited to all crops commonly grown in the county, though erosion is a major hazard. It is farmed as surrounding areas of the same soils. Capability unit IIe–1.

Miami silt loam, gravelly substratum, 6 to 12 percent slopes, eroded (MnC2).—This soil occupies ridges and slopes on uplands in the southern third of the county. The plow layer is a mixture of grayish-brown material of the original surface layer and of yellowish-brown material formerly in the subsoil. Depth to underlying gravel and sand is dominantly 4 to 6 feet, but it ranges from 3½ to 10 feet.

Included with this soil in mapping are small areas of severely eroded soils. Also included are small areas of soils that have 12 to 18 percent slopes.

This Miami soil is subject to further erosion. If practices that control erosion are applied, the soil is suited to all crops commonly grown in the county. Capability unit IIIe–1.

Miami silt loam, heavy substratum, 0 to 2 percent slopes (MoA).—This soil occupies outwash and upland areas in the northern two-thirds of the county. The subsoil is mostly dark-brown to reddish-brown clay loam to sandy clay loam, but it is gravelly clay loam in places. The underlying material is 35 to 40 percent clay. Depth to the underlying material is dominantly 40 to 50 inches, but it ranges from 36 to more than 50 inches. Mapped areas of this soil range from 1 to 6 acres.

Included with this soil in mapping are small areas of soil on 2 to 6 percent slopes that is moderately eroded. Also included are soils in slightly concave areas that have a thick surface layer.

This Miami soil is well suited to intensive cropping. Capability unit I–1.

Miami silt loam, heavy substratum, 2 to 6 percent slopes (MoB).—This soil occupies knolls and ridges in outwash and upland areas in the northern two-thirds of the county. The subsoil is mostly dark-brown to reddish-brown clay loam to sandy clay loam and gravelly clay loam. The underlying material is 35 to 40 percent clay. Depth to the underlying material is dominantly 40 to 50 inches, but it ranges from 36 to more than 50 inches.

Included with this soil in mapping are small areas of moderately eroded soils and of soils that have a surface layer of loam.

This Miami soil is suited to all crops commonly grown in the county, though erosion is a major hazard. It is farmed the same as larger areas of surrounding soils. Capability unit IIe–1.

Miami clay loam, 2 to 6 percent slopes, severely eroded (MrB3).—This soil occupies breaks and ridges on uplands in the southern third of the county. Slopes are short and hummocky. Nearly all of the original surface layer of this soil has been removed by erosion. The subsoil and underlying limy glacial till are exposed in some areas. The plow layer is mostly yellowish-brown clay loam, and the upper part of the subsoil is mostly silty clay loam. Mapped areas of this soil range from 1 to 15 acres.

Included with this soil in mapping are small areas of Miami silt loam, 6 to 12 percent slopes, eroded.

This Miami soil is subject to further erosion. It is very sticky when wet, and clods form if it is worked when too wet. If practices that help to control erosion are applied, this soil is suited to all crops commonly grown in the county. Capability unit IIIe–1.

Miami clay loam, 6 to 12 percent slopes, severely eroded (MrC3).—This soil occupies breaks and ridges on uplands in the southern third of the county. Nearly all of its original surface layer has been removed by erosion, and in places the subsoil and glacial till are exposed. The plow layer is mostly yellowish-brown clay loam. The upper part of the subsoil is mostly clay loam. Mapped areas of this soil range from 1 to 6 acres.

Included with this soil in mapping are small areas of Miami silt loam, 6 to 12 percent slopes, eroded, and small areas of Miami clay loam, 2 to 6 percent slopes, severely eroded.

This Miami soil is subject to further erosion. It is very sticky when wet, and clods form if it is worked when too wet. This soil is well suited to pasture and hay crops. Practices that control erosion are needed. Capability unit IVe-1.

Morley Series

The Morley series consists of deep, gently sloping to strongly sloping, well-drained soils. These soils are on uplands in the northern two-thirds of the county. They formed in glacial till that had a mantle of loess as much as 18 inches thick. The native vegetation was mainly mixed hardwoods.

In a representative profile the surface layer is about 7 inches of dark grayish-brown silt loam. The subsoil is about 18 inches thick and is mainly brown and dark yellowish-brown, firm silty clay. The upper and lower few inches, however, are silty clay loam. The underlying material is light olive-brown calcareous clay loam glacial till.

Morley soils are low in content of organic matter. The supplies of phosphorus and potassium are low. Available moisture capacity is high, and permeability is slow. Runoff is slow on the less eroded, gently sloping soils, but it is rapid on the strongly sloping soils.

These soils are well suited to corn, soybeans, and small grains. Crops on them respond well to lime and fertilizer. Erosion is the major hazard.

Representative profile of Morley silt loam, 2 to 6 percent slopes, in a cultivated field; 264 feet north and 465 feet east of the southwest corner of SW¼ sec. 9, T. 22 N., R. 10 E.:

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

Bt—7 to 10 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, fine, subangular and angular blocky structure; firm; medium acid; clear, smooth boundary.

B21t—10 to 14 inches, yellowish-brown (10YR 5/4) silty clay; strong, medium and coarse, angular blocky structure; firm; thin, distinct, dark-brown (10YR 3/3) clay films on many ped faces; medium acid; abrupt, smooth boundary.

B22t—14 to 21 inches, dark yellowish-brown (10YR 4/4) silty clay; strong, coarse, angular blocky structure; firm; medium dark-brown (10YR 3/3) clay films on all ped faces; a few black (N 2/0) iron and manganese oxide concretions; a few glacial pebbles that increase in number with depth; medium acid; clear, wavy boundary.

B23t—21 to 25 inches, brown (10YR 4/3) silty clay loam; weak, coarse, angular blocky structure; firm; thin gray (10YR 5/1) clay films on many ped faces; 3 percent gravel; neutral; abrupt, wavy boundary.

C—25 to 60 inches, light olive-brown (2.5Y 5/4) clay loam till; massive; firm; thin gray (10YR 5/1) clay films in cracks and old root channels; 3 percent gravel; calcareous.

The Ap horizon generally is silt loam, but it is silty clay loam in severely eroded areas. This horizon ranges from dark grayish brown to brown in color. It is lighter colored and finer textured in eroded areas because material formerly in the upper part of the subsoil has been mixed with the remaining surface layer. The B horizon ranges from silty clay loam to silty clay or clay loam. The C horizon is clay loam to silty clay loam and is calcareous. It is at a depth between 20 and 40 inches.

Morley soils have a finer textured B horizon and contain less sand than Martinsville soils. They have a finer textured, more compact subsoil than Miami soils but occupy similar positions on the landscape. They are finer textured than Ockley soils, but they lack gravelly material in the lower part of the B horizon and the underlying gravel and sand typical of those soils.

Morley silt loam, 2 to 6 percent slopes (MuB).—This soil is on ridges and knolls. It has the profile described as representative of the series. In places mottles are present at a depth below 18 inches. Mapped areas of this soil range from 1 to 10 acres or more.

Included with this soil in mapping are small areas of moderately eroded soils on 0 to 2 percent slopes. Also included are areas of soil that has gravelly and sandy material in the subsoil.

This Morley soil is subject to erosion. It is well suited to all crops commonly grown in the county if practices that control erosion are applied. Capability unit IIe-6.

Morley silt loam, 2 to 6 percent slopes, eroded (MuB2).—This soil is on ridges and knolls. Slopes vary in length, and in places the relief is hummocky. The plow layer is heavy silt loam or light silty clay loam. It is a mixture of grayish-brown material from the original surface layer and of yellowish-brown clayey material formerly in the subsoil. In places mottles are present at a depth below 18 inches. Mapped areas of this soil range from 1 to 20 acres.

Included with this soil in mapping, and making up about one-third of the mapped areas, are small areas of severely eroded soils. In these areas the original surface layer has been removed by erosion and the present surface layer is silty clay loam. The soil is cloddy in severely eroded areas, and preparing a seedbed in such areas is difficult. Also the content of organic matter is lower, the infiltration rate is slower, and runoff is more rapid than in moderately eroded areas.

This Morley soil is subject to further erosion. If practices are applied to help control erosion, this soil is suited to all crops commonly grown in the county. Small areas are farmed the same as larger areas of surrounding soils. Capability unit IIe-6.

Morley silt loam, 6 to 18 percent slopes, eroded (MuD2).—This soil occupies ridges and breaks. Slopes vary in length, and in places the degree of slope varies greatly within short distances. The plow layer in this soil is thinner than that in the profile described as representative of the series. It is a mixture of grayish-brown material from the original surface layer and of yellowish-brown clayey material formerly in the subsoil. Calcareous till is at a depth of 20 to 24 inches. In areas associated with kames and eskers, loose sand and gravel are at a depth of 4 to 10 feet. Mapped areas of this soil range from 1 to 20 acres in size.

Included with this soil in mapping are small areas of slightly eroded soils and severely eroded soils. Also included are soils that are as shallow as 15 inches to calcareous till.

This Morley soil is subject to further erosion, and practices that help to control erosion are needed. This soil is well suited to hay and pasture. The steeper areas are commonly pastured. Capability unit IIIe-6.

Morley silt loam, gravelly substratum, 2 to 6 percent slopes, eroded (MvB2).—This soil is on ridges of high eskers and kames. Slopes are short, and the relief is hummocky. The plow layer is a mixture of grayish-brown material from the original surface layer and of yellowish-brown clayey material formerly in the subsoil. In places mottles are present at a depth below 18 inches. Depth to loose gravel and sand is dominantly 4 to 6 feet but ranges from 3½ to 10 feet. Mapped areas range from 1 to 10 acres in size.

Included with this soil in mapping are small areas of slightly eroded soils. Also included are small areas where the slope is 0 to 2 percent.

This Morley soil is subject to further erosion. If practices that help to control erosion are applied, this soil is suited to all crops commonly grown in the county. Capability unit IIe–6.

Morley silt loam, gravelly substratum, 6 to 12 percent sopes, eroded (MvC2).—This soil occupies ridges and slopes on high eskers and kames. The plow layer is a mixture of grayish-brown material from the original surface layer and of yellowish-brown clayey material formerly in the subsoil. Depth to underlying loose gravel and sand is dominantly 4 to 6 feet, but it ranges from 3½ to 10 feet. Mapped areas of this soil range from 2 to 10 acres.

Included with this soil in mapping are small areas of severely eroded soils and of slightly eroded soils.

This Morley soil is subject to further erosion, and practices that help to control erosion are needed. It is suited to all crops commonly grown in the county and is used mostly for hay, pasture, and row crops. Row crops are not grown intensively, however, because this soil is near soils on rolling and steep slopes that are not suited to intensive cropping. Capability unit IIIe–6.

Morley silty clay loam, 2 to 6 percent slopes, severely eroded (MwB3).—This soil occupies breaks and ridges. Slopes are short and hummocky. Erosion has removed nearly all of the original surface layer of this soil (fig. 11). The plow layer is mostly yellowish-brown silty clay loam. In places the subsoil and limy glacial till are exposed.

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

This Morley soil is subject to further erosion. It is very sticky when wet and becomes cloddy if worked when too wet. If practices that help to control erosion are applied, this soil is suited to all crops commonly grown in the county. Capability unit IIIe–6.

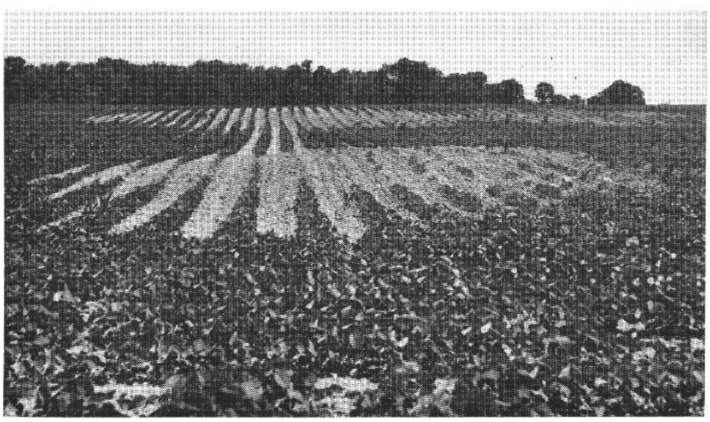

***Figure 11.*—Morley silty clay loam, 2 to 6 percent slopes, severely eroded, in center area that lacks vegetation.**

Morley silty clay loam, 6 to 12 percent slopes, severely eroded (MwC3).—This soil occupies breaks and ridges in the uplands. Erosion has removed nearly all of the original surface layer of this soil, and the plow layer is mostly yellowish-brown silty clay loam. In places the subsoil and limy glacial till are exposed. Loose gravel and sand are at a depth between 4 and 10 feet in areas associated with kames and eskers. Mapped areas of this soil range from 2 to 10 acres.

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

This Morley soil is subject to further erosion. It is very sticky when wet and clods if worked when too wet. This soil is well suited to hay and pasture. Practices that control erosion are needed. Capability unit IVe–6.

Ockley Series

The Ockley series consists of deep, nearly level and gently sloping, well-drained soils. These soils are on outwash and terrace areas throughout the county. They formed in thin layers of loess and the underlying loamy outwash. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is about 7 inches of dark grayish-brown silt loam. The next layer is dark-brown silt loam about 3 inches thick. The subsoil is about 39 inches of mostly brown firm clay loam and silty clay loam. The lower few inches, however, are dark reddish-brown gravelly loam. Brown and light yellowish-brown, stratified, calcareous gravel and sand are at a depth of 42 to 65 inches.

Ockley soils are low in content of organic matter. The supplies of phosphorus and potassium are low. Available moisture capacity is high, and permeability is moderate. Runoff is very slow on the nearly level soils, but it is slow on the gently sloping soils. The plow layer is medium acid in areas that have not been limed.

These soils are well suited to corn, soybeans, and fall-seeded small grains. Erosion is a major hazard on the sloping soils, but the nearly level soils have no important limitations. Crops on these soils respond well to lime and fertilizer.

Representative profile of Ockley silt loam, 0 to 2 percent slopes, in a cultivated field; 150 feet west and 230 feet north of the southeast corner of NE¼ of sec. 10, T. 20 N., R. 9 E.:

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

A2—7 to 10 inches, dark-brown (10YR 4/3) silt loam; moderate, fine and medium, granular structure; friable; slightly acid; clear, smooth boundary.

B21t—10 to 21 inches, brown (7.5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; thin dark-brown (7.5YR 3/2) clay films on some ped faces; strongly acid; gradual, wavy boundary.

IIB22t—21 to 42 inches, brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; medium, dark-brown (7.5YR 3/2) clay films on most ped faces and in root channels; strongly acid; abrupt, wavy boundary.

IIB3—42 to 49 inches, dark reddish-brown (5YR 3/3) gravelly loam; weak, coarse, subangular blocky structure; firm; dark reddish-brown (5YR 2/2) clay films on some ped faces, in voids, and in root channels; 7 percent cobblestones; neutral; abrupt, irregular boundary.

IIC—49 to 60 inches, brown (10YR 5/3) and light yellowish-brown (10YR 6/4) stratified gravel and sand; single grain; loose; calcareous.

The B horizon ranges from gravelly clay loam to silty clay loam in texture. The content of gravel in this horizon increases with depth. Tongues of material 3 to 10 inches wide extend from the lower B horizon to as deep as 3 feet into the C horizon.

Ockley soils are deeper to loose gravel and sand than Fox soils. They lack the stratified sand and silt in the C horizon typical of Martinsville soils but occupy similar positions on the landscape. Unlike Miami soils, Ockley soils have cobblestones in the lower part of the B horizon.

Ockley silt loam, 0 to 2 percent slopes (OcA).—This soil has the profile described as representative of the series. Depth to underlying gravel and sand varies within short distances. Mapped areas of this soil range from 1 to 10 acres.

Included with this soil in mapping are small areas of soils that have a surface layer of loam. Also included are soils in concave areas that have a thicker surface layer than this soil.

This Ockley soil is somewhat droughty during extended dry periods, but it has few other important limitations. It is well suited to all crops commonly grown in the county. Capability unit I–1.

Ockley silt loam, 2 to 6 percent slopes (OcB).—In this soil depth to the underlying gravel and sand varies within short distances. The mapped areas range from 1 to 8 acres.

Included with this soil in mapping are small areas of moderately eroded soils and of soils that have a surface layer of loam.

This Ockley soil is subject to erosion and is droughty during long dry periods. If practices that control erosion are applied, this soil is well suited to all crops commonly grown in the county. In many places the areas are farmed the same as larger areas of surrounding soils. Capability unit IIe–3.

Pewamo Series

The Pewamo series consists of deep, nearly level, very poorly drained soils. These soils formed in glacial till on flats and in upland depressions in the northern two-thirds of the county. The native vegetation was mixed hardwoods, swamp grasses, and sedges.

In a representative profile the surface layer is about 12 inches of very dark gray silty clay loam. The subsoil is about 33 inches thick and is gray, mottled, and firm. It is mainly silty clay in the upper 22 inches and silty clay loam below. The underlying material is grayish-brown and pale-brown, firm, calcareous clay loam.

Pewamo soils are high in content of organic matter. Supplies of phosphorus and potassium are low. Available moisture capacity is high, and permeability is slow. Runoff is very slow, and water ponds on the surface in places. The plow layer is neutral in areas that have not been limed.

If drained, these soils are well suited to corn, soybeans, and small grains. Crops on these soils respond well to fertilizer, and fertility levels can be built up over a period of time and easily maintained. Lime is not needed. Wetness is the major limitation.

Representative profile of Pewamo silty clay loam in a cultivated field; 264 feet east and 65 feet south of the northwest corner of SW¼ sec. 9, T. 22 N., R. 10 E.:

Ap—0 to 6 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A1—6 to 12 inches, very dark gray (10YR 3/1) heavy silty clay loam; moderate, medium, subangular and angular blocky structure; firm; neutral; clear, smooth boundary.

B21tg—12 to 19 inches, gray (N 5/0) silty clay; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; strong, medium, angular blocky structure; firm; thin dark-gray (N 4/0) clay films on some ped faces; neutral; clear, smooth boundary.

B22tg—19 to 34 inches, gray (N 5/0) silty clay; common, medium, distinct, light olive-brown (2.5Y 5/4) mottles; strong, medium, angular blocky structure; firm; thin very dark gray (N 4/0) clay films on all ped faces; neutral; clear, smooth boundary.

B23tg—34 to 45 inches, gray (N 5/0) heavy silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium and coarse, subangular blocky structure; firm; thin dark-gray (N 4/0) clay films on many ped faces; a few round black (10YR 2/1) manganese nodules; neutral; clear, wavy boundary.

Cg—45 to 60 inches, grayish-brown (10YR 5/2) and pale-brown (10YR 6/3) clay loam; massive; firm; a few glacial pebbles; calcareous.

The dark-colored A horizon is 10 to 15 inches thick. The B horizon ranges in texture from silty clay to silty clay loam. The C horizon is clay loam or silty clay loam and is calcareous. It is 40 to 55 inches below the surface.

Pewamo soils have a finer textured B horizon than Brookston soils and lack the loam and silt loam till in the C horizon typical of those soils, but they occupy similar positions on the landscape. They lack the sandy material in the lower B horizon and the stratified C horizon typical of Rensselaer soils.

Pewamo silty clay loam (0 to 2 percent slopes) (Pe).—This soil occupies most of the depressional and broad flat upland areas in the northern two-thirds of the county. It has the profile described as representative of the series. Thin strata of silt or sand 1 to 4 inches thick are present in places in the lower part of the subsoil. The mapped areas of this soil range from 2 to 80 acres or more. Some areas occupy narrow depressions that extend into higher lying upland soils. Other areas occupy large, continuous, broad flats (fig. 12).

Included with this soil in mapping are small areas that have an accumulation of moderately dark colored material on the surface. Also included are small areas that are very dark gray to a depth of 18 inches. Other small areas consist of somewhat poorly drained Blount soils.

This Pewamo soil is used intensively for crops, though wetness is a major limitation. If this soil is drained, it is well suited to all crops commonly grown in the county. Capability unit IIw–1.

Pewamo silty clay loam, stratified substratum (0 to 2 percent slopes) (Pf).—This soil occupies areas in lakebeds, mostly in the northern two-thirds of the county. Stratified layers of silt loam and light silty clay loam are at a depth of 42 to 78 inches. The mapped areas of this soil range from 1 to 30 acres or more.

Included with this soil in mapping are small areas of very poorly drained Kokomo soils.

This Pewamo soil is used intensively for crops, though wetness is a major limitation (fig. 13). If this soil is

Figure 12.—Typical area dominantly of Pewamo silty clay loam used intensively for corn. The residences in background are part of a subdivision.

Figure 13.—Low-lying depressional areas of Pewamo silty clay loam, stratified substratum, are identified by dark vegetation in open area of Blount and Pewamo soils. Ponding has killed the wheat that formerly was in these low-lying areas.

drained, it is well suited to all crops commonly grown in the county. Capability unit IIw–1.

Pewamo and Brookston silt loams, overwash (0 to 2 percent slopes) (Pk).—These soils (fig. 14) occupy depressions in uplands, outwash areas, and terraces throughout the county. The mapped areas range from 1 to 10 acres in size.

