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THE UNIVERSITY OF WISCONSIN
GEOLOGICAL AND NATURAL HISTORY SURVEY
SOIL SURVEY DIVISION

G. F. HANSON, DIRECTOR AND STATE GEOLOGIST
F. D. HOLE, Chairman, SOIL SURVEY DIVISION

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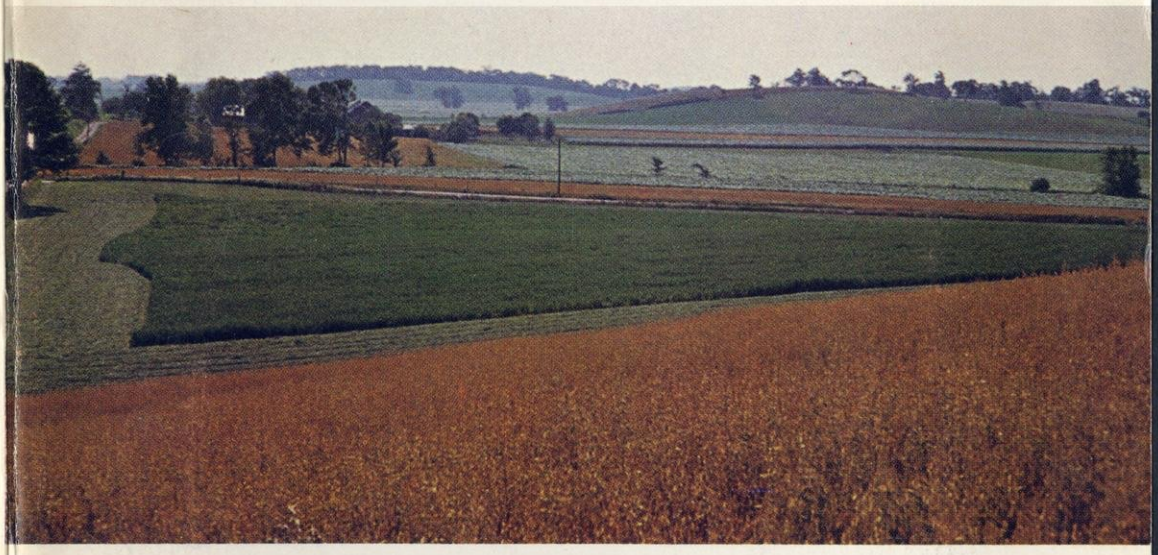

Cover: Landscape in June showing fields of oats, alfalfa, and corn on drumlin hills and lowlands between. The soil pictured below the landscape is Warsaw loam (Ap, B2, IIC horizons) which is on outwash benches between the Lapeer loams of the hills and the Clyman and Pella silt loams of the lowlands. Scale is in feet.

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By Clarence J. Milfred and Francis D. Hole

IN COOPERATION WITH
THE DEPARTMENT OF SOIL SCIENCE,
COLLEGE OF AGRICULTURAL AND LIFE SCIENCES
AND
THE SOIL CONSERVATION SERVICE,
U.S. DEPARTMENT OF AGRICULTURE

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Figure 1. This generalized soil map of the state shows that Jefferson County lies entirely in the region of the Grayish Brown Rolling Silt Loams. It has numerous drumlins (indicated by the north-south dashed lines), and is drained by the Rock River. The southeastern corner of the county includes a small portion of the Kettle Interlobate Moraine. These features already suggest that a complex pattern of upland and wetland soils may exist in the area, a supposition which is confirmed by the colored soil map accompanying this report, as well as by detailed soil maps in process of preparation on aerial photographs by the U.S. Soil Conservation Service.

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Figure 2. Lapeer loam — View shown above was taken across a road cut in a drumlin hill on which Lapeer loam has formed. The rolling landscape beyond the cut is typical of much of Jefferson County. This Lapeer loam soil profile (left) developed in glacial till with some additions of wind-blown silt and clay. The B horizon contains more clay than the A horizon. The soil is acid down to the stony, limy sandy loam C horizon.