Pewamo silt loam makes up about 60 percent of this mapping unit. This soil is in the northern two-thirds of the county. It has a recently deposited mantle of alluvium consisting of moderately dark colored silt loam. This mantle generally is 12 to 16 inches thick, but it ranges

Figure 14.—Pewamo and Brookston silt loams, overwash, is in center. Eroded material washed from higher lying surrounding soils was source of the overwash.

between 10 and 20 inches in thickness. In a few areas gravel and sandy material are at a depth of about 4 feet.

Brookston silt loam makes up about 35 percent of this mapping unit. This soil is in the southern third of the county. It also has a recently deposited mantle of alluvial outwash similar to that on the Pewamo soil. The subsoil is about 38 inches of firm clay loam and silty clay loam. The upper part is dark-gray material that has brown mottles. The lower part is olive-gray material that has yellowish-brown mottles. The underlying material generally is grayish-brown loam, but in places gravel and sandy material are at a depth of about 4 feet.

Included with this unit in mapping, and making up the remaining 5 percent of the acreage, are small areas of typical Pewamo and Brookston soils.

Soils in this mapping unit are well suited to corn, soybeans, and similar row crops, though wetness is a major limitation. Many areas are difficult to drain, and crops frequently are damaged because of ponded water. Areas of these soils are small, and in many places they are farmed the same as surrounding soils. Capability unit IIw–1.

Rensselaer Series

The Rensselaer series consists of deep, nearly level, very poorly drained soils. These soils are in depressional areas in lakebeds, sluiceways, and valley trains throughout the county. They formed in sandy and silty lacustrine sediment. The native vegetation was mixed hardwoods, swamp grasses, and sedges.

In a representative profile the surface layer is very dark gray and very dark brown silty clay loam about 12 inches thick. The subsoil is about 29 inches thick. It is dominantly mottled, gray and dark-gray, firm clay loam, but the lower few inches consist of strong-brown silt mottled with gray. The underlying material is dark-brown, grayish-brown, and gray fine sand, silt, and silty clay loam. This stratified lacustrine material is calcareous.

The Rensselaer soils are high in content of organic matter. The supplies of available phosphorus and potassium are low. Available moisture capacity is high, and permeability is slow. Runoff is very slow, and water is ponded on the surface in places. The plow layer is neutral in areas that have not been limed.

These soils are well suited to corn, soybeans, and small grains, though wetness is a major limitation. Fertility levels can be built up and easily maintained. Crops on these soils respond well to fertilizer. Lime is not needed.

Representative profile of Rensselaer silty clay loam in a cultivated field; 66 feet south and 66 feet east of the center of sec. 11, T. 21 N., R. 9 E.:

Ap—0 to 6 inches, very dark gray (10YR 3/1) light silty clay loam; moderate, medium and coarse, granular structure; friable; neutral; abrupt, smooth boundary.

A12—6 to 12 inches, very dark brown (10YR 2/2) light silty clay loam; common, fine, distinct, dark-brown (7.5YR 4/4) mottles; moderate, medium, subangular blocky structure; friable to firm; neutral; abrupt, smooth boundary.

B21tg—12 to 17 inches, dark-gray (10YR 4/1) light silty clay loam; many, fine, distinct, dark-brown (7.5YR 4/4) mottles; moderate, fine, subangular blocky structure; firm; 1 percent pebbles and silt; thin very dark brown (10YR 2/2) clay films on some ped faces; neutral; gradual, smooth boundary.

B22tg—17 to 29 inches, dark-gray (N 4/0) heavy clay loam; many, medium, distinct, dark-brown (7.5YR 4/4) mottles; moderate, fine and medium, subangular blocky structure; firm; thin dark grayish-brown (2.5Y 4/2) and grayish-brown (10YR 5/2) clay films on many horizontal and vertical ped faces; 1 percent gravel; neutral; gradual, smooth boundary.

B23tg—29 to 34 inches, gray (N 6/0) clay loam; many, medium, distinct, strong-brown (7.5YR 5/8) mottles; moderate, medium, subangular blocky structure; firm; thick olive-gray (5Y 5/2) and olive (5Y 5/3) clay films on many horizontal and vertical ped faces; a few very dark gray (10YR 3/1) organic films in root channels; neutral; gradual, wavy boundary.

B3—34 to 41 inches, strong-brown (7.5YR 5/8) silt; many, medium, distinct, gray (N 6/0) mottles; weak, medium and coarse, subangular blocky structure; friable; common dark-gray (N 4/0) organic films in root channels and cracks; a few yellowish-red (5YR 4/6) splotches throughout the horizon; neutral; abrupt, wavy boundary.

C1—41 to 47 inches, dark-brown (7.5YR 4/4) silt loam; thin strata and pockets of fine sand; many, medium, distinct, gray (N 5/0) mottles; friable; massive; calcareous; abrupt, wavy boundary.

IIC2—47 to 60 inches, grayish-brown (2.5Y 5/2) and gray (2.5Y 5/0) silty clay loam; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; firm; common, very dark gray (N 3/0) organic and silty material in cracks; calcareous.

The A horizon ranges from 10 to 13 inches in thickness. The B horizon is dominantly clay loam, but the upper part is mostly silty clay loam and the lower part ranges from silt to loam. The C horizon is stratified fine sand and silt. It contains gravel in places. In places gravel and sand of commercial potential are at a depth below 5 to 6 feet.

Rensselaer soils are underlain by lacustrine sediment, unlike Brookston soils, which are underlain by glacial till. They are deeper than Sebewa soils and lack the pebbles in the lower part of the B horizon and the gravel and sand in the C horizon typical of those soils. They do not have so much clay in the B horizon as the Pewamo soils.

Rensselaer silty clay loam (0 to 2 percent slopes) (Rc).—This is the only Rensselaer soil mapped in the county. In places gravelly material is intermixed with material in the substratum. Mapped areas of this soil range from 2 to 30 acres or more.

Included with this soil in mapping are small areas of soils that have a medium-textured surface layer. Also included are small areas of very poorly drained Brookston and Kokomo soils.

This Rensselaer soil is used intensively for crops, though wetness is a major limitation. The soil is sticky and clods form if it is worked when too wet. If this soil is drained, it is well suited to all crops commonly grown in the county. Capability unit IIw-1.

Ross Series

The Ross series consists of deep, nearly level, well-drained soils on flood plains along the Mississinewa and White Rivers. The soils formed in silty and loamy stream sediment of recent origin. The native vegetation was scattered mixed hardwoods and prairie grasses.

In a representative profile the surface layer is about 30 inches of silt loam. The upper 25 inches is very dark brown, and the lower 5 inches is very dark grayish brown. Below is very dark grayish-brown and dark-brown, friable, calcareous silt loam.

The Ross soils are high in content of organic matter and in natural fertility. Available moisture capacity is high, and permeability is moderate. Runoff is slow. Reaction is neutral to mildly alkaline throughout.

These soils are subject to annual flooding for short periods. They therefore are better suited to corn and soybeans than to fall-seeded small grains. Crops on these soils respond well to fertilizer. Lime is not needed.

Representative profile of Ross silt loam in a cultivated field; 790 feet north and 1,130 feet east of the southeast corner of SW¼ sec. 1, T. 19 N., R. 8 E.:

Ap—0 to 7 inches, very dark brown (10YR 2/2) silt loam; weak, medium, granular structure; friable; mildly alkaline (a few calcareous shells); abrupt, smooth boundary.

A12—7 to 25 inches, very dark brown (10YR 2/2) silt loam; moderate, coarse, granular structure; friable; a few sand pockets in voids and root channels; mildly alkaline (a few calcareous shells); abrupt, smooth boundary.

A13—25 to 30 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; many, fine, dark reddish-brown (5YR 3/3) iron stains; moderately alkaline (calcareous); clear, smooth boundary.

C—30 to 60 inches, very dark grayish-brown (10YR 3/2) and dark-brown (10YR 3/3) silt loam; massive; friable; a few sand grains in worm and root channels; moderately alkaline (calcareous).

The Ap horizon ranges from black to very dark grayish brown. Its texture is silt loam, but in places the material contains enough sand to make it feel gritty. In places these soils are dark grayish brown or dark brown below a depth of 24 to 50 inches. Depth to loose sand and gravel ranges from 36 to 50 inches. An appreciable amount of sand occurs throughout the profile.

Ross soils are darker colored throughout than Genesee soils, and in places they occupy somewhat higher areas in the flood plain. They are not so gray as Shoals soils, and they lack the brown and gray mottles below the surface layer typical of those soils.

Ross silt loam (0 to 2 percent slopes) (Ro).—This is the only Ross soil mapped in the county. It is on flood plains in slightly higher areas than surrounding soils on the flood plain. In places thin lenses of loam, sandy loam, or silty clay loam occur below a depth of 2 feet.

Included with this soil in mapping are small areas of well-drained Genesee soils. Also included are small areas of soils that have mottling below a depth of 18 inches.

This soil is well suited to such cash crops as corn and soybeans. It is subject to occasional flooding, but it has few other important limitations. In some years late planting or replanting is necessary. Capability unit I–2.

Sebewa Series

The Sebewa series consists of nearly level to depressional, very poorly drained soils that are moderately deep over stratified gravel and sand. These soils are in valley trains and in terraces throughout the county.

In a representative profile the surface layer is about 8 inches of very dark gray and black light silty clay loam. The subsoil is about 25 inches of very dark gray, dark gray, and gray silty clay loam and clay loam that is mottled and firm. The underlying material is gray and dark-brown, calcareous gravel and sand.

The Sebewa soils are high in content of organic matter. The supplies of available phosphorus and potassium are low. Available moisture capacity is low or moderate, and permeability is moderate. Runoff is very slow, and water ponds on the surface in places. The plow layer is neutral in areas that have not been limed.

These soils are well suited to corn, soybeans, and small grains, though wetness is a major limitation. Crops on this soil respond well to fertilizer. Lime is not needed.

Representative profile of Sebewa silty clay loam in a cultivated field; 130 feet west and 400 feet north of the southeast corner of SW¼ sec. 19, T. 22 N., R. 11 E.:

Ap—0 to 6 inches, very dark gray (10YR 3/1) light silty clay loam; moderate, fine and medium, granular structure; friable; neutral; abrupt, smooth boundary.

A12—6 to 8 inches, black (10YR 2/1) light silty clay loam; moderate, coarse, subangular blocky structure; firm; neutral; abrupt, smooth boundary.

B21tg—8 to 11 inches, very dark gray (10YR 3/1) silty clay loam that is very dark grayish brown (10YR 3/2) rubbed; common, fine, distinct, dark-brown (7.5YR 4/4) mottles; moderate, fine and medium, subangular blocky structure; firm; a few dark reddish-brown (2.5YR 3/4) stains in root channels; thin black (10YR 2/1) clay films and organic films on many vertical and horizontal ped faces; neutral; clear, smooth boundary.

B22tg—11 to 15 inches, very dark gray (10YR 3/1) silty clay loam; common, medium, distinct, dark reddish-brown (5YR 3/4) mottles; moderate, medium, angular and subangular blocky structure; firm; less than 1 percent coarse fragments; a few dark-brown (10YR 3/3) clay films on many horizontal and vertical ped faces and in root and worm channels; neutral; abrupt, smooth boundary.

B23tg—15 to 24 inches, dark-gray (10YR 4/1) clay loam; many, medium, distinct, dark-brown (7.5YR 4/4) mottles; moderate, medium, subangular blocky structure; firm; medium dark-brown (10YR 3/3) clay films on many vertical and horizontal ped faces; 2 percent gravel; neutral; clear, wavy boundary.

B24tg—24 to 33 inches, gray (10YR 5/1) clay loam; common, fine, distinct, dark-brown (7.5YR 3/2) mottles; moderate, coarse, subangular blocky structure; firm; medium dark-brown (10YR 3/3) clay films on many vertical and horizontal ped faces; 2 percent gravel; neutral; abrupt, wavy boundary.

IIC—33 to 60 inches, gray (10YR 5/1) and dark-brown (7.5YR 4/2) stratified gravel and sand; single grain; loose; calcareous.

The Ap horizon is clay loam or is light silty clay loam that in places contains enough sand to make it feel gritty. The profile is very dark gray or black to a depth of 10 to 15 inches. The B horizon is clay loam or gravelly clay loam in the lower part. The C horizon is loose gravel and sand. It is at a depth of 24 to 40 inches.

Sebewa soils lack the silt and clayey material in the C horizon typical of the stony subsoil phases of the Brookston soils. They have a coarser textured B horizon than the Pewamo, stratified substratum, soils, and their C horizon lacks the lacustrine silt and clayey material typical of those soils. Their B horizon is coarser textured in the lower part than that in Rensselaer soils, and they lack the C horizon of sand and silt typical of those soils.

Sebewa silty clay loam (0 to 2 percent slopes) (Se).—This soil occupies low areas associated with small streams and old glacial channels. In many places the subsoil is gravelly in the lower part. Depth to underlying loose gravel and sand varies within short distances.

Included with this soil in mapping are small areas of soil that has a surface layer of heavy silt loam. Also included are small areas of very poorly drained Brookston silty clay loam, stony subsoil.

This Sebewa soil is well suited to all crops commonly grown in the county, though wetness is a major limitation. In places coarse gravel and boulders hinder farming operations and the installing of tile drains. Capability unit IIw–4.

Shoals Series

The Shoals series consists of deep, nearly level, somewhat poorly drained soils on flood plains. These soils formed in silty and loamy sediment laid down recently by streams. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark grayish-brown silt loam about 12 inches thick. The subsoil is about 18 inches of mottled dark grayish-brown and grayish-brown, friable silt loam. The underlying material is mottled grayish-brown and dark yellowish-brown, calcareous silty clay loam.

The content of organic matter is low in Shoals soils. Natural fertility is high. Available moisture capacity is high, and permeability is moderate. Runoff is slow.

Shoals soils are better suited to such crops as corn and soybeans than to fall-seeded small grains. Wetness is a major limitation, and the soils are subject to annual flooding for short periods. Crops on these soils respond to fertilizer. Lime is not needed.

Representative profile of Shoals silt loam in a cultivated field; 115 feet east and 725 feet south of the northwest corner of NE¼ sec. 21, T. 21 N., R. 11 E.:

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

A12—6 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; common, fine, distinct, brown (7.5YR 4/4) mottles; moderate, coarse and very coarse, granular structure; friable; neutral; abrupt, smooth boundary.

A13—10 to 12 inches, dark grayish-brown (10YR 4/2) silt loam; common, fine, distinct, brown (7.5YR 4/4) mottles; weak, thick, platy structure parting to moderate, coarse, granular; friable; thin grayish-brown (10YR 5/2) silt films on cracks and in root channels; neutral; abrupt, smooth boundary.

B21g—12 to 20 inches, dark grayish-brown (10YR 4/2) silt loam; many, fine, distinct, yellowish-red (5YR 4/6) mottles; very weak, coarse, prismatic structure and massive; friable; thin grayish-brown (10YR 5/2) silt films on cracks and along root channels; mildly alkaline; abrupt, wavy boundary.

B22g—20 to 30 inches, grayish-brown (10YR 5/2) heavy silt loam; many, medium, distinct, yellowish-red (5YR 4/6) and dark reddish-brown (5YR 3/4) mottles; very weak, coarse, prismatic structure to massive; friable; medium gray (10YR 5/1) silt films in worm channels and in root channels; a few, very dark brown (10YR 2/2), manganese concretions; mildly alkaline; clear, wavy boundary.

C1g—30 to 39 inches, grayish-brown (10YR 5/2) light silty clay loam; many, medium, distinct, brown (10YR 4/3) and strong-brown (7.5YR 5/6) mottles; massive; friable to firm; medium gray (10YR 5/1) silt films in cracks and root channels; mildly alkaline; abrupt, smooth boundary.

IIC2—39 to 60 inches, dark yellowish-brown (10YR 4/4) silty clay loam; massive; firm; medium to thick gray (10YR 5/1) clay films in many cracks and root channels; 3 percent gravel; calcareous.

The Ap horizon ranges from dark grayish brown to grayish brown in color. The underlying horizons are silt loam, loam, or silty clay loam.

These soils are outside the defined range of the Shoals series in that they are slightly calcareous. They are enough alike the Shoals series in composition and behavior that a new series is not warranted.

Shoals soils are not so well drained nor so brown as Genesee and Ross soils. They occupy somewhat higher areas than Sloan soils, and they are lighter colored and are not so poorly drained as those soils.

Shoals silt loam (0 to 2 percent slopes) (Sh).—This is the only Shoals soil mapped in the county. Most areas are long and narrow and are along smaller streams, but areas of this soil are along streams throughout the county. The mapped areas range from 1 to 10 acres. Texture of this soil varies throughout, and the sequence and thickness of the layers change within short distances.

Included with this soil in mapping are small areas of soils that have a surface layer of loam and silty clay loam. Also included are small areas that have limy glacial till at a depth of 4 to 6 feet. Other small areas consist of very poorly drained Sloan soils.

This soil is subject to frequent overflow from nearby streams, and in some years replanting or late planting is necessary. Nevertheless, row crops can be grown year after year. Capability unit IIw-7.

Sloan Series

The Sloan series consists of deep, nearly level, very poorly drained soils. These soils formed in recent loamy and silty stream sediment. They are on flood plains that are depressional in places. The native vegetation was mixed hardwoods, swamp grasses, and sedges.

In a representative profile the surface layer is about 13 inches of very dark gray silt loam. The subsoil is mottled, dark-gray firm clay loam that is calcareous. The underlying material is mainly stratified silt loam and loamy sand, but it includes clay in places.

Sloan soils are high in content of organic matter and in natural fertility. Available moisture capacity is high, and permeability is moderately slow. Runoff is very slow.

These soils are wet and are subject to annual flooding for short periods. They are better suited to such crops as corn and soybeans than to fall grains. Crops on these soils respond well to fertilizer. Lime is not needed.

Representative profile of Sloan silt loam in a cultivated field; 858 feet north and 330 feet west of the southeast corner of NE¼ sec. 19, T. 20 N., R. 10 E.:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; moderate, medium and coarse, granular structure; friable; mildly alkaline; abrupt, smooth boundary.

A12—8 to 13 inches, very dark gray (10YR 3/1) silt loam; weak, medium, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

B21g—13 to 19 inches, dark-gray (10YR 4/1) light clay loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, fine, subangular blocky structure; friable; a few black (10YR 2/1) organic films on some ped faces; many marine remains; mildly alkaline (a few calcareous shells); clear, smooth boundary.

B22g—19 to 26 inches, dark-gray (10YR 4/1) clay loam; many, medium, distinct, brown (7.5YR 4/4) mottles; weak, fine and medium, subangular blocky structure; friable; thin, very dark gray (10YR 3/1), organic films and clay films on some ped faces and in voids; a few marine remains that are calcareous; mildly alkaline; abrupt, smooth boundary.

C1—26 to 37 inches, gray (10YR 5/1) silt loam; many, medium, distinct, brown (10YR 4/3) and brown to dark-brown (7.5YR 4/4) mottles; massive; friable; many remains of small shells; calcareous; abrupt, smooth boundary.

IIC2—37 to 60 inches, gray to light-gray (10YR 6/1) and pale-brown (10YR 6/3) loamy sand; silt and clay pockets in places; massive to single grain; friable; black (10YR 2/1) organic pockets in voids.

The Ap horizon is very dark gray to very dark brown in color. The A horizon is silt loam, heavy silt loam, or light silty clay loam 10 to 14 inches thick. Reaction in this horizon is neutral and mildly alkaline. Small calcareous shells are present in places throughout all horizons.

These soils are outside the defined range of the Sloan series in that they are slightly calcareous. They are enough like the Sloan series in composition and behavior that a new series is not warranted.

Sloan soils have a less developed B horizon than Sebewa soils. They are more poorly drained than Shoals soils and are grayer than those soils.

Sloan silt loam (0 to 2 percent slopes) (Sn).—This is the only Sloan soil mapped in the county. It is on low flood plains along streams throughout the county. Most areas are along the smaller streams and are narrow and long. The mapped areas range from 2 to 10 acres. The surface layer is moderately alkaline and calcareous in areas within 50 to 100 feet from the streams. Farther away the surface layer is neutral or mildly alkaline and noncalcareous.

Included with this soil in mapping are small areas of soil that has a surface layer of silty clay loam. Also included are small areas of somewhat poorly drained Shoals soils.

This Sloan soil is in low areas where excess water from higher areas collects. It also is subject to frequent overflow from nearby streams. Such row crops as corn and soybeans can be grown intensively. Flooding in spring, however, makes replanting or late planting necessary in some years. Capability unit IIIw-9.

Wallkill Series

The Wallkill series consists of deep, very poorly drained soils. These soils formed in about 20 inches of recent silty mineral material laid down over thick deposits of organic material. These soils occupy large depressions in cutoffs and small pockets throughout the county. The present vegetation is hardwoods and grasses that tolerate wetness.

In a representative profile the upper 17 inches is dark grayish-brown silt loam. The underlying material is black, dark reddish-brown, and olive muck.

Wallkill soils are low in content of organic matter. Natural fertility is high in the mineral layers. Available moisture capacity is very high, and permeability is moderate. Runoff is very slow, and in places water ponds on the surface during wet seasons. The plow layer is neutral in areas not limed.

These wet soils are better suited to such crops as corn and soybeans than to small grains that are seeded in fall or early in spring. Crops on them respond well to fertilizer. Lime is not needed.

Representative profile of Wallkill silt loam in a cultivated field; 990 feet north and 335 feet west of the southeast corner sec. 34, T. 22 N., R. 11 E.:

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

C1—5 to 15 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium and coarse, granular structure; friable; black (10YR 2/1) material intermixed in lower part by action of worms; neutral; abrupt, smooth boundary.

C2—15 to 17 inches, black (10YR 2/1) mucky silt loam; moderate, fine and medium, subangular blocky structure; friable; thin dark grayish-brown (10YR 4/2) silt films on surface of peds and in cracks; neutral; abrupt, smooth boundary.

IIOa1b—17 to 25 inches, dark reddish-brown (5YR 2/2) muck; moderate, thin and medium, platy structure; friable; slightly acid; clear, smooth boundary.

IIOa2b—25 to 36 inches, black (5YR 2/1) muck; moderate, thin, platy structure; friable; 30 percent undecomposed twigs, stems, and seeds; slightly acid; clear, smooth boundary.

IIOa3b—36 to 60 inches, olive (5Y 4/3) muck; weak, thin, platy structure; friable; a few identifiable plant fragments; neutral.

The mineral layers consist of very dark grayish-brown to grayish-brown silt loam or light silty clay loam 10 to 20 inches thick. Reaction in these layers ranges from neutral to moderately alkaline. In some areas the underlying organic layers contain low-grade marl; in others, layers of stratified minerals are below a depth of 48 inches.

Wallkill soils lack the organic material in their upper 17 inches typical of Carlisle soils. Their uppermost layer contains less organic material than that in Linwood soils.

Wallkill silt loam (0 to 2 percent slopes) (Wa).—This is the only Wallkill soil mapped in the county. It occupies low depressional areas on outwash and terrace areas throughout the county. Thickness of the alluvium over the original buried soil of organic muck and peat ranges from 10 to 20 inches. Mapped areas of this soil range from 1 to 10 acres.

Included with this soil in mapping are small areas of very poorly drained Carlisle and Linwood soils.

If drained, this soil is well suited to such row crops as corn and soybeans. Because of the low position of this soil, however, areas are difficult to drain. As a result, water ponds on the surface and crops frequently are lost. Capability unit IIw-7.

Use and Management of the Soils

This section explains the system of capability classification used by the Soil Conservation Service and describes the management of the soils by capability units. Then predicted average acre yields of principal crops are given, and management of the soils for wildlife, recreation, and engineering is discussed.

Woodland is not a major resource in the county, and its management is not a part of this section. In 1958 only about 7 percent of the county was in woodland, and the projected amount for 1975 is about 5 percent. Most of the woodland is used as pasture or recreational areas or as sites for housing developments.

Capability Grouping of Soils

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

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

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

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

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

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

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

Class V soils (none in Delaware County) are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, or wildlife.

Class VI soils (none in Delaware County) have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

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

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

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, not used in Delaware County and used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

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

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–3 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by Capability Units

More than 81 percent of the total area in Delaware County is used for cultivated crops. The major crops grown are corn, soybeans, wheat, oats, hay, and pasture, but tomatoes and other special crops also are grown.

Most soils in the county are wet, and artificial drainage is needed. Examples are Brookston silty clay loam and Pewamo silty clay loam. Tile and open ditches commonly are used to remove excess water, and surface drains and sod waterways are used to provide supplemental drainage.

A few of the soils, such as the Fox and Ockley, are droughty. Growing small grains or crops that mature early in the season and using green-manure crops are effective practices on these soils.

The sloping soils are likely to erode if cultivated. Examples are Miami silt loam, 12 to 18 percent slopes, and Morley silt loam, 6 to 8 percent slopes, eroded. Among the effective ways of controlling erosion are plowing in spring, using a cropping system that includes mixtures of grasses and legumes, farming on the contour, terracing, and disking cornstalks and returning all other crop residues to the soils. These practices also help to maintain the content of organic matter and to keep the soil in good tilth. A fall cover crop will help to protect the soil following a soybean crop.

On all of the soils, lime and fertilizer should be applied in the amounts indicated by soil tests and field trials.

In the pages that follow each of the capability units in Delaware County is described, and suggestions for the use and management of the soils in each unit are given. The units are not numbered consecutively, because not all of the units in the statewide system are represented in this county. The names of the soil series represented are mentioned in the description of each unit, but this does not mean that all soils in a given series are in the unit. The names of all soils in any given unit can be found by referring to the "Guide to Mapping Units" at the back of this survey.

Capability unit I–1

This unit consists of deep, nearly level, well-drained, medium-textured soils of the Martinsville, Miami, and Ockley series. These soils formed in till on plains and terraces in the uplands.

Runoff is slow on these soils, and the erosion hazard is none or slight. The available moisture capacity is high. Content of organic matter and natural fertility are low.

These soils are suited to all crops commonly grown in the county. Corn and soybeans are the main crops, but the soils are also suited to small grains, mixtures of grasses and legumes, and to tomatoes and other special field crops. Corn can be grown year after year.

Soils in this unit are easy to cultivate, and they respond well to good management. They are suited to many cropping systems. Maintaining the organic-matter content and fertility and improving tilth are the main concerns of management.

Capability unit I–2

This unit consists of deep, nearly level, well-drained, medium-textured soils of the Genesee and Ross series. These soils are on flood plains of major streams. They are flooded occasionally early in spring and late in fall.

Runoff is slow on these soils. Available moisture capacity and natural fertility are high. The content of organic matter is low to medium in Genesee soils and high in Ross soils. Except for stream cutting, erosion is not a hazard. In most areas sediment accumulates gradually.

These soils are well suited to such cash crops as corn and soybeans. Corn generally is grown year after year.

Soils in this unit are easy to cultivate, and they respond well to good management. Small grains seeded in fall and grasses and legumes may be severely damaged during prolonged floods.

Capability unit IIe–1

This unit consists of deep, gently sloping, well-drained, medium-textured soils of the Miami series. Runoff is slow to medium on these soils, and the hazard of erosion is slight or moderate. Available moisture capacity is high. Natural fertility is low.

Corn, soybeans, and small grains are the main crops grown on these soils. The soils are suited, however, to all crops commonly grown in the county.

Soils in this unit are easy to cultivate, and they respond well to good management. Several cropping systems are suited. Control of erosion, maintenance of fertility, and improvement of tilth and content of organic matter are the main concerns of management.

Capability unit IIe–3

This unit consists of deep, gently sloping, well-drained, medium-textured soils of the Martinsville and Ockley series. These soils are on outwash plains and terraces.

Runoff is slow or medium on these soils, and erosion is slight. Available moisture capacity is high. Natural fertility is low.

These soils are suited to all crops commonly grown in the county. Corn, soybeans, and small grains are the main crops, and several cropping systems are suited. Controlling erosion, maintaining fertility and content of organic matter, and improving tilth are the main concerns of management. Where feasible, contour farming can be used for control of erosion.

Capability unit IIe–6

This unit consists of deep, gently sloping, well-drained, medium-textured soils of the Morley series. These soils occupy till plains and moraines on uplands.

Runoff is slow or medium on soils of this unit, and the erosion hazard is slight or moderate. Available moisture capacity is high. Natural fertility is low.

Some of these soils are slightly eroded, and others are moderately eroded. The slightly eroded soils are easy to cultivate and are in good tilth, but the moderately eroded soils are somewhat more difficult to cultivate and are in poorer tilth. The moderately eroded soils have a higher content of clay in the plow layer than the slightly eroded ones. If the moderately eroded soils are worked when too wet or too dry, they become cloddy and preparing a seedbed is difficult. Under the same management, the slightly eroded soils tend to be slightly more productive than the moderately eroded ones.

The soils in this unit are suited to all crops commonly grown in the county. Corn, soybeans, and small grains are the main crops, and several cropping systems are suited. Crops on these soils respond well to good management.

Controlling erosion, maintaining fertility and content of organic matter, and improving tilth are the main concerns of management. Where feasible, contour cultivation can be used to help control erosion.

Capability unit IIe–9

Fox silt loam, 2 to 6 percent slopes, is the only soil in this unit. This soil is moderately deep over gravel and sand and is well drained and slightly eroded. It occupies terraces, kames, eskers, and moraines in outwash areas.

Runoff is low or medium on this soil. Natural fertility is low, and available moisture capacity is low or moderate. This soil is droughty during long dry periods.

This Fox soil is suited to all crops commonly grown in the county. Corn, soybeans, small grains, and mixtures of grasses and legumes are the main crops. This soil is easy to cultivate, and it responds well to good management. It is suited to several cropping systems. The chief concerns of management are controlling erosion and maintaining the content of organic matter.

Capability unit IIe–12

This unit consists of deep, gently sloping, somewhat poorly drained soils that are medium textured. These slightly eroded or moderately eroded soils are in the Blount series.

Runoff is medium on soils of this unit. Permeability is slow, and available moisture capacity is high. Natural fertility is moderate.

The slightly eroded soils are in good tilth and are easy to cultivate. The moderately eroded soils, however, are more clayey, are in poorer tilth, and are more difficult to cultivate. If the moderately eroded soils are worked when too wet or too dry, they become cloddy and preparing a seedbed is difficult. Under the same management, the slightly eroded soils are more productive than the moderately eroded ones.

The soils in this unit are well suited to all crops commonly grown in the county. Corn and soybeans are the main crops, but tomatoes, small grains, and mixtures of grasses and legumes for hay and pasture also are grown.

Wetness and the hazard of further erosion are the main concerns of management. Maintaining the content of organic matter and fertility are also concerns. Artificial drainage is needed for good growth of crops.

Capability unit IIw–1

This unit consists of deep, nearly level, poorly drained, mainly moderately fine textured soils of the Brookston, Kokomo, Pewamo, and Rensselaer series. Runoff is very slow on these soils, and some areas are ponded. The erosion hazard is none or slight. Permeability is slow, and available moisture capacity is high. Natural fertility is low. The content of organic matter is high.

Corn and soybeans are the main crops grown on these soils, but small grains, legumes, and tomatoes also are grown. All row crops commonly grown in the county are suited. Several cropping systems are suitable, and row crops can be grown year after year.

The water table is at or near the surface of these soils in spring and late in fall. If worked when wet, the plow layer becomes cloddy and puddled. Installing suitable drainage systems and maintaining good tilth are the main concerns of management. The soils become warm earlier in spring if adequate drainage is provided.

Capability unit IIw–2

This unit consists of deep, nearly level, somewhat poorly drained, medium-textured soils of the Blount and Crosby series. These soils occupy till plains on uplands.

Runoff is slow on soils in this unit. The water table is near the surface early in spring and in winter in the nearly level soils, but it is at a greater depth in the gently sloping soils. Permeability is slow in all of these soils, and available moisture capacity is high. The content of organic matter is low.

Soils in this unit are suited to all crops commonly grown in the county. Corn and soybeans are the main crops, but small grains, legumes, and tomatoes also are grown. Many cropping systems are suitable, and corn can be grown year after year.

These soils are easy to cultivate. Wetness is the main concern of management, and drainage is needed for good growth of crops. Maintaining the content of organic matter and preventing crusting of the surface layer are other concerns.

Capability unit IIw-4

Sebewa silty clay loam is the only soil in this unit. This soil is in depressions, in valley trains, in sluiceways, and in channels of small streams. It is moderately deep to sand and gravel, very poorly drained, and moderately fine textured.

Runoff is very slow on this soil, and in places water ponds on the surface. The erosion hazard is none or slight. The water table is at or near the surface in winter and spring. In places the plow layer becomes cloddy and puddled if it is worked when wet. Permeability is moderate, and available moisture capacity is low or moderate. Content of organic matter is high.

Corn and soybeans are the main crops, but this soil is suited to all crops commonly grown in the county. Several cropping systems are suited, and row crops can be grown year after year.

Maintaining good tilth and constructing and maintaining suitable drainage systems that lower the water table are the main concerns of management. Adequate drainage is needed for good crop growth. Also, the soil warms earlier in spring if adequate drainage is provided.

Capability unit IIw-7

This unit consists of deep, nearly level, somewhat poorly drained to very poorly drained, medium-textured soils of the Shoals and Wallkill series. These soils are on flood plains.

Runoff is very slow on these soils, and in places water ponds on the surface. The hazard of erosion is none or slight. Permeability is moderate, and available moisture capacity is high and very high. The content of organic matter is low, and natural fertility is high.

These soils are suited to such cash grain crops as corn and soybeans. Corn generally is grown year after year. Many areas of these soils occupy long, narrow flood plains dissected by meandering streams. Such areas are not suited to row crops but are well suited to pasture and hay crops. Because of frequent flooding in fall, winter, and spring, tillable areas are suited only to row crops grown for cash.

Soils in this unit are easy to cultivate, and they respond well to good management. The water table is near or at the surface in winter and spring. Maintaining good tilth and constructing and maintaining suitable drainage systems that lower the water table are the chief concerns of management.

Capability unit IIw-10

Linwood muck is the only soil in this unit. This soil is gently sloping and is very poorly drained. It is on flats and in depressions.

Runoff is very slow on this soil, and in places water ponds on the surface. The erosion hazard is slight or none. Permeability is moderate, and available moisture capacity is very high. Content of organic matter is very high, and fertility is low.

Linwood muck is well suited to grain and vegetable crops grown for cash. Corn is the main crop and is grown year after year. Small grains also are grown, but less extensively.

This soil is easy to cultivate, and it responds well to good management. Many cropping systems are suited. The main concern of management is providing drainage. Some areas are 1 to 5 acres in size, however, and are difficult to drain. These areas generally are farmed the same as surrounding larger areas of soils.

Capability unit IIs-1

Fox silt loam, 0 to 2 percent slopes, is the only soil in this unit. This soil occupies terraces, kames, eskers, and moraines.

Runoff is very slow on this soil, and erosion is slight. Available moisture capacity is low or moderate. Content of organic matter and natural fertility are low.

The soils in this unit are suited to all crops commonly grown in the county. Corn, soybeans, mixtures of grasses and legumes, and small grains are the main crops. Several cropping systems are suited.

This soil is easy to cultivate. Maintaining fertility and content of organic matter are the chief concerns of management. Also, this soil is droughty during extended dry periods, and crops on it are subject to damage because of lack of moisture.

Capability unit IIIe-1

This unit consists of deep, gently sloping and moderately sloping, well-drained soils of the Miami series. These soils are on till plains in the uplands. They are medium textured and moderately fine textured, and they are moderately eroded or severely eroded.

Runoff is medium to rapid on soils of this unit, and available moisture capacity is high. Content of organic matter is low. Natural fertility is low in the severely eroded soils and moderate in the moderately eroded soils.

The soils in this unit are suited to all crops commonly grown in the county. Corn, soybeans, and small grains are the main crops, but hay and pasture crops also are grown.

These soils respond well to good management. The main concerns of management are controlling erosion and maintaining natural fertility and content of organic matter. The moderately eroded soils are in good tilth, but the severely eroded soils are in poor tilth. If worked when wet, the severely eroded soils become cloddy and puddled. Where feasible, contour farming and stripcropping can be used to help prevent further erosion. These practices also help to increase the number of years that row crops can be grown in a cropping system.

Capability unit IIIe-6

This unit consists of gently sloping to strongly sloping, well-drained, medium textured and moderately fine textured soils of the Morley series. These soils are on uplands. The gently sloping soils are severely eroded, and the moderately sloping and strongly sloping soils are moderately eroded.

Runoff is medium or rapid on soils in this unit. Available moisture capacity is high. Content of organic matter is low, and fertility is low.

The soils in this unit are suited to the cultivated crops commonly grown in the county, and they are well suited to hay and pasture plants. Corn, soybeans, and small grains are the main crops, and several cropping systems are suited.

The main concerns of management are controlling erosion, maintaining the content of organic matter and fertility at a desirable level, and improving tilth. Tilth is poor in all soils in this unit, but it is better in the sloping soils than in the gently sloping ones. If these soils are worked when wet, the plow layer becomes cloddy and puddled. Where feasible, farming on the contour and stripcropping can be used to control erosion. These practices also help to increase the number of years that row crops can be grown in the cropping system.

Capability unit IIIe-9

This unit consists of moderately deep, gently sloping and moderately sloping, well-drained soils of the Fox series. These outwash soils occupy terraces, kames, eskers, and moraines. The gently sloping soils are moderately fine textured, and they are severely eroded. The moderately sloping soils are medium textured, and they are moderately eroded.

Runoff is medium or rapid on soils of this unit. Content of organic matter and natural fertility are low. Available moisture capacity is low or moderate in the gently sloping soils and low in the moderately sloping ones.

The soils in this unit are suited to the cultivated crops commonly grown in the county, and they are well suited to grasses and legumes for hay and pasture. Corn, soybeans, and small grains are the main crops. Corn and soybeans do not grow so well on these soils, however, as on the other soils in the county. Several cropping systems are suitable for these soils.

The main concerns of management are controlling erosion and maintaining the content of organic matter and fertility at a desirable level. These soils are droughty during extended dry periods, and the lack of moisture causes damage to crops. The gently sloping soils are in poor tilth, and they become cloddy and puddled if worked when wet. The moderately sloping soils are in good tilth. Where feasible, contour farming and stripcropping can be used to help prevent further erosion. These practices also help to increase the number of years row crops can be grown in the cropping system.

Capability unit IIIe-15

Martinsville sandy loam, 6 to 12 percent slopes, eroded, is the only soil in this unit. This soil is deep, well drained, and moderately coarse textured. It is on outwash plains and terraces. Runoff is medium. Available moisture capacity is high.

All crops commonly grown in the county can be grown on this soil, but the slope and sand content make the soil better suited to some crops than to others. This soil is well suited to small grains, grasses, and legumes and to pasture crops. Corn and soybeans are less well suited. Several cropping systems are suitable for this soil.

The chief concerns of management are controlling erosion and maintaining the content of organic matter. This soil is droughty during extended dry periods. Where feasible, contour farming and stripcropping can be used to help prevent further erosion. These practices also help to increase the number of years row crops can be grown in the cropping system.

Capability unit IIIw-8

Carlisle muck is the only soil in this unit. This soil is nearly level and is very poorly drained. It is on flats and in depressions.

Runoff is very slow on this soil, and in places water ponds on the surface. The hazard of erosion is none to slight. Permeability is moderately rapid, and available moisture capacity is very high. Content of organic matter is very high, and fertility is low.

If drained, this soil is well suited to vegetables and to other row crops. Small grains also are suited but are not grown so extensively. Row crops can be grown year after year.

This soil is easy to cultivate and responds well to good management. The chief concern of management is providing drainage.

Capability unit IIIw-9

Sloan silt loam is the only soil in this unit. This soil is nearly level and is very poorly drained. It is on flood plains.

Runoff is very slow on this soil, and in places water ponds on the surface. The hazard of erosion is none or slight. Permeability is moderately slow, and available moisture capacity is high. Content of organic matter and natural fertility are high.

The chief concerns of management are providing drainage and maintaining good tilth. If the soil is drained, it is well suited to corn and soybeans, which are the main crops grown. Frequent overflow from nearby streams makes this soil poorly suited to small grains and to grasses and legumes. The overflow occurs mostly in spring and late in fall.

Capability unit IVe-1

This unit consists of deep, moderately sloping and strongly sloping, well-drained soils of the Miami series. These soils are medium textured and moderately fine textured. They occupy till plains on uplands. The moderately sloping soils are severely eroded, and the strongly sloping soils are slightly eroded.

Runoff is medium on the moderately sloping soils and rapid on the strongly sloping ones. Available moisture capacity is high in all of the soils. Content of organic matter and natural fertility are low.

Suitable cropping systems for these soils include small grains, grasses and legumes, and pasture plants. Such row crops as corn and soybeans can be grown only occasionally in the cropping systems.

Controlling erosion and maintaining the content of organic matter are the chief concerns of management. The slightly eroded soils are in good tilth. The severely eroded soils are in poor tilth, and if worked when wet, they become cloddy and puddled. Where feasible, farming on the contour and stripcropping can be used to help prevent further erosion. These practices also permit use of more row crops in the cropping system.

Capability unit IVe-6

Morley silty clay loam, 6 to 12 percent slopes, severely eroded, is the only soil in this unit. It is deep and is well drained. This soil occupies till plains on uplands. Runoff is medium on this soil. Content of organic matter and natural fertility are low.

This soil is well suited to cropping systems that include small grains, grasses and legumes, and pasture crops. Row crops such as corn and soybeans can be grown only occasionally. Contour farming and stripcropping help to prevent further erosion. These practices also permit use of more row crops in the cropping system.

Capability unit IVe-9

This unit consists of moderately deep, moderately sloping and strongly sloping, well-drained soils of the Fox series. These soils occupy terraces, kames, eskers, and moraines on outwash. The moderately sloping soils are moderately fine textured, and the strongly sloping soils are medium textured. Erosion is severe on the moderately sloping soils, and moderate on the strongly sloping soils.

Runoff is medium or rapid on soils of this unit. Available moisture capacity is moderate or low. Content of organic matter and natural fertility are low on the moderately sloping soils and moderate or low on the strongly sloping soils.

Soils of this unit are suited to cropping systems that include small grains, grasses and legumes, and pasture plants. Such row crops as corn or soybeans can be grown only occasionally.

The main concerns of management are controlling erosion and maintaining the content of organic matter and good tilth. The moderately sloping soils are in poor tilth, and if worked when too wet, they become cloddy and puddled. Contour farming and stripcropping help to protect the soils from erosion and permit the use of more row crops in the cropping system.

Capability unit VIIe-2

This unit consists of soils of the Hennepin series and of pits from which the soil material has been removed. The areas occur on breaks between upland till plains and low terraces or flood plains.

The soils in this unit are well drained and medium textured. Runoff is very rapid or rapid, and the soils are slightly eroded. Natural fertility is low, and the content of organic matter is high. Available moisture capacity is high.

Soils in this unit are suitable for limited grazing and for use as woodland, wildlife habitat, and recreational areas.

The chief concern of management is controlling erosion. Keeping a permanent cover of vegetation on the areas helps to control erosion and to increase available moisture capacity. Cultivating on the contour and doing all renovating operations on the contour also help to control erosion.

Capability unit VIIIs-2

This unit consists of Gravel pits and Stone quarries and of Made land. In places areas of these land types can be made suited to wildlife, but major reclamation generally is required before vegetation will grow. Members of fishing clubs fish in some of the abandoned gravel pits, and areas surrounding these pits are used for other recreational purposes. Made land is presently being used as a place to dump refuse.

Predicted Yields

Table 2 shows for each soil the yields per acre of corn, soybeans, wheat, and alfalfa-grass hay mixtures under two levels of management. The figures in columns A are yields to be expected under an average or medium level of management. Those in columns B represent yields that can be expected under the improved or high level of management that farmers are now practicing in places in the county.

The following are assumed to be part of an average management system:

1. Using cropping systems that maintain tilth and content of organic matter.
2. Following management practices that control erosion sufficiently to prevent serious reduction in the quality of the soil.
3. Applying fertilizer and lime in moderate amounts if need is indicated by soil tests.
4. Returning most of the crop residue to the soil.
5. Using conventional plowing and tillage methods.
6. Using crop varieties that are generally adapted to the climate and the soils.
7. Controlling weeds fairly well by tillage and spraying.
8. Draining wet areas enough for cropping but not always enough to prevent lower yields.

The following are assumed to be part of a high-level management system:

1. Using cropping systems that maintain tilth and content of organic matter.
2. Controlling erosion to the maximum extent feasible, so that the quality of the soil is maintained or improved rather than reduced.
3. Maintaining a high level of fertility by means of frequent soil tests and use of fertilizers in accordance with recommendations of the State Agricultural Experiment Station.
4. Liming the soils in accordance with the results of soil tests.
5. Using the crop residue to the fullest extent practicable to protect and improve the soil.
6. Following minimum tillage practices where needed because of the soil hazards of compaction and erosion.
7. Using only the crop varieties that are best adapted to the climate and soil.
8. Controlling weeds carefully by tillage and spraying.
9. Draining wet areas well enough so that wetness does not restrict yields of adapted crops.

The yields shown in table 2 are estimated averages for a period of 5 to 10 years. They are based on farm records, on interviews with farmers and members of the staff of the Purdue Agricultural Experiment Station, and on

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TABLE 2.—*Predicted average yields per acre of the principal crops under two levels of management*

Yields in columns A can be expected under an average level of management; those in columns B can be expected under a high level of management. Dashed lines indicate that the crop is either not grown or is not suited to the soil specified]

Soil	Corn		Soybeans		Wheat		Alfalfa-grass hay mixtures	
	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Blount silt loam, 0 to 2 percent slopes	85	105	30	40	35	45	3	5
Blount silt loam, 2 to 4 percent slopes	80	100	30	40	35	45	3	5
Blount silt loam, 2 to 4 percent slopes, eroded	70	85	25	35	30	40	3	5
Borrow pits	------	------	------	------	------	------	1	2. 5
Brookston silty clay loam	95	120	35	45	35	45	3	5
Brookston silty clay loam, stony subsoil	85	110	35	45	35	45	3	5
Carlisle muck	80	110	25	40	------	------	------	------
Crosby silt loam, 0 to 2 percent slopes	85	105	30	40	35	45	3	5
Crosby silt loam, stony subsoil, 0 to 2 percent slopes	85	100	30	40	35	45	3	5
Fox silt loam, 0 to 2 percent slopes	60	75	20	28	30	43	2. 5	3. 5
Fox silt loam, 2 to 6 percent slopes	55	70	20	28	25	43	2. 5	4
Fox gravelly clay loam, 2 to 6 percent slopes, severely eroded	55	70	20	30	28	35	2. 5	3. 5
Fox gravelly clay loam, 6 to 12 percent slopes, severely eroded	35	40	15	20	20	25	2. 5	3. 5
Fox loam, 6 to 12 percent slopes, eroded	50	75	20	30	28	35	2. 5	3. 5
Fox loam, 12 to 18 percent slopes, eroded	25	30	15	20	15	20	2. 5	3. 5
Genesee silt loam	75	110	25	35	32	40	2. 5	4
Gravel pits and Stone quarries	------	------	------	------	------	------	------	------
Hennepin loam, 18 to 50 percent slopes	------	------	------	------	------	------	1. 5	2. 5
Kokomo silty clay loam, stratified substratum	85	120	35	45	35	45	3	5
Kokomo mucky silt loam, stratified substratum	85	120	35	45	35	45	3	5
Linwood muck	80	100	25	38	------	------	------	------
Made land	------	------	------	------	------	------	1	2
Martinsville loam, 0 to 2 percent slopes	75	105	30	40	37	45	3. 5	5
Martinsville loam, 2 to 6 percent slopes	65	95	25	35	32	40	3	4
Martinsville sandy loam, 6 to 12 percent slopes, eroded	50	70	18	25	25	40	2. 3	3. 3
Miami silt loam, 0 to 2 percent slopes	75	105	30	40	37	45	3. 5	5
Miami silt loam, 2 to 6 percent slopes, eroded	60	85	28	38	35	45	3	4. 5
Miami silt loam, 6 to 12 percent slopes, eroded	55	80	20	30	30	38	2. 7	4. 5
Miami silt loam, 12 to 18 percent slopes	45	65	16	24	25	33	3	4
Miami silt loam, gravelly substratum, 0 to 2 percent slopes	75	105	30	40	37	45	3. 5	5
Miami silt loam, gravelly substratum, 2 to 6 percent slopes	70	95	28	38	35	45	3	4. 5
Miami silt loam, gravelly substratum, 6 to 12 percent slopes, eroded	55	80	20	30	30	38	2. 7	4. 5
Miami silt loam, heavy substratum, 0 to 2 percent slopes	75	105	30	40	37	45	3. 5	5
Miami silt loam, heavy substratum, 2 to 6 percent slopes	70	95	28	38	35	45	3	4. 5
Miami clay loam, 2 to 6 percent slopes, severely eroded	55	85	20	30	30	38	2. 7	4. 5
Miami clay loam, 6 to 12 percent slopes, severely eroded	50	70	16	24	25	33	3	4
Morley silt loam, 2 to 6 percent slopes	60	85	20	26	25	35	2. 5	3. 5
Morley silt loam, 2 to 6 percent slopes, eroded	55	75	20	26	25	35	2. 5	3. 5
Morley silt loam, 6 to 18 percent slopes, eroded	40	55	------	------	18	28	2. 5	3
Morley silt loam, gravelly substratum, 2 to 6 percent slopes, eroded	50	70	20	26	25	35	2. 5	3. 5
Morley silt loam, gravelly substratum, 6 to 12 percent slopes, eroded	55	70	20	30	28	35	2. 5	4
Morley silty clay loam, 2 to 6 percent slopes, severely eroded	45	65	20	30	28	35	2. 5	4
Morley silty clay loam, 6 to 12 percent slopes, severely eroded	40	60	------	------	18	28	2. 5	3
Ockley silt loam, 0 to 2 percent slopes	75	105	30	40	37	45	3. 5	5
Ockley silt loam, 2 to 6 percent slopes	65	95	25	35	32	40	3	4
Pewamo silty clay loam	85	120	35	45	35	45	3	5
Pewamo silty clay loam, stratified substratum	85	120	35	45	35	45	3	5
Pewamo and Brookston silt loams, overwash	85	120	35	45	35	40	3	5
Rensselaer silty clay loam	85	120	35	45	35	45	3	5
Ross silt loam	75	110	25	35	------	------	------	------
Sebewa silty clay loam	65	95	25	35	30	40	2. 5	3
Shoals silt loam	70	95	25	35	------	------	------	------
Sloan silt loam	75	95	25	40	------	------	------	------
Wallkill silt loam	70	90	25	35	15	25	2	2. 5

direct observations by soil scientists and soil conservationists. Considered in making the estimates were the prevailing climate, the characteristics of the soil, and the influence of different kinds of management on the soils.

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

Use of the Soils for Wildlife

The soil and water resources of Delaware County are favorable for the development of wildlife habitat. Most of the soils, however, are used for cultivated crops.

Three major kinds of wildlife are recognized in Delaware County—openland wildlife, woodland wildlife, and wetland wildlife. The potential for development of openland wildlife and woodland wildlife habitat is high throughout most of the county. Only small local areas in the county are suited to wetland wildlife habitat.

In table 3 each of the 11 wildlife groups is given a rating of *well suited*, *suited*, *poorly suited*, or *not suited*. These ratings indicate in a general way the places where habitat can be most suitably managed to satisfactorily support the kinds of wildlife shown in the table. Also indicated is the suitability of the soils in each group for various kinds of plants. The three major kinds of wildlife are defined in the following paragraphs.

Openland wildlife

Openland wildlife are those birds and mammals that normally frequent cropland, pasture, and hayland overgrown with grasses, herbs, and shrubs. Examples of openland wildlife are rabbits, red foxes, skunks, quails, and meadowlarks. Suitability of the soil for these kinds of wildlife is determined by its capability to grow seed and grain crops, grasses and legumes, wild herbaceous upland plants, and hardwoods.

Woodland wildlife

Woodland wildlife are mammals and birds that frequent areas of hardwoods and conifers, shrubs, or combinations of these types of vegetation. Examples of woodland wildlife are squirrels, deer, raccoons, woodpeckers, and nuthatches. Suitability of the soil for these species is determined by its capability to grow grasses and legumes, wild herbaceous upland plants, and conifers.

Wetland wildlife

Wetland wildlife are mammals and birds that frequent such wet areas as ponds, marshes, and swamps. Examples of wetland wildlife are muskrats, wild ducks, geese, kingfishers, and redwinged blackbirds. Suitability of the soil for these species is determined by its capability to grow wetland plants for food and cover, its capability to grow seed and grain crops, and its usefulness for shallow water developments and excavated ponds.

Use of the Soils for Recreation

The soils and water resources of Delaware County are favorable for many kinds of recreation. The county is near areas where the population is rapidly expanding, and the demand for recreational facilities is increasing. Areas for hunting game, for picnicking, and for fishing and other water sports would attract many to the county.

In table 4 the soils in the county are placed in groups, and ratings for selected recreational purposes and limitations for these uses are given. The ratings are based on soil features and do not include other items that may be important in selecting an area for the purpose stated. A rating of *slight* means that the soil is relatively free of limitations or has limitations that are easy to overcome; a rating of *moderate* indicates that limitations should be recognized but can be overcome through correct planning, careful design, and good management; a rating of *severe* indicates that limitations are extreme enough to make use questionable and that careful planning and intensive management practices are required; a rating of *very severe* means that extreme measures are needed to overcome the limitations and that use of the soil for the specified purpose generally is not practical.

In the paragraphs that follow, each recreation use is defined and the properties important in rating the limitations for such purposes are given. The information can be used, along with table 4, with information in other parts of the survey as a guide in planning the use of the soils for recreation. Before beginning any construction projects, however, an investigation should be made at the site being considered.

Recreational buildings are those that are constructed for use as seasonal or year-round cottages, washrooms and bathhouses, picnic shelters, and service buildings. Soil properties most important in rating the soils for such uses are wetness and the hazard of flooding, slopes, the content of rocks and stones, and depth to hard rock. Other factors that need to be considered are shrink-swell potential, bearing capacity, possibility of frost and of hillside slippage, and suitability of the soil for use as filter fields for septic tanks. In making the final evaluation of a soil for use as a site for recreational buildings, the capability of the soil to support vegetation should be considered, as well as whether basements or underground utilities are needed.

Campsites for tents and trailers are areas suitable for tents and for small camp trailers and the activities that accompany outdoor living. It is assumed that the areas require little site preparation. The soils must be able to support heavy traffic by horses and vehicles, as well as people. Factors most important in rating the soils for such uses are wetness and the hazard of flooding, permeability of the soil, the slope, texture of the surface soil, and content of stones and rocks. Capability of the soil to support vegetation also should be considered.

Picnic grounds, parks, and other extensive play areas are areas that are suitable for pleasure outings at which a meal is eaten outdoors and the grounds can be used for outdoor games and for hiking. The soils must be suitable for heavy foot traffic. Factors considered in rating the soils for picnic grounds, parks, and other extensive play areas are wetness and the hazard of flooding, slope, tex-

TABLE 3.—*Suitability of soils for kinds of wildlife*

[Not included in this table, because their characteristics are too variable for their suitability to be estimated, are the land types Borrow pits, Gravel pits and Stone quarries, and Made land]

Group, soil series, and map symbols	Kinds of wildlife		
	Openland	Woodland	Wetland
Group 1: Blount: BlB, BlB2	Well suited	Suited: somewhat poorly drained; well suited to hardwoods; poorly suited to conifers; well suited to wild herbaceous upland plants; suited to grasses and legumes.	Poorly suited: somewhat poorly drained; poorly suited to wetland plants for food and cover, to shallow water developments, and to excavated ponds; suited to grain and seed crops.
Group 2: Sloan: Sn	Poorly suited: very poorly drained; well suited to hardwoods; poorly suited to grasses and legumes and wild herbaceous upland plants; not suited to grain and seed crops.	Well suited	Poorly suited: very poorly drained; suited to wetland plants for food and cover and to shallow water devlopments; not suited to excavated ponds; poorly suited to grain and seed crops.
Group 3: Shoals: Sh	Well suited	Well suited	Poorly suited: somewhat poorly drained; suited to wetland plants for food and cover and to shallow water developments; not suited to excavated ponds; poorly suited to grain and seed crops.
Group 4: Brookston: Br, Bs. Kokomo: Km, Ko. Pewamo: Pe, Pf. Pewamo and Brookston, overwash: Pk. Rensselaer: Rc. Sebewa: Se.	Suited: very poorly drained; suited to grain and seed crops and to grasses and legumes; poorly suited to wild herbaceous upland plants; well suited to hardwoods.	Suited: very poorly drained; suited to hardwoods; well suited to conifers; suited to grasses and legumes and wild herbaceous upland plants.	Well suited.
Group 5: Blount: BlA. Crosby: CrA, CsA.	Well suited	Well suited	Suited: somewhat poorly drained; suited to wetland plants for food and cover and to shallow water developments, excavated ponds, and grain and seed crops.
Group 6: Martinsville: MdC2, MeB, Miami: MmB2, MoA, MoB. Morley: MuB. Ockley: OcB.	Well suited	Suited: well drained; suited to grasses and legumes; poorly suited to conifers; well suited to wild herbaceous upland plants and to hardwoods.	Not suited: well drained; not suited to wetland plants for food and cover, to shallow water developments, and to excavated ponds; well suited to grain and seed crops.

TABLE 3.—*Suitability of soils for kinds of wildlife*—Continued

Group, soil series, and map symbols	Kinds of wildlife		
	Openland	Woodland	Wetland
Group 7: Fox: FoC2, FsA, FsB, FxB3, FxC3. Genesee: Ge. Martinsville: MeA. Miami: MmA, MmC2, MnA, MnB, MnC2. Morley: MuB2, MvB2, MvC2. Ockley: OcA. Ross: Ro.	Well suited	Well suited	Not suited: well drained; not suited to wetland plants for food and cover, to shallow water developments, and to excavated ponds; well suited to grain and seed crops.
Group 8: Miami: MrB3. Morley: MwB3.	Suited: well drained; suited to grain and seed crops, grasses and legumes, and wild herbaceous upland plants; well suited to hardwoods.	Well suited	Not suited: well drained; not suited to wetland plants for food and cover, to shallow water developments, and to excavated ponds; well suited to grain and seed crops.
Group 9: Carlisle: Ca. Linwood: Lm. Wallkill: Wa.	Not suited: very poorly drained; not suited to grain and seed crops, grasses and legumes, wild herbaceous upland plants, and to hardwoods.	Not suited: very poorly drained; not suited to grasses and legumes, wild herbaceous upland plants, and conifers.	Suited: very poorly drained; suited to wetland plants for food and cover; well suited to shallow water developments and excavated ponds; not suited to grain and seed crops.
Group 10: Miami: MmD, MrC3. Morley: MuD2, MwC3.	Suited: well drained; suited or poorly suited to grain and seed crops; well suited or suited to grasses and legumes; well suited to wild herbaceous upland plants and to hardwoods.	Well suited or suited: well drained; well suited or suited to grasses and legumes; well suited to wild herbaceous upland plants and to hardwoods; poorly suited to conifers.	Not suited: well drained; suited to wetland plants for food and cover, shallow water developments, and excavated ponds; suited or poorly suited to grain and seed crops.
Group 11: Fox: FoD2. Hennepin: HeE.	Suited: well drained; poorly suited to grain and seed crops; suited to grasses and legumes and wild herbaceous upland plants; well suited to hardwoods.	Poorly suited: well drained; poorly suited to grasses and legumes; suited to wild herbaceous upland plants; well suited to hardwoods; poorly suited to conifers.	Not suited: well drained; not suited to wetland plants for food and cover, shallow water developments, and excavated ponds; suited to poorly suited to grain and seed crops.

TABLE 4.—*Ratings and limitations of the*

[Not included in this table because their characteristics are too variable to be rated are

Group, soil series, and map symbols	Recreational buildings [1]	Campsites for tents and trailers
Group 1: Fox: FsA. Martinsville: MeA. Miami: MmA, MnA, MoA. Ockley: OcA.	Slight	Slight
Group 2: Fox: FsB. Martinsville: MeB. Miami: MmB2, MnB, MoB. Morley: MuB, MuB2, MvB2. Ockley: OcB.	Slight	Slight
Group 3: Fox: FxB3. Miami: MrB3. Morley: MwB3.	Slight	Slight
Group 4: Blount: BlA, BlB, BlB2.	Moderate to severe: seasonal perched high water table; slow permeability.	Moderate to severe: seasonal perched high water table; slow permeability.
Group 5: Crosby: CrA, CsA.	Moderate: seasonal perched high water table; slow permeability.	Moderate: seasonal perched high water table; slow permeability.
Group 6: Fox: FxC3. Miami: MrC3. Morley: MwC3.	Moderate: moderate slopes; moderately fine textured surface layer; stones in places.	Moderate: moderate slopes; moderately fine textured surface layer; stones in places.
Group 7: Fox: FoD2. Miami: MmD. Morley: MuD2.	Moderate to severe: strong slopes	Moderate to severe: strong slopes
Group 8: Genesee: Ge. Ross: Ro. Shoals: Sh.	Severe: subject to flooding	Severe: subject to flooding
Group 9: Fox: FoC2. Martinsville: MdC2. Miami: MmC2, MnC2. Morley: MvC2.	Moderate: moderate slopes	Moderate: moderate slopes
Group 10: Brookston: Br, Bs. Kokomo: Km, Ko. Pewamo: Pe, Pf, Pk. Rensselaer: Rc. Sebewa: Se.	Severe: Seasonal high water table; subject to ponding.	Severe: seasonal high water table; subject to ponding.
Group 11: Hennepin: HeE.	Severe: steep slopes	Severe: steep slopes
Group 12: Sloan: Sn.	Severe: subject to flooding or ponding	Severe: subject to flooding or ponding
Group 13: Carlisle: Ca. Linwood: Lm. Wallkill: Wa.	Very severe: high water table; unstable materials; low position; subject to ponding.	Very severe: high water table; unstable materials; low position; subject to ponding.

[1] Limitations for septic systems were not considered in determining the ratings for this column.

soils for recreational purposes

the land types Borrow pits (Bp), Gravel pits and Stone quarries (Gp), and Made land (Ma)]

Picnic grounds, parks, and other extensive play areas	Playgrounds, athletic fields, and other intensive play areas	Paths and trails	Golf fairways
Slight.	Slight.	Slight.	Slight.
Slight.	Moderate: gentle slopes.	Slight.	Slight.
Slight.	Moderate: gentle slopes; subject to erosion; moderately fine textured surface layer; stones in places.	Slight.	Severe: subject to erosion; moderately fine textured surface layer; stones in places.
Moderate to severe: seasonal perched high water table.	Moderate to severe: seasonal perched high water table.	Moderate: seasonal perched high water table.	Moderate: seasonal perched high water table; slow permeability.
Moderate: seasonal perched high water table.	Moderate: seasonal perched high water table.	Moderate: seasonal perched high water table.	Moderate: seasonal perched high water table; slow permeability.
Moderate: moderate slopes; moderately fine textured surface layer; stones in places.	Severe: moderate slopes; moderately fine textured surface layer; stones in places.	Slight.	Severe: severe erosion; moderately fine textured surface layer; stones in places.
Moderate to severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate to severe: strong slopes; highly erodible.
Moderate to severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.
Moderate: moderate slopes.	Severe: moderate slopes.	Slight.	Moderate: moderate slopes.
Severe: seasonal high water table; subject to ponding.	Severe: seasonal high water table; subject to ponding.	Severe: seasonal high water table; subject to ponding.	Severe: seasonal high water table; subject to ponding.
Severe: steep slopes.	Severe: steep slopes.	Moderate or severe: steep slopes.	Severe: steep slopes; highly erodible.
Severe: subject to flooding or ponding.	Severe: subject to flooding or ponding.	Severe: subject to flooding or ponding.	Severe: subject to flooding or ponding.
Very severe: high water table; unstable materials; subject to ponding.	Very severe: high water table; unstable materials; subject to ponding.	Very severe: high water table; subject to ponding.	Very severe: high water table; subject to ponding.

ture of the surface soil, and content of stones and rocks. The ratings do not take into account the presence of trees or ponds that would affect the desirability of a site. The capability of the soils to support vegetation also should be considered.

Playgrounds, athletic fields, and other intensive play areas are used for playgrounds and for baseball, football, tennis, badminton, and other organized games. The areas are used frequently and intensively and should withstand heavy foot traffic. Good drainage and a level and firm surface generally are required. It is assumed that a good cover of vegetation can be established and maintained on the soils where needed.

Paths and trails are areas used for cross-country hiking, bridle paths, and other nonintensive uses that allow for random movement of people. It is assumed that all such areas will be used as they occur in nature and that little soil will have to be moved to make the area suitable for use.

The most desirable soils for bridle paths and trails are loamy and are well drained and are nearly level to sloping. Such soils have good stability and are not subject to erosion. They are free of stones and other coarse fragments and of rock outcrops. Paths and trails on sloping soils should be placed on the contour to help control erosion. The slope should not exceed 12 percent for prolonged distances.

The ratings of the soils for *golf fairways* refer to fairways only because most golf greens, traps, and tees are manmade. Also the soil materials for greens and traps generally are transported from other areas.

Soils suitable for golf fairways should be well drained and free from flooding during the season of use. Trafficability should be good, and few stones or other coarse fragments should be on the surface. Soils used for fairways should be capable of providing a good turf, and they should be suitable for growing many kinds of trees and shrubs. Loamy soils are well suited, but coarse-textured soils that are adequately irrigated are also suited. Sandy soils can be used as a source of material for traps and for greens. Areas of poorly drained mineral and organic soils have severe limitations for use as golf fairways. They can be used as sites for ponds for storing water to help maintain the turf and to enhance the appearance of the golf course.

Engineering Uses of the Soils

Soils are of special interest to engineers because soil properties affect the construction and maintenance of roads, airports, and pipelines, the foundations of buildings, facilities for storing water, structures for controlling erosion, drainage systems, and systems for disposing of sewage. Among the soil properties most important to engineers are permeability, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, texture, plasticity, and reaction. Also important are relief, depth to water table and to bedrock, and the flooding hazard. Such information is made available in this section. Engineers can use it to—

1. Make soil and land use studies that will aid in selecting and developing sites for industries, businesses, residences, and recreational areas.
2. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, cables, and sewage disposal systems, and in planning more detailed surveys of the soils at selected locations.
3. Make estimates of the engineering properties of soils for use in the planning of agricultural drainage systems, farm ponds, grassed waterways, terraces and diversions, and other structures for conserving soil and water.
4. Locate probable sources of sand, gravel, and other materials for use in construction.
5. Correlate the performance of engineering structures with soil mapping units to develop information for overall planning that will be useful in designing and maintaining other structures.
6. Determine the suitability of the soils for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps, reports, and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Used with the soil map to identify the soils, the engineering interpretations in this section are useful for many purposes. It should be emphasized, however, that these interpretations may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads or where the excavations are deeper than the depth of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that can be expected.

Information of value in planning engineering work is given throughout the text, particularly in the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

Much of the information in this section is given in tables 5, 6, and 7. Only the data in table 5 are from actual laboratory tests. The estimates in table 6 and the interpretations in table 7 are based on comparisons of soils with those tested. At many construction sites, major variations in soil characteristics occur within the depth of the proposed excavation, and several kinds of soil occur within short distances. Specific laboratory data on engineering properties of the soil at the site should be obtained before planning detailed engineering work.

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some words—for example, soil, clay, silt, and sand—have special meanings in soil science. These and other special terms that are used are defined in the Glossary at the back of this survey.

Engineering classification systems

Two systems for classifying soil are commonly used by engineers. These are the systems used by the American Association of State Highway Officials (AASHO) (*1*) and the Unified system (*11*). Both classifications are used in this survey.

In the AASHO system, soil materials are classified in seven principal groups, based on grain-size distribution, liquid limit, and plasticity index. The groups range from A–1 through A–7. In group A–1 are gravelly soils of high bearing capacity that are considered the best soils for subgrade. In group A–7 are clay soils that have low strength when wet and are the poorest soils for subgrade. Highly organic soils, such as peat and muck, are not included in the AASHO classification because their use as construction material or foundation material should be avoided.

For each of the principal groups, the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best materials to 20 for the poorest. The group index number is shown in parentheses following the group symbol in table 5.

In the Unified system, soils are classified according to their texture and plasticity and their performance as engineering construction materials. Soils are identified as coarse grained, eight classes; fine grained, six classes; and highly organic. Table 5 shows the Unified classification of the soils tested, and table 6 the estimated Unified classification of all soils in the county.

Engineering test data

Table 5 gives test data for samples from three important series in the county. Selected layers of each soil were sampled at two different locations. The samples were tested by standard procedures in the laboratories of the Joint Highway Research Project at Purdue University, under the sponsorship of the Bureau of Public Roads. These samples do not represent all of the soils in the county, nor even the entire range of characteristics within the series sampled. The results of the tests can be used, however, as a general guide in estimating the engineering properties of the soils in the county. Tests were made for moisture-density relationships, grain-size distribution, liquid limit, and plasticity index.

In the *moisture density*, or compaction test, a sample of the soil material is compacted several times with a constant compactive effort, each time at a successively higher moisture content. The moisture content increases until the optimum moisture content is reached. After that the density decreases with increase in moisture content. The highest density obtained in the compaction test is termed "maximum dry density." Moisture-density data are important in planning earthwork, because generally the soil is most stable if it is compacted to about its maximum dry density when it is at approximately the optimum moisture content.

The mechanical analysis was made by combined sieve and hydrometer methods (*3*, *4*). The results were used to determine the relative proportion of the different sized particles. The terms "sand," "silt," and "clay" do not mean the same to engineers as to soil scientists. For this reason, the percentages determined by these tests should not be used as a basis for naming textural classes of soils. For example, "clay" to the soil scientist means the mineral grains less than 0.002 millimeter in diameter. The engineer, however, may define "clay" as all mineral grains less than 0.005 millimeter in diameter (*5*).

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The tests for liquid limit and plastic limit measure the effect of water on the consistence of soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from the plastic state 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 *liquid limit* is the moisture content at which the soil material passes from a plastic to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and the plastic limit. It indicates the range in moisture content within which a soil material is in a plastic condition.

Engineering properties of the soils

In table 6 the soil series of the county and the symbols for mapping units are listed, and certain properties that are significant to engineering are described. Some of the estimates are based on available test data. Estimates of properties of soils not tested are based on test data for similar soils in this county and other counties and upon experience gained from working with and observing similar soils in other areas. These estimates provide information that can be used by the engineer. They are not, however, a substitute for detailed testing that may be needed at a site selected for construction. In general, the information in this table applies to a depth of about 5 feet. Because bedrock is at a great depth in this county and is not significant to engineering, it is not given in table 6.

Depth to seasonal high water table is the depth to free ground water during extended wet periods. During extended dry periods, depth to the water table varies from the depth shown.

Depth from the surface normally is given only for the major horizons, but other horizons also are listed if they differ significantly from the major horizons.

The dominant USDA texture is based on the classification used by the U.S. Department of Agriculture, which uses the relative amounts of sand, silt, and clay in a soil. The Unified and the AASHO classifications are made according to the relative amounts of the various sized particles and the liquid limit and the plasticity index of the fine material.

The amounts passing sieves No. 10, No. 40, and No. 200 have been rounded to the nearest 5 percent. Gravel size material does not pass the No. 10 sieve. The percent material passing the No. 200 sieve is mainly silt and clay, though the smaller grains of very fine sand also pass through it.

Permeability, based largely on texture, structure, and consistence, refers to the downward movement of water through undisturbed soil material.

Available moisture capacity, expressed as inches of water per inch of soil, is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. The capacity of a particular horizon to deliver water to plant roots depends on whether the roots can reach the horizon.

TABLE 5.—*Engineering*

[Tests performed by Purdue University in cooperation with Indiana State Highway Department and U.S. Department of Commerce,

Soil name and location [1]	Depth	Moisture-density data [2]		Mechanical analysis [3]		
		Maximum dry density	Optimum moisture	Percentage passing sieve—		
				¾-in.	⅜-in.	No. 4 (4.7 mm.)
Blount silt loam:	*Inches*	*Lb./cu. ft.*	*Percent*			
NE¼NW¼ sec. 9, T. 22 N., R. 11 E. (Finer textured C horizon than modal.)	0–6	98	22	----------	----------	100
	19–32	98	23	----------	----------	100
	32–44	104	19	100	99	98
NE¼SE¼ sec. 8, T. 22 N., R. 10 E. (Modal.)	0–7	96	23	----------	----------	----------
	18–27	99	22	----------	----------	----------
	27–33	106	18	----------	----------	100
Morley silt loam:						
NE¼NW¼ sec. 9, T. 22 N., R. 11 E. (Finer textured and thinner A horizon than modal.)	0–5	94	24	----------	100	99
	10–20	99	22	----------	100	99
	29–34	117	14	100	97	95
NW¼SW¼ sec. 9, T. 22 N., R. 10 E. (Modal.)	0–7	99	22	----------	100	99
	14–21	99	22	----------	100	99
	21–31	119	15	100	99	95
Pewamo silty clay loam:						
NW¼NW¼ sec. 9, T. 22 N., R. 11 E. (Coarser textured B horizon than modal.)	13–24	101	21	----------	----------	100
	24–34	103	19	----------	----------	100
	47–78	113	12	100	99	98
NW¼SW¼ sec. 9, T. 22 N., R. 10 E. (Modal.)	0–6	94	25	----------	----------	100
	19–34	111	16	----------	100	99
	45–56	114	13	100	98	94

[1] Parent material of the tested soils is calcareous till of Wisconsin age.
[2] Based on AASHO Designation T 99–57, Methods A and D (*1*).
[3] Mechanical analyses according to the AASHO Designation T 88–57(*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2

test data

Bureau of Public Roads (BPR), in accordance with standard procedures of the American Association of State Highway Officials (AASHO) (*1*)

Mechanical analysis [3]—Continued							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Con.			Percentage smaller than—							
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO	Unified [4]
99	94	87	86	70	28	18	39	13	A-6(9)	CL or OL
98	96	89	87	80	61	47	53	27	A-7-6(17)	MH-CH
95	91	85	84	77	59	45	45	23	A-7-6(14)	CL
100	97	93	89	76	33	19	34	11	A-6(8)	CL or OL
----------	100	99	98	97	70	52	54	32	A-7-6(19)	CH
99	98	97	96	90	62	40	36	16	A-6(10)	CL
98	93	81	78	65	38	24	38	14	A-6(10)	CL
98	95	86	84	78	64	51	51	26	A-7-6(17)	CH
90	85	76	73	65	47	34	34	15	A-6(10)	CL
98	94	84	80	62	35	21	37	15	A-6(10)	CL
92	88	81	79	74	59	50	53	30	A-7-6(19)	CH
87	80	68	66	58	36	24	32	15	A-6(9)	CL
99	98	87	84	75	52	40	53	29	A-7-6(18)	MH-CH
99	97	87	85	76	51	40	50	26	A-7-6(16)	CH
95	89	78	75	67	49	35	36	17	A-6(11)	CL
99	98	90	87	77	53	39	50	18	A-7-5(13)	OH
98	96	88	87	78	56	45	49	28	A-7-6(17)	OL
90	84	72	69	58	39	29	38	19	A-6(11)	CL

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.

[4] SCS and BPR have agreed to consider that all soils having plasticity indexes within two points from A-line are to be given a borderline classification. An example of borderline classification obtained by this use is MH-CH.

TABLE 6.—*Estimated engineering*

[Not included in this table because their characteristics are too variable to be classified, are the land types Borrow pits (Bp), Gravel pits not be applicable.

Soil series and map symbols	Depth to seasonal high water table	Depth from surface (representative profile)	Classification		
			Dominant USDA texture	Unified	AASHO
	Feet	*Inches*			
Blount:					
BlA, BlB, BlB2	[1]1–3	0–9	Silt loam	ML or CL	A–4 or A–6
		9–33	Silty clay	CL or CH	A–7
		33–60	Clay loam or silty clay loam	CL or CH	A–6 or A–7
Brookston:					
Br	0–3	0–12	Silty clay loam	CL	A–6
		12–50	Silty clay loam or clay loam	CL or CH	A–6 or A–7
		50–60	Loam or silt loam	ML or CL	A–4 or A–6
Bs	0–3	0–10	Silty clay loam	CL	A–7
		10–34	Silty clay loam, clay loam, or gravelly clay loam.	CL or CH	A–6 or A–7
		34–60	Gravelly sandy loam, gravelly loam, or gravelly silt loam.	SM	A–2
Carlisle:					
Ca	0–2	0–31	Muck	Pt	
		31–60	Peat and muck	Pt	
Crosby:					
CrA	[1]1–3	0–9	Silt loam	ML or CL	A–4 or A–6
		9–32	Silty clay loam or clay loam	CL or CH	A–6 or A–7
		32–60	Loam or silt loam	ML or CL	A–4 or A–6
CsA	[1]1–3	0–11	Silt loam	ML or CL	A–4 or A–6
		11–40	Silty clay loam, clay loam, or gravelly clay loam.	CL or CH	A–6 or A–7
		40–60	Gravelly sandy loam, gravelly loam, or gravelly silt loam.	M or CL	A–4 or A–6
Fox:					
FoC2, FoD2, FsA, FsB	>5	0–11	Silt loam or loam	CL	A–4
		11–39	Clay loam or gravelly clay loam	CL or SC	A–6
		39–60	Stratified gravel and sand	SM–SP or GM–GP	A–1
FxB3, FxC3	>5	0–8	Gravelly clay loam	CL	A–6 or A–7
		8–34	Clay loam or gravelly clay loam	CL or SC	A–6 or A–7
		34–60	Stratified gravel and sand	SM–SP or GM–GP	A–1
Genesee:					
Ge	>5	0–26	Silt loam	ML or CL	A–4 or A–6
		26–60	Silt loam, loam, or sandy loam	ML or CL	A–4 or A–6
Hennepin:					
HeE	>5	0–3	Loam	ML or CL	A–4 or A–6
		3–14	Clay loam, silty clay loam, or silt loam.	CL or ML	A–6
		14–60	Loam, silt loam, or clay loam	ML or CL	A–4 or A–6
Kokomo:					
Km	0–3	0–9	Mucky silt loam	OL	A–4
		9–36	Silty clay loam or silty clay	CL or CH	A–6 or A–7
		36–60	Stratified sand and silt, with some clay and gravel.	SM or ML	A–4
Ko	0–3	0–16	Silty clay loam	CL or CH	A–6 or A–7
		16–37	Silty clay, clay loam, or silty clay loam.	CL or CH	A–6 or A–7
		37–60	Stratified sand and silt, with some clay and gravel.	SM or ML	A–2 or A–4

properties of the soils

and Stone quarries (Gp), and Made land (Ma). Absence of an entry in a column indicates that a determination was not made, or it would
>=greater than]

Percentage passing sieve— No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available moisture capacity	Reaction	Frost-heave potential	Shrink-swell potential
			Inches per hour	*Inches per inch of soil*	*pH value*		
100	90–100	70–90	0. 63–2. 0	0. 17–0. 19	6. 1–6. 5	Moderate	Low.
100	95–100	90–95	0. 06–0. 2	0. 18–0. 20	5. 5–7. 4	Moderate or high	High.
100	90–100	70–95	0. 2–0. 63	0. 17–0. 19	7. 4–8. 4	Moderate	Moderate.
100	95–100	85–95	0. 2–0. 63	0. 18–0. 20	6. 6–7. 3	Moderate	Moderate.
100	95–100	85–90	0. 06–0. 2	0. 18–0. 20	6. 6–7. 3	Moderate	Moderate.
100	85–100	60–90	0. 2–0. 63	0. 17–0. 19	7. 4–8. 4	Moderate	Low.
100	95–100	85–95	0. 2–0. 63	0. 18–0. 20	6. 6–7. 3	Moderate	Moderate.
90–100	70–80	80–90	0. 06–0. 2	0. 18–0. 20	6. 6–7. 3	Moderate	Moderate.
70–80	44–55	25–35	2. 0–6. 3	0. 14–0. 17	7. 4–8. 4	Moderate	Low.
			2. 0–6. 3	>0. 25	6. 0–7. 3	Low	Low.
			2. 0–6. 3	>0. 25	6. 5–7. 3	Low	Low.
100	90–100	70–90	0. 63–2. 0	0. 17–0. 19	5. 6–6. 5	Moderate or high	Low.
100	95–100	85–95	0. 06–0. 2	0. 18–0. 20	5. 5–7. 5	Moderate	Moderate.
100	85–100	60–90	0. 2–0. 63	0. 16–0. 18	7. 4–8. 4	Moderate	Low.
100	90–100	70–90	0. 63–2. 0	0. 17–0. 19	5. 6–6. 5	Moderate or high	Low.
90–100	80–90	65–75	0. 06–0. 2	0. 18–0. 20	5. 6–6. 0	Moderate	Moderate.
75–85	65–75	50–65	2. 0–6. 3	0. 14–0. 17	7. 4–8. 4	Low	Low.
100	90–100	70–90	0. 63–2. 0	0. 17–0. 19	5. 6–6. 0	Moderate	Low.
90–100	70–80	35–55	0. 63–2. 0	0. 18–0. 20	5. 6–6. 0	Moderate	Moderate.
50–70	15–30	5–10	6. 3–20. 0	0. 03–0. 06	7. 4–8. 4	Low	Very low.
70–80	60–70	55–65	0. 2–0. 63	0. 18–0. 20	5. 6–6. 0	Moderate	Low.
75–85	60–70	45–55	0. 63–2. 0	0. 18–0. 20	5. 6–6. 0	Moderate	Moderate.
50–70	15–30	5–10	6. 3–20. 0	0. 03–0. 06	7. 4–8. 4	Low	Very low.
100	90–100	70–90	0. 63–2. 0	0. 17–0. 19	7–4–8. 4	Moderate	Low.
100	60–95	50–80	0. 63–2. 0	0. 14–0. 19	7. 4–8. 4	Moderate	Low.
100	90–100	70–90	0. 63–2. 0	0. 17–0. 19	6. 1–6. 5	Moderate or high	Low.
100	90–100	70–80	0. 63–2. 0	0. 18–0. 20	6. 1–6. 5	Moderate	Low or moderate.
100	85–100	60–80	0. 63–2. 0	0. 16–0. 18	7. 4–8. 4	Moderate	Low.
100	95–100	85–95	0. 63–2. 0	0. 19–0. 21	6. 6–7. 3	Moderate	Moderate.
100	95–100	85–95	0. 06–0. 2	0. 18–0. 20	6. 6–7. 3	Moderate	Moderate or high.
90–100	60–80	45–80	2. 0–6. 3	0. 14–0. 17	7. 4–8. 4	Moderate	Low.
100	95–100	85–95	0. 2–0. 63	0. 18–0. 20	6. 6–7. 3	Moderate	Moderate.
100	95–100	85–95	0. 06–0. 2	0. 18–0. 20	6. 6–7. 3	Moderate	Moderate or high.
90–100	60–80	25–65	2. 0–6. 3	0. 14–0. 17	7. 4–8. 4	Moderate	Low.

TABLE 6.—*Estimated engineering*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface (representative profile)	Classification		
			Dominant USDA texture	Unified	AASHO
	Feet	*Inches*			
Linwood:					
Lm	0–2	0–26	Muck	Pt	
		26–60	Silt loam, loam, or sandy loam	ML or CL	A–4 or A–6
Martinsville:					
MdC2	>5	0–11	Sandy loam	SM	A–4 or A–2
		11–47	Clay loam, sandy clay loam, or sandy loam.	CL or SC	A–6
		47–60	Stratified sand and silt with some gravel.	SM–SP	A–2
MeA, MeB	>5	0–10	Loam	ML or CL	A–4 or A–6
		10–43	Silty clay loam, clay loam, or sandy clay loam.	CL or CH	A–6 or A–7
		43–60	Stratified sand and silt with some gravel	SP–SM	A–2
Miami:					
MmA, MmB2, MmC2, MmD.	>5	0–12	Silt loam	ML or CL	A–4 or A–6
		12–36	Clay loam or silty clay loam	CL or CH	A–6 or A–7
		36–60	Loam or silt loam	ML or CL	A–4 or A–6
MnA, MnB, MnC2	>5	0–12	Silt loam	ML or CL	A–4 or A–6
		12–40	Silty clay loam or clay loam	CL or CH	A–6 or A–7
		40–50	Loam or silt loam	ML or CL	A–4
		50–120	Stratified gravel and sand	GM–GP	A–1
MoA, MoB	>5	0–10	Silt loam	ML or CL	A–4 or A–6
		10–40	Clay loam	CL or SC	A–6 or A–4
		40–60	Clay loam or silty clay loam	CL or CH	A–6 or A–7
MrB3, MrC3	>5	0–8	Clay loam or silty clay loam	CL or CH	A–6 or A–7
		8–34	Clay loam or silty clay loam	CL or CH	A–6 or A–7
		34–60	Loam or silt loam	ML or CL	A–4 or A–6
Morley:					
MuB, MuB2, MuD2	>5	0–7	Silt loam	ML or CL	A–4 or A–6
		7–25	Silty clay or silty clay loam	CL or CH	A–7
		25–60	Clay loam or silty clay loam	CL or CH	A–6
MvB2, MvC2	>5	0–8	Silt loam	ML or CL	A–4 or A–6
		8–26	Silty clay or silty clay loam	CL or CH	A–7
		26–48	Clay loam or silty clay loam	CL or CH	A–6
		48–120	Stratified gravel and sand	GP–GM	A–1
MwB3, MwC3	>5	0–6	Silty clay loam	CL or CH	A–6 or A–7
		6–22	Silty clay or silty clay loam	CL or CH	A–7
		22–60	Clay loam or silty clay loam	CL or CH	A–6 or A–7
Ockley:					
OcA, OcB	>5	0–10	Silt loam	ML or CL	A–4 or A–6
		10–49	Silty clay loam or clay loam	CL or CH	A–6 or A–7
		49–60	Stratified gravel and sand	GP–GM	A–1
Pewamo:					
Pe, Pk (For properties of Brookston soils in mapping unit Pk, see Brookston series in this table.)	0–3	0–12	Silty clay loam or silt loam	CL or CH	A–6, A–4, or A–7
		12–45	Silty clay	CL or CH	A 6 or A–7
		45–60	Clay loam or silty clay loam	CL	A–6 or A–7
Pf	0–3	0–10	Silty clay loam	CL or CH	A–6 or A–7
		10–42	Silty clay loam	CL or CH	A–7
		42–60	Silt loam or silty clay loam	CL or ML	A–6 or A–4
Rensselaer:					
Rc	0–3	0–12	Silty clay loam	CL or CH	A–6 or A–7
		12–41	Silty clay loam or clay loam	CL or CH	A–7
		41–60	Stratified sand and silt	SM	A–2

properties of the soils—Continued

Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Frost-heave potential	Shrink-swell potential
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
			Inches per hour	*Inches per inch of soil*	*pH value*		
------	------	------	2.0–6.3	>0.25	5.6–6.5	Low	Low.
100	85–100	60–90	0.63–2.0	0.17–0.19	7.4–8.4	Moderate	Low.
100	60–70	30–40	0.63–2.0	0.13–0.15	5.6–6.0	Moderate	Low.
100	60–90	35–55	0.63–2.0	0.18–0.20	5.6–6.0	Moderate	Moderate or low.
90–100	50–70	5–12	6.3–20.0	0.11–0.15	7.4–8.4	Low	Low.
100	90–100	70–90	0.63–2.0	0.17–0.19	5.6–6.5	Moderate or high	Low.
100	90–100	70–90	0.63–2.0	0.18–0.20	5.0–7.3	Moderate	Moderate.
90–100	50–70	5–12	2.0–6.3	0.11–0.15	7.4–8.4	Low	Low.
100	90–100	70–90	0.63–2.0	0.17–0.19	6.1–6.5	Moderate or high	Low.
100	90–100	70–80	0.63–2.0	0.18–0.20	5.6–6.0	Moderate	Moderate.
100	85–95	60–75	0.63–2.0	0.16–0.18	7.4–8.4	Moderate	Low.
100	90–100	70–90	0.63–2.0	0.17–0.19	6.1–6.5	Moderate or high	Low.
100	90–100	70–80	0.63–2.0	0.18–0.20	5.6–6.0	Moderate	Moderate.
100	85–95	60–75	0.63–2.0	0.16–0.18	7.4–7.8	Moderate	Low.
35–45	20–30	5–15	6.3–20.0	0.03–0.05	7.4–8.4	Low	Very low.
100	90–100	70–90	0.63–2.0	0.17–0.19	6.1–6.5	Moderate or high	Low.
95–100	70–80	35–55	0.63–2.0	0.18–0.20	5.6–6.0	Moderate	Moderate.
100	90–100	70–80	0.63–2.0	0.17–0.19	7.4–8.4	Moderate	Moderate.
100	90–100	70–80	0.2–0.63	0.18–0.20	5.6–6.0	Moderate or high	Moderate.
100	90–100	70–80	0.63–2.0	0.18–0.20	5.6–6.0	Moderate	Moderate.
100	85–95	60–75	0.63–2.0	0.16–0.18	7.4–8.4	Moderate	Low.
100	90–100	70–90	0.63–2.0	0.17–0.19	6.1–6.5	Moderate or high	Low.
100	95–100	90–95	0.06–0.2	0.18–0.20	5.6–6.0	Moderate or high	High.
100	90–100	70–80	0.2–0.63	0.17–0.19	7.4–8.4	Moderate	Moderate.
100	90–100	70–90	0.63–2.0	0.17–0.19	5.6–6.5	Moderate or hgih	Low.
100	95–100	90–95	0.06–0.24	0.18–0.20	5.6–6.0	Moderate or high	High.
100	90–100	70–80	0.2–0.63	0.17–0.19	7.4–7.8	Moderate	Moderate.
35–45	20–30	5–12	6.3–20.0	0.03–0.05	7.4–8.4	Low	Very low.
100	95–100	85–95	0.2–0.63	0.18–0.20	6.1–6.5	Moderate or high	Moderate or high.
100	95–100	90–95	0.06–0.2	0.18–0.20	5.6–6.0	Moderate or high	High.
100	90–100	70–80	0.2–0.63	0.17–0.19	7.4–8.4	Moderate	Moderate.
100	90–100	70–90	0.63–2.0	0.17–0.19	6.0–7.3	Moderate or high	Low.
100	85–100	65–80	0.63–2.0	0.18–0.20	5.0–7.3	Moderate	Moderate.
35–45	20–30	5–12	6.3–20.0	0.03–0.05	7.4–8.4	Low	Low.
100	95–100	85–95	0.2–0.63	0.18–0.20	6.6–7.3	Moderate or high	Moderate.
100	95–100	90–95	0.06–0.2	0.18–0.21	6.6–7.3	Moderate or high	High.
100	90–100	70–90	0.06–0.63	0.17–0.19	7.4–8.4	Moderate	Moderate.
100	95–100	85–95	0.2–0.63	0.18–0.20	6.6–7.3	Moderate	Moderate.
100	95–100	85–95	0.06–0.2	0.18–0.20	6.6–7.3	Moderate or high	High.
100	90–100	70–95	0.06–0.63	0.18–0.20	7.4–8.4	Moderate	Moderate.
100	95–100	85–95	0.2–0.63	0.18–0.20	6.6–7.3	Moderate	Moderate.
100	90–100	70–90	0.06–0.20	0.18–0.20	6.6–7.3	Moderate	Moderate.
100	50–90	15–35	2.0–6.3	0.14–0.17	7.4–8.4	Low	Low.

TABLE 6.—*Estimated engineering*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface (representative profile)	Classification		
			Dominant USDA texture	Unified	AASHO
	Feet	*Inches*			
Ross:					
Ro	>5	0–30	Silt loam	ML or CL	A–4 or A–6
		30–60	Silt loam or loam	ML or CL	A–4 or A–6
Sebewa:					
Se	[2] 0–3	0–11	Silty clay loam	CL or CH	A–6 or A–7
		11–33	Clay loam or silty clay loam	CL or CH	A–6 or A–7
		33–60	Stratified gravel and sand	GP	A–1
Shoals:					
Sh	1–3	0–12	Silt loam	ML	A–4
		12–30	Silt loam	ML	A–4
		30–60	Silty clay loam, clay loam, or loam	CL	A–4 or A–6
Sloan:					
Sn	[2] 0–3	0–13	Silt loam	ML or CL	A–4 or A–6
		13–26	Clay loam	CL or SC	A–6 or A–7
		26–60	Silt loam, loam, or loamy sand	ML, CL, or SM	A–2 or A–4
Wallkill:					
Wa	[2] 0–2	0–17	Silt loam	ML or CL	A–4 or A–6
		17–60	Muck and Peat	Pt	----------

[1] Water table is perched.

properties of the soils—Continued

Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Frost-heave potential	Shrink-swell potential
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
			Inches per hour	*Inches per inch of soil*	*pH value*		
100	90–100	70–90	0. 63–2. 0	0. 17–0. 19	7. 4–8. 4	Moderate	Low.
100	85–100	60–90	0. 63–2. 0	0. 17–0. 19	7. 4–8. 4	Moderate	Low.
100	95–100	85–95	0. 63–2. 0	0. 18–0. 20	6. 6–7. 3	Moderate	Low or moderate.
90–100	70–80	35–55	0. 63–2. 0	0. 18–0. 20	6. 6–7. 3	Moderate	Moderate.
25–35	5–10	0–5	6. 3–20. 0	0. 03–0. 05	7. 4–8. 4	Low	Very low.
100	90–100	70–90	0. 63–2. 0	0. 17–0. 19	6. 6–7. 3	Moderate or high	Low.
100	90–100	70–90	0. 63–2. 0	0. 17–0. 19	6. 6–7. 8	Moderate or high	Low.
100	85–100	60–80	0. 63–2. 0	0. 17–0. 19	7. 4–8. 4	Moderate	Moderate.
100	90–100	70–90	0. 63–2. 0	0. 17–0. 19	7. 4–7. 8	Moderate	Low.
90–100	70–80	35–55	0. 2–0. 63	0. 18–0. 20	7. 4–8. 4	Moderate	Moderate.
100	50–85	15–75	2. 0–20. 0	0. 14–0. 18	7. 4–8. 4	Low	Low.
100	90–100	70–90	0. 63–2. 0	0. 17–0. 19	6. 6–7. 3	Moderate	Low.
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[2] Ponded.

TABLE 7.—*Engineering*

[Not included in this table, because their characteristics are too variable to be classified,

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Reservoir area
Blount: BlA, BlB, BlB2	Good to a depth of 9 inches; poor below; clayey.	Not suitable	Poor in subsoil: high shrink-swell potential; highly plastic. Fair to poor in substratum: moderate shrink-swell potential; seasonal high perched water table.	Seasonal high perched water table; subject to frost heaving; plastic clay below the surface layer.	Slow seepage; seasonal high perched water table; clayey subsoil and substratum.
Brookston: Br	Fair or good to a depth of 12 inches; poor below; moderately fine textured.	Not suitable	Fair to poor in subsoil and substratum: moderate to low shrink-swell potential; subject to frost heaving; seasonal high water table.	Seasonal high water table; subject to frost heaving; moderately fine textured subsoil.	Seasonal high water table; slow seepage; moderately fine textured subsoil.
Bs	Fair to a depth of 12 inches; poor below; moderately fine textured; cobblestones on surface and in subsoil.	Not suitable	Poor in subsoil: cobblestones and boulders; seasonal high water table. Fair in substratum: low shrink-swell potential.	Seasonal high water table; subject to frost heaving; cobblestones and boulders in subsoil.	Seasonal high water table; slow seepage; cobblestones and boulders in subsoil.
Carlisle: Ca	Poor: organic material subsides rapidly; erodible.	Not suitable	Not suitable: organic; unstable; high water table.	Not suitable: unstable; high water table; subject to flooding.	High water table; organic material susceptible to flotation and cave-in.
Crosby: CrA	Good to a depth of 10 inches; poor below; moderately fine textured.	Not suitable	Poor in subsoil: moderate shrink-swell potential; moderately fine textured; seasonal high perched water table. Fair in substratum.	Seasonal high perched water table; subject to frost heaving; moderately fine textured subsoil.	Seasonal high perched water table; slow permeability; slow seepage; moderately fine textured subsoil.
CsA	Fair to a depth of 10 inches; poor below; cobblestones on surface and in subsoil.	Not suitable	Poor to fair in subsoil: moderate shrink-swell potential; cobblestones and boulders; seasonal high perched water table. Fair to good in substratum.	Seasonal high perched water table; cobblestones and boulders in subsoil; subject to frost heaving.	Seasonal high perched water table; cobblestones and boulders in subsoil.

interpretations of the soils

are the land types Borrow pits (Bp), Gravel pits and Stone quarries (Gp), and Made land (Ma)]

Soil features affecting—Continued					Limitations for sewage disposal	
Embankment	Agricultural drainage	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Clayey; medium to high compressibility; moderate to high shrink-swell potential.	Slow permeability; seasonal high perched water table.	Dense clayey subsoil; difficult to establish vegetation.	Dense clayey subsoil; highly erodible; gently sloping.	Shrink-swell potential high in subsoil and moderate below a depth of 3 feet; seasonal high perched water table; slow permeability.	Severe: seasonal high perched water table; slow permeability.	Slight.
Moderately fine textured; medium to high compressibility; moderate to low shrink-swell potential.	Seasonal high water table; slow permeability.	Nearly level and in depressions; runoff very slow to ponded.	Features generally favorable.	Shrink-swell potential moderate in subsoil and low below a depth of 4 feet; seasonal high water table.	Severe: seasonal high water table; subject to ponding; slow permeability.	Slight.
Cobblestones and boulders in subsoil; low to medium compressibility in substratum.	Seasonal high water table; slow permeability; cobblestones and boulders on surface and in subsoil.	Nearly level; wetness; cobblestones and boulders in subsoil.	Cobblestones and boulders in subsoil.	Shrink-swell potential moderate in subsoil and low below a depth of 3½ feet; seasonal high water table.	Severe: seasonal high water table; subject to ponding; slow permeability.	Moderate or severe: stones in subsoil and substratum.
Organic; unstable; highly compressible.	Organic material subject to subsidence; poor outlets; high water table.	Nearly level and in depressions; wetness.	Runoff very slow; ponded in places; low in available phosphorus and potassium.	Unstable; organic; high water table.	Severe: high water table; nearly level and in depressions.	Severe: high content of organic matter; nearly level and in depressions; frequently ponded; drainage from higher areas.
Slow permeability; moderately fine textured subsoil; fair stability and compaction.	Slow permeability; seasonal high perched water table.	Features generally are favorable.	Dense moderately fine textured subsoil; moderately erodible.	Shrink-swell potential moderate in subsoil and low below a depth of 3 feet; seasonal high perched water table.	Severe: seasonal high perched water table; slow permeability.	Slight.
Slow permeability; cobblestones and boulders in subsoil; low compressibility.	Cobblestones and boulders in subsoil; seasonal high perched water table; slow permeability.	Cobblestones and boulders in subsoil.	Cobblestones and boulders in subsoil.	Shrink-swell potential moderate in subsoil and low below a depth of 3 feet; seasonal high perched water table.	Severe: slow permeability; seasonal high perched water table.	Moderate or severe: stones in subsoil and substratum.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Reservoir area
Fox:					
FoC2, FoD2, FsA, FsB	Good to a depth of 9 inches; poor below; gravelly; moderately fine textured.	Good below a depth of 20 to 40 inches.	Fair to a depth of 20 to 40 inches; good below.	Well drained; loose gravel and sand in substratum; easily excavated; cuts and fills needed in many places; exposed road cuts difficult to vegetate.	Rapid seepage; substratum highly porous.
FxB3, FxC3	Poor in surface layer and subsoil; moderately fine textured; gravelly.	Good below a depth of 20 to 40 inches.	Fair to a depth of 20 to 40 inches; good below.	Well drained; loose gravel and sand in substratum; easily excavated; cuts and fills needed in many places; exposed road cuts difficult to vegetate.	Rapid seepage; substratum highly porous.
Genesee:					
Ge	Good to a depth of 36 inches.	Not suitable	Fair: subject to flooding.	Subject to flooding; subject to frost heaving.	Subject to flooding; moderate seepage.
Hennepin:					
HeE	Fair to a depth of 6 inches; steep; poor in subsoil.	Not suitable	Fair to poor: difficult to work and compact if wet; highly erodible.	Cuts and fills are needed; difficult to vegetate road cuts; very erodible.	Not suitable: steep
Kokomo:					
Km	Fair to good to a depth of 10 inches; poor in subsoil; clayey and gravelly.	Not suitable	Poor in subsoil: clayey and plastic. Fair in substratum: high water table.	High water table; subject to frost heaving; clayey subsoil; subject to ponding.	High water table; slow seepage; clayey subsoil.
Ko	Fair to a depth of 16 inches; poor below; clayey; high water table.	Not suitable	Poor in subsoil: clayey and plastic. Fair in substratum: high water table.	High water table; subject to frost heaving; clayey subsoil; subject to ponding.	High water table; slow seepage; clayey subsoil.

interpretations of the soils—Continued

Soil features affecting—Continued					Limitations for sewage disposal	
Embankment	Agricultural drainage	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Fair to good stability and compaction in subsoil; good stability and compaction in substratum; rapid permeability.	Generally well drained; strong short slopes in places; hazard of erosion; droughty.	Sand and gravel at a depth of 20 to 40 inches.	Sand and gravel at a depth of 20 to 40 inches.	Low compressibility; loose gravel and sand below a depth of 20 to 40 inches.	Slight on slopes of not more than 6 percent; moderate on slopes of 6 to 12 percent; severe on slopes of more than 12 percent; possible pollution of shallow wells by effluent.	Severe: loose porous gravel and sand at a depth of 20 to 40 inches.
Fair to good stability and compaction in subsoil; good stability and compaction in substratum; rapid permeability.	Well drained; short uneven slopes; hazard of erosion; droughty.	Sand and gravel at a depth of 20 to 40 inches.	Sand and gravel at a depth of 20 to 40 inches.	Low compressibility; loose gravel and sand below a depth of 20 to 40 inches.	Slight on slopes of not more than 6 percent; moderate on slopes of 6 to 12 percent; severe on slopes of more than 12 percent; possible pollution of shallow wells by effluent.	Severe: loose porous gravel and sand at a depth of 20 to 40 inches.
Moderate permeability; fair stability; fair compaction.	Soil features generally favorable; subject to flooding; nearly level.	On nearly level flood plains; runoff is slow.	Nearly level	On flood plains and subject to flooding.	Severe: subject to flooding.	Severe: moderate permeability; subject to flooding.
Fair stability and compaction; medium compressibility.	Well drained	Short, steep slopes; highly erodible.	Steep slopes; difficult to vegetate; highly erodible.	Steep slopes	Severe on slopes of more than 18 percent.	Severe on slopes of more than 18 percent.
Fair stability, fair to good compaction, and slight to medium compressibility in subsoil; fair stability, fair compaction, and medium compressibility in substratum.	High water table; slow permeability; in depressions; poor outlets.	Nearly level and in depressions.	Nearly level and in depressions; very poorly drained; low in phosphorus and potassium.	Slight to medium compressibility and moderate or high shrink-swell potential in subsoil; high water table.	Severe: high water table; subject to ponding; slow permeability.	Severe: subject to ponding; drainage from higher areas.
Fair stability, fair to good compaction, slow permeability, and slight to medium compressibility in subsoil. Fair stability, fair compaction, and medium compressibility in substratum; contains stratified sand, silt, and some gravel.	High water table; slow permeability; in depressions; poor outlets.	Nearly level and in depressions.	Nearly level and in depressions; clayey subsoil; wetness.	Medium compressibility; moderate or high shrink-swell potential in subsoil; high water table.	Severe: high water table; subject to ponding; slow permeability.	Severe: subject to ponding.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Reservoir area
Linwood: Lm	Poor: organic material subsides rapidly; erodible.	Not suitable	Poor in organic material: unstable; high water table. Fair to poor below organic layer.	Organic material to a depth of 12 to 40 inches; high water table; subject to frost heaving; low relief; subject to ponding.	Organic material to a depth of 12 to 40 inches; high water table; slow seepage in substratum;
Martinsville: MdC2	Fair to a depth of 11 inches; fair to poor below; moderately fine textured; sand content increases with depth.	Not suitable	Good in subsoil; fair to good in substratum.	Cuts and fills needed.	Moderate seepage; stratified sand and silt in substratum.
MeA, MeB	Good to a depth of 10 inches; fair to poor below; moderately fine textured; sand content increases with depth.	Not suitable	Good in subsoil; fair to good in substratum.	Cuts and fills needed.	Moderate seepage; stratified sand and silt in substratum.
Miami: MmA, MmB2, MmC2, MmD.	Good to a depth of 8 inches; poor below.	Not suitable	Poor in subsoil: moderately fine textured; plastic. Fair to poor in substratum: low shrink-swell potential; difficult to work and compact if wet.	Cuts and fills needed; subject to frost heaving; moderately fine textured subsoil.	Moderate to slow seepage; moderately fine textured subsoil.
MnA, MnB, MnC2	Good to a depth of 8 inches; poor below.	Good below a depth of 4 to 10 feet.	Poor in subsoil: plastic; moderately fine textured. Good in substratum.	Cuts and fills needed; subject to frost heaving; moderately fine textured subsoil; loose gravel and sand at a depth of 4 to 10 feet.	Rapid seepage in stratified sand and gravel.
MoA, MoB	Good to a depth of 8 inches; poor below.	Not suitable	Poor in subsoil: plastic; moderately fine textured. Poor in substratum: moderate shrink-swell potential; difficult to work and compact if wet.	Cuts and fills needed; subject to frost heaving; plastic; moderately fine textured below a depth of 3 feet.	Moderate to slow seepage.

interpretations of the soils—Continued

Soil features affecting—Continued					Limitations for sewage disposal	
Embankment	Agricultural drainage	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Unstable organic material to a depth of 12 to 40 inches; fair stability, fair compaction, and medium compressibility in substratum.	Organic material subject to subsidence; high water table; poor outlets.	In depressions; runoff very slow; ponded in places; organic material.	Very poorly drained; wetness; low in phosphorus and potassium.	Unstable organic material to a depth of 12 to 40 inches; high water table.	Severe: high water table; subject to ponding.	Severe: organic material.
Fair to good stability and compaction and medium compressibility in subsoil and substratum.	Well drained	Most features favorable, depending on slope.	All features favorable.	Deep; permeable; moderate to low shrink-swell potential.	Slight: possible pollution of shallow wells by effluent.	Severe: stratified sand and silt in substratum.
Fair to good stability and compaction and medium compressibility in subsoil and substratum.	Well drained	Most features favorable, depending on slope.	All features favorable.	Deep; permeable; moderate to low shrink-swell potential.	Slight: possible pollution of shallow wells by effluent.	Severe: stratified sand and silt in substratum.
Fair stability and compaction; moderately fine textured subsoil.	Well drained	All features favorable, if slopes are uniform.	Highly erodible on slopes of more than 6 percent; no limitations on lesser slopes; high runoff.	Shrink-swell potential moderate in subsoil and low at a depth of 2 to 3 feet.	Moderate on slopes of not more than 12 percent; severe on slopes of more than 12 percent; moderate permeability.	Slight on slopes of not more than 2 percent; moderate on slopes of 2 to 6 percent; severe on slopes of more than 6 percent.
Fair stability and compaction; moderately fine textured subsoil.	Well drained	Most features favorable, if slopes are uniform.	Features generally favorable on slopes of 6 percent or less; highly erodible on slopes of more than 6 percent; high runoff.	Shrink-swell potential moderate in subsoil and low to very low in substratum.	Moderate on slopes of not more than 12 percent; moderate permeability. Severe on slopes of more than 12 percent; possible pollution of shallow wells by effluent.	Severe: loose, porous gravel and sand at a depth of 4 to 10 feet.
Fair stability and compaction; medium to high compressibility.	Well drained	Most features favorable, if slopes are uniform.	Features generally favorable.	Shrink-swell potential moderate in subsoil and substratum.	Moderate: moderate permeability.	Slight on slopes of not more than 2 percent; moderate on slopes of 2 to 6 percent.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Reservoir area
Miami—Continued MrB3, MrC3	Poor in surface layer and subsoil; moderately fine textured.	Not suitable	Poor in subsoil: plastic; moderately fine textured. Fair to poor in substratum: moderate shrink-swell potential; difficult to work and compact if wet.	Cuts and fills needed; subject to frost heaving; moderately fine textured subsoil.	Moderate to slow seepage.
Morley: MuB, MuB2, MuD2	Fair to good to a depth of 8 inches; poor below; clayey.	Not suitable	Poor in subsoil and substratum: moderate to high shrink-swell potential; plastic clay; difficult to work; compact if wet.	Cuts and fills needed; subject to frost heaving; plastic clay.	Slow seepage; clayey subsoil and substratum.
MvB2, MvC2	Fair to good to a depth of 8 inches; poor below; clayey.	Good below a depth of 4 to 10 feet.	Poor in subsoil: moderate to high shrink-swell potential; plastic clay. Good in substratum.	Cuts and fills needed; subject to frost heaving; plastic clay; erodes readily.	Slow seepage in clayey subsoil; porous loose gravel and sand below a depth of 4 to 10 feet.
MwB3, MwC3	Poor in surface layer and in subsoil; clayey.	Not suitable	Poor in subsoil and substratum: moderate to high shrink-swell potential; plastic clay.	Cuts and fills needed; plastic clay.	Slow seepage; clayey.
Ockley: OcA, OcB	Good to a depth of 10 inches; poor below; moderately fine textured; gravelly.	Good below a depth of 42 inches.	Fair to a depth of 42 inches and good below.	Well drained; stratified gravel and sand below a depth of 42 inches; easily excavated.	Rapid seepage in substratum.

interpretations of the soils—Continued

Soil features affecting—Continued					Limitations for sewage disposal	
Embankment	Agricultural drainage	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Fair stability and compaction; medium to high compressibility.	Well drained	Most features favorable, if slopes are uniform.	Features generally favorable.	Shrink-swell potential moderate in subsoil and low in substratum.	Moderate on slopes of 2 to 12 percent; severe on slopes of more than 12 percent; moderately slow to moderate permeability.	Moderate on slopes of 2 to 6 percent; severe on slopes of more than 6 percent.
Fair stability and compaction; slow permeability; medium to high compressibility; clayey subsoil.	Well drained	Most features favorable, if slopes are uniform.	Dense clayey subsoil; difficult to vegetate.	Shrink-swell potential high in subsoil and moderate below a depth of 2½ feet; slow permeability.	Severe: slow permeability.	Moderate on slopes of 2 to 6 percent; severe on slopes of more than 6 percent.
Fair stability and compaction; slow permeability; moderate to high shrink-swell potential; medium to high compressibility; clayey subsoil; loose gravel and sand below a depth of 4 to 10 feet.	Well drained	Most features favorable, if slopes are uniform.	Clayey subsoil; difficult to vegetate.	High shrink-swell potential in subsoil.	Severe: slow permeability.	Severe: loose porous gravel and sand below a depth of 4 to 10 feet; slopes of more than 6 percent.
Fair stability and compaction; slow permeability; moderate to high shrink-swell potential; medium to high compressibility; clayey subsoil.	Well drained	Most features favorable, if slopes are uniform; difficult to vegetate.	Dense clayey surface layer and subsoil; difficult to vegetate.	Shrink-swell potential high in subsoil and moderate below a depth of 2 feet.	Severe: slow permeability.	Moderate on slopes of 2 to 6 percent; severe on slopes of more than 6 percent.
Fair stability, fair compaction, and slight to medium compressibility in subsoil; loose gravel and sand, good compaction, fair to poor stability, and slight compressibility in substratum.	Well drained	Most features favorable, if slopes are uniform.	Features generally favorable.	Deep; moderate permeability; moderate shrink-swell potential in subsoil; loose gravel and sand below a depth of 42 inches.	Slight: possible pollution of shallow wells by effluent.	Severe: gravelly in lower subsoil; porous loose gravel and sand at a depth of 42 inches.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Reservoir area
Pewamo:					
Pe	Fair to a depth of 12 inches; poor below; clayey.	Not suitable	Poor in subsoil and substratum: difficult to compact; moderate to high shrink-swell potential; subject to frost heaving; seasonal high water table.	Seasonal high water table; subject to frost heaving; clayey below surface layer.	Seasonal high water table; slow seepage; clayey below surface layer.
Pf	Fair to a depth of 12 inches; poor below; clayey.	Not suitable	Poor in subsoil and substratum: moderate to high shrink-swell potential; plastic clay difficult to compact; seasonal high water table.	Seasonal high water table; plastic clay; clayey subsoil.	Slow seepage; clayey subsoil; seasonal high water table.
Pk (For interpretations of Brookston soils in mapping unit Pk, see Brookston series in this table.)	Good to a depth of 10 to 20 inches; poor below; clayey.	Not suitable	Poor in subsoil and substratum: moderate to high shrink-swell potential; subject to frost heaving; plastic clay; seasonal high water table.	Seasonal high water table; subject to frost heaving; clayey below surface layer; subject to ponding.	Seasonal high water table; slow seepage; clayey subsoil.
Rensselaer:					
Rc	Fair or good to a depth of 12 inches; poor below; moderately fine textured.	Not suitable	Fair to poor in subsoil: plastic; moderately fine textured. Fair in substratum: silt and stratified sand; seasonal high water table.	Seasonal high water table; subject to frost heaving; moderately fine textured subsoil.	Seasonal high water table; moderate to slow seepage; moderately fine textured subsoil.
Ross:					
Ro	Good to a depth of 36 inches.	Not suitable	Fair: low shrink-swell potential; medium compressibility; fair stability.	Subject to flooding; subject to frost heaving.	Subject to flooding; moderate to slow seepage.
Sebewa:					
Se	Fair or good to a depth of 11 inches; poor below; moderately fine textured; gravelly.	Good below a depth of 24 to 40 inches.	Fair to poor in subsoil: low or moderate shrink-swell potential; seasonal high water table. Good in substratum: stratified gravel and sand.	Seasonal high water table; subject to frost heaving; loose gravel and sand at a depth of 24 to 40 inches.	Seasonal high water table; rapid seepage in substratum.
Shoals:					
Sh	Good to a depth of 12 inches; good to poor below; variable stratified layers.	Not suitable	Fair: seasonal high water table; difficult to work and compact if wet.	Subject to flooding; seasonal high water table; subject to frost heaving.	Seasonal high water table; subject to flooding; slow seepage.

interpretations of the soils—Continued

Soil features affecting—Continued					Limitations for sewage disposal	
Embankment	Agricultural drainage	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Fair stability and compaction; slow permeability; medium to high compressibility; clayey subsoil.	Seasonal high water table; slow permeability.	Nearly level and in depressions.	Very poorly drained; wetness; low in phosphorus and potassium.	Shrink-swell potential high in subsoil and moderate below a depth of 4 feet; seasonal high water table; slow permeability.	Severe: seasonal high water table; subject to ponding; slow permeability.	Slight: slow permeability; high clay content.
Fair stability; slow permeability; clayey subsoil; medium to high compressibility.	Seasonal high water table; slow permeability.	Nearly level and in depressions.	Very poorly drained; wetness; low in phosphorus and potassium.	Compressibility and shrink-swell potential high in subsoil and moderate below a depth of 4 feet; seasonal high water table.	Severe: slow permeability; seasonal high water table.	Slight: slow permeability; high clay content.
Fair stability and compaction; slow permeability; medium to high compressibility; clayey subsoil.	Seasonal high water table; slow permeability; poor outlets; subject to ponding.	Nearly level and in depressions.	Subject to ponding; wetness.	Shrink-swell potential moderate to high in subsoil and moderate below a depth of 4 feet; seasonal high water table; slow permeability; subject to ponding.	Severe: seasonal high water table; slow permeability; subject to ponding.	Slight.
Fair stability, fair to good compaction, medium compressibility, and slow permeability in subsoil; fair stability, fair compaction, and medium compressibility in substratum.	Seasonal high water table; slow permeability.	Nearly level and in depressions.	Runoff slow; ponded in places; low in phosphorus and potassium.	Shrink-swell potential moderate in subsoil and low below a depth of 3½ feet; seasonal high water table.	Severe: seasonal high water table; subject to ponding; slow permeability.	Slight.
Moderate permeability; fair stability; fair compaction; subject to flooding.	Well drained____	Nearly level; on flood plains.	Nearly level; on flood plains.	On flood plains and subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Fair stability and fair to good compaction in subsoil; good stability and compaction in substratum; contains loose gravel and sand.	Seasonal high water table; sand and gravel below a depth of 24 to 40 inches.	Nearly level and in depressions.	Very poorly drained; wetness.	Shrink-swell potential moderate in subsoil and low at a depth of 24 to 40 inches; seasonal high water table.	Severe: seasonal high water table; possible stream pollution through loose gravel and sand.	Severe: gravelly in lower subsoil; loose gravel and sand at a depth of 24 to 40 inches.
Fair stability and compaction; subject to flooding; medium compressibility.	Seasonal high water table; subject to flooding.	Nearly level; on flood plains.	Somewhat poorly drained; wetness.	Seasonal high water table; on flood plains and subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Reservoir area
Sloan: Sn	Fair or good to a depth of 12 inches; poor below; variable stratified layers; gravelly.	Not suitable	Fair to poor: subject to frost heaving and flooding; seasonal high water table.	Subject to flooding; seasonal high water table; subject to frost heaving.	Seasonal high water table; subject to flooding; slow seepage.
Wallkill: Wa	Good to a depth of 10 to 20 inches.	Not suitable	Not suitable	Organic material at a depth below 10 to 20 inches; unstable; subject to ponding.	Organic material; high water table.

Reaction, the degree of alkalinity or acidity of a soil, is expressed in pH values. This column lists estimated ranges in field pH values for each major horizon. A pH of 7, for example, indicates a neutral soil, a lower pH value indicates acidity, and a higher value indicates alkalinity.

Frost-heave potential indicates the degree of susceptibility of each major soil layer to the formation of ice lenses and the subsequent loss of stability on thawing. Silty soils are particularly susceptible to frost heave.

Shrink-swell potential indicates the volume change to be expected with change in moisture content. The estimates are based primarily on the amount and kind of clay in the soil.

Engineering interpretations of the soils

Table 7 rates the soils according to their suitability as a source of topsoil, sand and gravel, and road fill. It also lists soil features that would affect use of the soil as sites for highways, work on structures that conserve soil and water, and foundations for low buildings. In addition, ratings of the limitations of the soils for use as sites for septic tank filter fields and sewage lagoons are given, and the chief reasons for assigning moderate or severe limitations are listed. The interpretations in this table apply to the representative profile of each series described in the section "Descriptions of the Soils."

A soil feature may be helpful in one kind of engineering work and a hindrance in another. For example, a soil that has a permeable substratum is not desirable as a site for a farm pond, but may be desirable as a location for a highway.

Topsoil refers to soil material, preferably rich in organic matter, that is used as a topdressing on back slopes, embankments, lawns, gardens, and the like. The suitability ratings are based mainly on texture of the soil and its content of organic matter.

The suitability of a soil as a source of sand and gravel applies to the soil material within a depth of 7 feet. Depth to sand or sand and gravel varies, even within the same soil series. Test pits therefore are needed to determine the extent and availability of sand or sand and gravel.

The suitability of the soils as a source for road fill is based on the performance of the soil material when used to build embankments. Both the subsoil and substratum are rated if they widely differ in texture. Soil texture and the nature of the clay are the main features considered.

Features considered in rating the soils for highway location were those that affect the overall performance of the soil. The ratings are based on undisturbed soil without artificial drainage.

Permeability of the undisturbed soil, which affects seepage, is the main feature considered in determining the suitability of the soils for reservoir areas.

The features considered for farm-pond embankments are those that affect the use of the disturbed soil material for constructing embankments to impound surface water.

Agricultural drainage is influenced by features that affect the installation and performance of surface and subsurface drainage practices. Among these features are texture, permeability, relief, seasonal water table, and restricting layers.

interpretations of the soils—Continued

Soil features affecting—Continued					Limitations for sewage disposal	
Embankment	Agricultural drainage	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Fair stability and compaction; subject to flooding; medium compressibility.	Seasonal high water table; subject to flooding.	Nearly level and in depressions; flood plains.	Runoff very slow; wetness.	Shrink-swell potential moderate in subsoil and low below a depth of 3 feet; subject to flooding and ponding; seasonal high water table; moderately slow permeability.	Severe: seasonal high water table; subject to flooding; moderately slow permeability.	Severe: subject to flooding.
Organic material at a depth below 10 to 20 inches; subject to ponding.	High water table; subject to ponding; poor outlets.	In depressions.	Level; very poorly drained.	Unstable organic material below a depth of 10 to 20 inches; high water table; subject to ponding.	Severe: high water table; subject to ponding; organic material below a depth of 10 to 20 inches.	Severe: high content of organic matter; low and frequently ponded; drainage from higher areas.

Features that affect the layout and construction of terraces and diversions are relief, texture, and depth to soil material unfavorable to good growth of crops.

For grassed waterways features that affect the establishment and growth of plants and the layout and construction of the waterways were considered. Among such features are runoff, texture, and stones on and in the soil.

The soil features considered for building foundations are those properties of undisturbed soils that affect their suitability for supporting foundations of low buildings with normal foundation loads. Evaluations were largely made on the subsoil and the substratum because these layers generally provide the base for foundations.

Among the features considered in rating the soils for use as septic tank filter fields were permeability, seasonal water table, susceptibility to flooding, and relief.

Use of the soils for sewage lagoons is influenced chiefly by such soil features as permeability, slope, suitability of the material for embankment and for reservoir basin, and presence of coarse fragments on the surface.

Formation and Classification of Soils

In this section the factors that have affected the formation of soils in Delaware County are discussed. Then the current system of soil classification is explained, and the soil series are placed in higher categories. The soil series in the county, including a profile representative of each series, are described in the section "Descriptions of the Soils."

Factors of Soil Formation

Soil is formed by weathering and other processes that act upon parent material. The characteristics of a soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the parent material has been in place and subject to the soil-forming processes.

Climate and plants and animals are the active forces of soil formation. They act on the parent material accumulated through the weathering of rocks and slowly change it into soil. The effects of climate, plants, and animals are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing parent material into a soil. It may be much or little, but some time is always required for differentiation of soil horizons. Usually, a long period of time is needed for distinct horizons to develop.

Few generalizations can be made regarding the effect of any one factor of soil formation, because the effect of each is modified by the other four. Many of the processes of soil development are unknown.

Parent material

The parent materials from which the soils of Delaware County are derived consist of glacial till and of outwash gravel and sand of Wisconsin age and of alluvial deposits along streams.

The bedrock of Delaware County is middle Silurian dolomitic limestone. It is near the northern end of the Cincinnati arch. The bedrock dips westerly from almost no dip at all across the broad top of the north end to a dip of 30 feet per mile in the southwest. The limestone ranges in thickness from 50 to more than 200 feet. Thickness of the glacial drift over the bedrock ranges from 5 to 200 feet. Bedrock is near the surface south of Eaton along the Mississinewa River, at the southwest edge of Muncie along Cornbread Road, and where the tracks of the Norfolk and Western Railway Company cross White River at the east edge of Muncie.

The glaciation in Delaware County occurred during the Pleistocene epoch. The drift that was left by the glaciers is of Wisconsin age. The main advance of glacial ice into central Indiana during Wisconsin age had two distinct advances within a span of about 1,000 years. The first, which occurred about 21,000 years ago, reached farthest south to the end moraine (*13*). After the first advance the ice melted somewhat and then, about 20,000 years ago, readvanced to a new position a few miles north of its previous one. The segment of the continental ice sheet that covered most of central Indiana during this time was the East White sublobe of the Ontario-Erie lobe. This sheet produced what is recognized as the broad Tipton till plain.

The glacial drift in Delaware County is divided into two distinct parts. The soils in roughly the southern third of the county formed in loam and silt loam till. The dominant soils in this area are in the Miami, Brookston, and Crosby series. The clayey soils in the northern two-thirds of the county formed in clay loam or silty clay loam till. The dominant soils in this area are in the Blount, Pewamo, and Morley series. The dividing line between the two tills underlying these soils is along White River from the east edge of the county to Muncie. From Muncie west the line follows a rather indistinguishable series of low rolling ridges along the tracks of the Norfolk and Western Railway Company.

The glaciation left a number of moraines, eskers, and kames in the county. The rolling slopes in the southeastern part of the county are part of the Knightstown moraine (*12*). The abrupt ridge system rising above the till plain northeast of Muncie is the Muncie esker. This esker is rich in gravel and sand. Several kames in the county rise above the till plain like an inverted bowl. They also are rich in gravel and sand. Soils of the Fox series are most commonly associated with the kame and esker formation. Immediately west of the esker is the esker trough, which is parallel with the esker. The esker trough is a very poorly drained, low-lying area that contains organic material in places. Soils of the Kokomo series that have a stratified substratum occupy much of the trough.

A thin capping of loess up to 18 inches thick was deposited over the drift materials by wind. This material is silt loam that is easy to work. It makes up the plow layer in uneroded areas.

Climate

Climate influences the formation of soils both directly and indirectly. It affects the weathering and reworking of parent material directly through rainfall, temperature, and wind. It affects the soils indirectly through the amount and kind of vegetation and animal life sustained.

Summers in Delaware County are hot and humid; winters are cold. Total annual precipitation is about 37 inches. The amount of rainfall is greater in fall and spring than in other seasons. Water from heavy rainfall has leached plant nutrients from the surface layer of the soils. The climate is so uniform throughout the county, however, that differences among the soils cannot be attributed to the climate.

Plants and animals

Higher plants, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to soil formation. The higher plants bring moisture and plant nutrients from the lower part of the profile to the upper part and return organic matter to the soil. Bacteria and fungi cause dead vegetation waste to decompose into organic matter and to be incorporated into the soil.

The native vegetation of Delaware County consisted mainly of hardwood trees, such as oak, hickory, elm, maple, and ash. Trees return a comparatively small amount of organic matter to the soils. In uncleared parts of the upland, the surface has a thin cover of forest litter and leaf mold. The topmost inch or two of the soils contains a small amount of organic matter derived from decayed leaves and twigs. In some small areas, the native vegetation consisted of swamp grasses, sedges, and water-tolerant trees. The soils in these areas were covered with water much of year, and the organic matter decayed slowly. Some accumulation of organic matter resulted.

The vegetation is fairly uniform throughout the county. Major differences among the soils, therefore, cannot be explained on the basis of differences in vegetation. Some comparatively minor variations in the vegetation are associated with different soils, but these variations probably are the result, not the cause, of differences among the soils.

Man, through his activity, also affects the formation of soils. He determines, by the kind of management he uses, whether the soil is conserved or is lost through erosion. Erosion removes topsoil, organic matter, and plant nutrients and makes a soil that is soft, friable, and easy to work hard, cloddy, and sticky. By draining the dark-colored depressional soils, man has improved aeration in the subsoil and, in places, improved the oxidizing of minerals. If these drained soils are plowed when they are wet, however, the friable surface soil becomes hard and cloddy. Man has also changed the soils by use of diversions and other structures that change the natural flow of the water.

Areas in the county greatly changed by man are mapped as Made land, Borrow pits, and Gravel pits and Stone quarries. Also, Pewamo and Brookston silt loams, overwash, formed largely as the result of man's activity. The original dark-colored organic soil is now covered by recent alluvium or colluvium that comprises the surface layer of these soils.

Relief

Relief influences the formation of soils through its effect on drainage, runoff, leaching, and normal and accelerated erosion.

The relief in Delaware County ranges from nearly level on bottom lands, terraces, and upland flats to steep on short breaks. Areas of rolling soils in the county have been dissected by stream cutting and erosion.

Strongly sloping soils are not so well developed as level and gently sloping soils, even though the parent material was the same. This weaker development of the strongly sloping soils comes from more rapid geologic erosion, less leaching, and lack of enough water in the soil for vigorous growth of plants. Soils that formed under the same kind of vegetation and from the same kind of parent material vary in degree of profile development that takes place largely because of the amount of water that passes through the soils.

The Morley, Blount, and Pewamo soils are examples of soils that show the effects of variation in relief on formation of soils that developed from similar parent material. All of these soils formed in a mantle of loess overlying glacial till. The Morley soils, which are gently sloping to strongly sloping, are well drained. The Blount soils, which are level to nearly level, are somewhat poorly drained. The Pewamo soils, which are level and in depressional areas, are very poorly drained.

Time

The length of time that soil material remains in place and is acted upon by the soil-forming processes largely determines whether a soil is fully developed and mature or is poorly developed and young. Soils along the flood plains are said to be young. They show little profile development because fresh material is deposited on the areas periodically. Examples are soils of the Genesee, Shoals, and Sloan series. Many soils on steep slopes, such as those of the Hennepin series, are immature because geologic erosion removes material nearly as fast as it is formed.

Mature soils have well-developed A and B horizons that were produced by the natural processes of soil formation. Soils of the Miami, Crosby, and Brookston series, which were derived from Wisconsin till, have strong differentiating horizons and are leached of carbonates to a depth of 24 to 42 inches. Morley, Blount, and Pewamo soils were also derived from materials of the Wisconsin glaciation. They formed in finer textured till and are from a different segment of the sublobe. The A and B horizons of these soils are also well developed and are leached of carbonates to a depth of 20 to 40 inches.

Processes of Soil Formation

Four processes were involved in the formation of horizons (*10*) in the soils of this county. These processes are the accumulation of organic matter, the leaching of calcium carbonates and bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the formation of horizons.

The accumulation of organic matter in the upper part of the profile to form an A1 horizon has been important. In general, the soils that contain much organic matter have a thick, dark-colored surface layer and have produced the most grass in their natural environment.

Carbonates and bases have been leached from the upper horizons of nearly all of the soils of this county. This leaching is generally believed to precede the translocation of silicate clay minerals.

Clay particles accumulate in pores and form films on the surface along which water moves. Leaching of bases and the translocation of silicate clays are among the more important processes in horizon differentiation in the soils of this county. Soils of the Morley series are examples of soils in which translocated silicate clays have accumulated in the B2t horizon in the form of clay films.

The reduction and transfer of iron, or gleying, is evident in some of the very poorly drained soils, such as those of the Pewamo series. The gray color of the subsoil indicates the reduction and loss of iron. Mottles, which occur in some horizons, indicate segregation of iron.

Classification of Soils

Soils are classified so that we may more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of lands.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering works; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*7*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965 (*8*). It is under continual study. Therefore, readers interested in developments of this system should search the latest literature available (*6*). The soil series of Delaware County are placed in some categories of the current system in table 8. The classes in the current system are briefly defined in the paragraphs that follow:

ORDERS: Ten soil orders are recognized in the current system. They are Aridisols, Entisols, Vertisols, Inceptisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The exceptions, Entisols and Histosols, occur in many different climates. Four soil orders are represented in Delaware County—Alfisols, Histosols, Inceptisols, and Mollisols.

Alfisols are soils containing a clay-enriched B horizon that has medium or high base saturation.

Histosols are highly organic soils that formed in marshes and swamps where organic matter from decaying plants accumulated.

Inceptisols generally form on young, but not recent, land surfaces. These soils have weakly developed or incipient horizons.

Mollisols have formed mostly under grass. They have a thick, friable, dark-colored surface layer. Base saturation is more than 50 percent.

SUBORDERS: Each order is subdivided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders have a narrower climatic range than the orders. The criteria for suborders chiefly reflect the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUPS: Each suborder is separated into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons.

SUBGROUPS: Each great group is subdivided into subgroups. One of these subgroups represents the central (typic) segment of the great group, and the others, called intergrades, contain those soils having properties of soils in another group, suborder, or order.

FAMILIES: Each subgroup is divided into families, primarily on the basis of properties important to the growth of plants. Among the properties considered are texture, mineralogy, reaction, and soil temperature.

SERIES: The series consists of a group of soils that formed from a particular kind of parent material and having genetic horizons that, except for texture of the surface soils, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, consistence, reaction, and mineralogical and chemical composition.

General Nature of the County

Most of the early settlers in Delaware County came from Virginia, Pennsylvania, and Kentucky. The Delaware and Miami Indians were living there when they arrived and remained until 1818. Muncie, the county seat, was named for the chief of the Delaware tribe.

The area was officially established as a county in 1827. The discovery of natural gas in the county in 1886 led to the development of many local industries. Ball Brothers Glass Corporation, the largest of these, was responsible for the establishment of Ball State University and Ball Memorial Hospital. Some businesses closed after the supply of natural gas was depleted, but in general industry continued to increase over the years. Today Muncie is one of the major industrial areas in central Indiana. The main industries are plants that treat metal, produce alloys, and provide metal products; factories that manufacture automotive equipment, electrical transformers, and tool and die equipment; and firms that process meat, sell retail foods, and supply trucking services. A fairly new industry in the county is the excavation and sale of peat. The peat is used in urban areas as a mulch and soil conditioner.

Delaware County is presently changing from an essentially rural area to a modern urban area. Many residents of the county now commute to work daily to cities outside the county.

The county is served by the Norfolk and Western, the Penn Central, and the Chesapeake and Ohio railroads. Local and interstate buses serve most communities. Allegheny Airlines provides service to larger cities, and small airlines provide commuter service to Muncie.

TABLE 8.—*Classification of soil series of Delaware County* [1]

Series	Family	Subgroup	Order
Blount	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Brookston	Fine-loamy, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Carlisle	Nonacid, nonwoody, nonclastic, organic-fragmental, mesic.	Hemic Medisaprists	Histosols.
Crosby	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Fox	Fine-loamy over sandy or sandy skeletal, mixed, mesic.	Typic Hapludalfs	Alfisols.
Genesee [2]	Fine-loamy, mixed, mesic	Fluventic Eutrochrepts	Inceptisols.
Hennepin	Fine-loamy, mixed, mesic	Typic Eutrochrepts	Inceptisols.
Kokomo	Fine, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Linwood	Nonacid, nonwoody, nonclastic, loamy, mesic	Terric Medisaprists	Histosols.
Martinsville	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Miami	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Morley	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Ockley	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Pewamo	Fine, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Rensselaer	Fine-loamy, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Ross	Fine-loamy, mixed, mesic	Cumulic Hapludolls	Mollisols.
Sebewa	Fine-loamy over sandy or sandy skeletal, mixed, noncalcareous, mesic.	Typic Argiaquolls	Mollisols.
Shoals [2]	Fine-loamy, mixed, nonacid, mesic	Aeric Fluventic Haplaquepts	Inceptisols.
Sloan [2]	Fine-loamy, mixed, noncalcareous, mesic	Fluventic Haplaquolls	Mollisols.
Wallkill	Fine-loamy, mixed, nonacid, mesic	Thapto-Histic Haplaquepts	Inceptisols.

[1] Placement of some soil series in the current system of classification, particularly in families, may change as more information becomes available.

[2] These soils are taxadjuncts to their series because they are slightly calcareous.

Climate[2]

The climate of Delaware County is characterized by four well-defined seasons, by frequent changes in temperature and humidity, and by nearly ideal rainfall. Table 9 shows representative temperature and precipitation data. Table 10 shows the last freezing temperatures in spring and the first in fall.

Temperatures of 90° or higher occur on an average of 9 days during July, the warmest month of the year. Temperatures below zero occur on an average of 7 days in winter. January generally is the coldest month of the year.

Maximum precipitation generally is in spring and early in summer. The average rainfall in winter is less than 3 inches per month, and the average in spring is more than 4 inches per month. The months of April, May, and June each have an average of 8 days with one-tenth inch or more of rain. The winter months and the months in the latter part of summer have an average of 5 days with this amount of rainfall. Rainfall of 1.3 inches or more in 1 hour occurs about once every 2 years; 2.1 inches in 1 hour, about every 10 years; and 2.5 inches in 1 hour, about every 25 years. Two inches of rain falls in a 6-hour period about once every 2 years, and 3.4 inches in a 6-hour period falls about once every 10 years. Droughts are infrequent in the county, and they affect farming only occasionally.

The average yearly snowfall is 21 inches. Most snow comes in January, but snow occurs as early as October and as late as May. The most snow in any one day, 14 inches, was recorded November 26, 1950. The record for 1 month is 18.5 inches that fell during March in 1924.

Relative humidity on a typical summer day ranges from in the 40's in the afternoon to 90° or higher just before dawn. In winter the most probable range is from in the 60's to in the 90's. Relative humidity in a 24-hour period generally rises as temperature falls and falls as temperature rises. Thus the humidity pattern generally is the reverse of the temperature pattern.

Fall generally is the best time of year for outdoor activities. About 70 percent of the maximum sunshine is available, the chance of rain showers is at a minimum, and temperatures are comfortable.

Severe storms are rare in the county, but 17 tornadoes have been reported in the period 1916–66. Low-pressure centers from the west cross the plains and move up to the valley of the Ohio and St. Lawrence Rivers to the Atlantic Ocean. Most of the rainfall in the county comes as a result of these storms. Thunderstorms occur in the afternoons in summer and are the primary source of summer rainfall. About 47 days each year have such storms. About one thunderstorm a year occurs in winter.

[2] By LAWRENCE A. SCHAAL, State climatologist, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Temperature and precipitation data*

[All data from Muncie]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average monthly highest maximum	Average monthly lowest minimum	Average monthly total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Days with snow cover[1]	Average depth of snow on days with snow cover[1]
	° F.	° F.	° F.	° F.	Inches	Inches	Inches		Inches
January	37	20	58	−5	2.8	0.7	4.6	9	3
February	40	22	60	−1	2.1	.5	3.4	6	3
March	49	30	72	12	3.6	1.1	5.4	3	4
April	62	40	81	24	3.8	1.9	6.1	0	0
May	74	50	87	32	4.1	2.1	5.8	0	0
June	83	59	94	43	4.4	1.5	7.1	0	0
July	86	62	95	49	3.6	1.7	5.6	0	0
August	85	60	95	45	3.5	1.7	4.7	0	0
September	79	53	93	35	3.6	.6	6.0	0	0
October	68	43	84	26	2.7	.8	5.0	0	0
November	51	32	71	14	2.9	1.5	4.6	1	5
December	39	23	60	−1	2.6	.6	3.7	8	3
Year	63	41	[2] 98	[3] −10	39.7	14.7	62.0	27	4

[1] One inch or more.
[2] Average annual highest maximum.
[3] Average annual lowest minimum.

TABLE 10.—*Probabilities of last freezing temperatures in spring and first in fall*

	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	April 1	April 8	April 21	May 2	May 15
2 years in 10 later than	March 25	April 1	April 15	April 27	May 11
5 years in 10 later than	March 11	March 19	April 3	April 15	May 1
Fall:					
1 year in 10 earlier than	November 9	October 22	October 19	October 5	September 23
2 years in 10 earlier than	November 15	October 30	October 25	October 10	September 27
5 years in 10 earlier than	November 27	November 10	November 4	October 21	October 7

Natural Resources

Delaware County is abundantly supplied with a variety of natural resources. Among these are limestone, gravel, sand, and clay. Natural gas wells are no longer producing gas, but a few provide limited quantities of oil. Some of the old gas wells are now an excellent source of water.

Limestone is near the surface in several areas. It is used commercially for roadbuilding, for concrete, and as a source of lime for farming. Some of the limestone is used for decorative stone and for flagstone.

Many sources of gravel and sand are in the county, as well as many gravel pits. Several of the gravel pits are good commercial sources, and many potential sources for gravel remain to be opened.

The soils in the county generally contain enough clay to be used in the manufacture of brick tile and field tile. Most of the bricks in the early brick homes, schools, and stores in the county were made from local clay. A small factory that manufactures field tile still operates just north of the Delaware County line.

Farming

The farms in Delaware County are some of the most productive in the State, and their output is consistently high. Most farms in the county are now specialized enterprises, such as dairy farms, cash-grain farms, and farms where cattle are fed for market. The small family farms are decreasing in number and, for economic reasons, have been replaced by larger farms.

In 1964, according to the U.S. Census of Agriculture, 1,387 farms were in the county, and they occupied 207,515 acres. Of these farms, 779 were fully owned, 412 were partly owned, 195 were operated by the tenants, and 1 farm was operated by a manager.

Corn occupied a total of 57,239 acres in the county in 1964; soybeans, 42,668 acres; wheat, 19,399 acres; alfalfa and alfalfa mixtures, 9,134 acres; oats, 5,860 acres; and clover, timothy, and grasses, 4,335 acres.

The chief livestock enterprise in the county is the raising of hogs. The number of hogs and pigs is decreasing, however, and the number of beef cattle is increasing. In 1964, 55,238 hogs and pigs were reported in the county; 26,627 cattle and calves; 4,458 milk cows; and 6,696 sheep and lambs. In addition 70,559 chickens, 4 months old and older, were reported on the farms.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere, but that in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

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

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: Clay coat, clay skin.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Depth, soil. Total depth of soil profile over bedrock or other strongly contrasting nonconforming rock material. Depth class limits used in describing soils in this survey and their depth are—

	Inches
Shallow	20 or less.
Moderately deep	20 to 40.
Deep	40 or more.

Drift (geology). Material of any sort deposited by geologic processes in one place after having been moved from another; includes drift materials deposited by glaciers and by streams and lakes associated with them.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Esker (geology). A narrow, winding ridge or mound of stratified gravelly and sandy drift that was deposited by a subglacial stream.

Flood plain. Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlaying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or materials.

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 ponded. Relative terms for expressing drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Krotovinas. Irregular tubular streaks within one horizon transported from another horizon. They are caused by the filling of tunnels made by burrowing animals in one horizon with material from outside the horizon.

Lacustrine deposit (geology). Material deposited in lake water and exposed by lowering of the water or elevation of the land.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Loess. A fine-grained deposit laid down by wind and consisting dominantly of silt particles.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Natural soil drainage. Refers to the conditions of frequency and duration of periods of saturation or partial saturation 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 soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have 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 the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and in 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 disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Runoff. The amount of water removed by flow over the surface of the soil. The amount and rapidity of runoff are affected by such factors as texture, structure, and porosity of the surface soil; the plant cover; the prevailing climate; and the slope. The degree of runoff is expressed by the terms *very rapid, medium, slow, very slow,* and *ponded.*

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 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.

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.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or 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."

Till (geology). See Drift (geology).

Till plain. A level or undulating land surface covered by till, which is unstratified glacial drift consisting of clay, sand, gravel, and boulders intermingled.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

[For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. In referring to a capability unit, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, p. 8.
Predicted yields, table 2, p. 32.
Suitability of the soils for kinds of wildlife, table 3, p. 34.
Ratings and limitations of the soils for recreational purposes, table 4, p. 36.
Engineering uses of the soils, tables 5, 6, and 7, pp. 40 through 59.

Absence of a number for a wildlife or recreational group indicates that the mapping unit was not placed in a group]

Map symbol	Mapping unit	Described on page	Capability unit		Recreational group	Wildlife group
			Symbol	Page	Number	Number
BlA	Blount silt loam, 0 to 2 percent slopes	8	IIw-2	28	4	5
BlB	Blount silt loam, 2 to 4 percent slopes	9	IIe-12	28	4	I
BlB2	Blount silt loam, 2 to 4 percent slopes, eroded	9	IIe-12	28	4	I
Bp	Borrow pits	9	VIIe-2	31	--	--
Br	Brookston silty clay loam	9	IIw-1	28	10	4
Bs	Brookston silty clay loam, stony subsoil	10	IIw-1	28	10	4
Ca	Carlisle muck	10	IIIw-8	30	13	9
CrA	Crosby silt loam, 0 to 2 percent slopes	11	IIw-2	28	5	5
CsA	Crosby silt loam, stony subsoil, 0 to 2 percent slopes	11	IIw-2	28	5	5
FoC2	Fox loam, 6 to 12 percent slopes, eroded	12	IIIe-9	30	9	7
FoD2	Fox loam, 12 to 18 percent slopes, eroded	13	IVe-9	31	7	11
FsA	Fox silt loam, 0 to 2 percent slopes	12	IIs-1	29	1	7
FsB	Fox silt loam, 2 to 6 percent slopes	12	IIe-9	28	2	7
FxB3	Fox gravelly clay loam, 2 to 6 percent slopes, severely eroded	12	IIIe-9	30	3	7
FxC3	Fox gravelly clay loam, 6 to 12 percent slopes, severely eroded	12	IVe-9	31	6	7
Ge	Genesee silt loam	13	I-2	27	8	7
Gp	Gravel pits and Stone quarries	13	VIIIs-2	31	--	--
HeE	Hennepin loam, 18 to 50 percent slopes	14	VIIe-2	31	11	11
Km	Kokomo mucky silt loam, stratified substratum	15	IIw-1	28	10	4
Ko	Kokomo silty clay loam, stratified substratum	15	IIw-1	28	10	4
Lm	Linwood muck	15	IIw-10	29	13	9
Ma	Made land	16	VIIIs-2	31	--	--
MdC2	Martinsville sandy loam, 6 to 12 percent slopes, eroded	16	IIIe-15	30	9	6
MeA	Martinsville loam, 0 to 2 percent slopes	16	I-1	27	1	7
MeB	Martinsville loam, 2 to 6 percent slopes	16	IIe-3	28	2	6
MmA	Miami silt loam, 0 to 2 percent slopes	17	I-1	27	1	7
MmB2	Miami silt loam, 2 to 6 percent slopes, eroded	17	IIe-1	27	2	6
MmC2	Miami silt loam, 6 to 12 percent slopes, eroded	17	IIIe-1	29	9	7
MmD	Miami silt loam, 12 to 18 percent slopes	18	IVe-1	30	7	10
MnA	Miami silt loam, gravelly substratum, 0 to 2 percent slopes	18	I-1	27	1	7
MnB	Miami silt loam, gravelly substratum, 2 to 6 percent slopes	18	IIe-1	27	2	7
MnC2	Miami silt loam, gravelly substratum, 6 to 12 percent slopes, eroded	18	IIIe-1	29	9	7
MoA	Miami silt loam, heavy substratum, 0 to 2 percent slopes	18	I-1	27	1	6
MoB	Miami silt loam, heavy substratum, 2 to 6 percent slopes	18	IIe-1	27	2	6

Map symbol	Mapping unit	Described on page	Capability unit		Recreational group	Wildlife group
			Symbol	Page	Number	Number
MrB3	Miami clay loam, 2 to 6 percent slopes, severely eroded	18	IIIe-1	29	3	8
MrC3	Miami clay loam, 6 to 12 percent slopes, severely eroded	18	IVe-1	30	6	10
MuB	Morley silt loam, 2 to 6 percent slopes	19	IIe-6	28	2	6
MuB2	Morley silt loam, 2 to 6 percent slopes, eroded	19	IIe-6	28	2	7
MuD2	Morley silt loam, 6 to 18 percent slopes, eroded	19	IIIe-6	29	7	10
MvB2	Morley silt loam, gravelly substratum, 2 to 6 percent slopes, eroded	19	IIe-6	28	2	7
MvC2	Morley silt loam, gravelly substratum, 6 to 12 percent slopes, eroded	20	IIIe-6	29	9	7
MwB3	Morley silty clay loam, 2 to 6 percent slopes, severely eroded	20	IIIe-6	29	3	8
MwC3	Morley silty clay loam, 6 to 12 percent slopes, severely eroded	20	IVe-6	31	6	10
OcA	Ockley silt loam, 0 to 2 percent slopes	21	I-1	27	1	7
OcB	Ockley silt loam, 2 to 6 percent slopes	21	IIe-3	28	2	6
Pe	Pewamo silty clay loam	21	IIw-1	28	10	4
Pf	Pewamo silty clay loam, stratified substratum	21	IIw-1	28	10	4
Pk	Pewamo and Brookston silt loams, overwash	22	IIw-1	28	10	4
Rc	Rensselaer silty clay loam	23	IIw-1	28	10	4
Ro	Ross silt loam	23	I-2	27	8	7
Se	Sebewa silty clay loam	24	IIw-4	29	10	4
Sh	Shoals silt loam	25	IIw-7	29	8	3
Sn	Sloan silt loam	25	IIIw-9	30	12	2
Wa	Wallkill silt loam	26	IIw-7	29	13	9

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