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Clarence J. Milfred and Francis D. Hole

ABSTRACT

Jefferson County, located in southeastern Wisconsin, is a square block of 16 townships with a total area of 374,400 acres — 360,960 of land and 13,440 of water. It had a population of 52,000 in 1968. It is part of a rolling till plain, studded with southerly oriented drumlin hills and indented with wetlands and with lakes that are associated with outwash sand and gravel deposits on the west and east. The Rock River flows from the northeast corner to the 12-square mile Lake Koshkonong (elevation, 776 feet) at the southwest corner. The Crawfish River is the chief tributary, entering from the north and west. The southeast corner of the county lies in the rugged Kettle Moraine where elevations reach 1,080 and relief, 250 feet. Because of the thickness of the glacial drift, outcrops of the extensive Paleozoic dolomitic limestones are few.

The soils have developed during a period of about 14,000 years from a discontinuous loess covering, glacial till, outwash, lake-laid deposits and peat and muck of boglands under a variety of vegetative cover. A few remnants are left of the five major types of natural vegetation: prairie, oak savanna, sugar maple-basswood forest, sedge meadow, and conifer swamp. Corresponding soil groups are recognized throughout the county. The soils range in texture from gravelly sandy loams on kame hills to black silty clay loams and mucks in the extensive lowlands. The upland soils constitute areas of groundwater recharge and lowland soils are areas of gradual discharge of runoff waters. Peat mounds and flowing wells attest to the abundance of water at the lower elevations. Most of the soils have large natural reserves of plant nutrients and respond well to good management. Under dairy farming practices over about 80 percent of the land area, forage crops have protected sloping soils from serious erosion. Information on the properties and behavior of the soils of this area is useful in locating reserves of sand and gravel, and in rating soils for agricultural, silviculture, engineering, recreational, and urban uses.

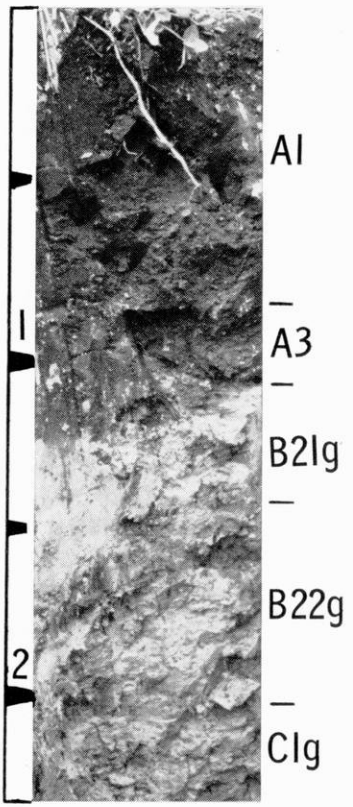


Figure 3. Keowns silt loam — (above) Black body of Keowns and associated poorly drained soils in the middle distance. This Keowns silt loam profile consists of a nearly black A horizon about a foot thick over a limy, olive-yellow, spotted B horizon of equal thickness on stratified silts and fine sands.

I. INTRODUCTION

Purpose and Scope of Investigation

The people of Wisconsin are becoming increasingly aware of the importance of natural resources in the development of the state from the economic, health, recreational, and aesthetic standpoints. Jefferson County (Figure 1), long recognized as an outstanding dairy farming county, is affected by the tide of urbanization spreading from large cities and arteries of rapid transportation. Decisions about the best use for each piece of land have to be made more than ever before with attention to an ensemble of factors and possibilities. People are looking at land use problems with a new sense of urgency as pressures mount for cropland, forestland, recreational land, urban and industrial lands, sand and gravel for construction purposes, and watersheds with protected soil and water resources. Basic to land use considerations is information about the soils, in the form of both detailed and generalized maps, and in reports. This publication provides a generalized soil map, and information about the origin, properties, classification and capabilities of the soils.

A study of the soils of Jefferson County was made during the period 1963-1966, by the Soil Survey Division of the Geological and Natural History Survey, University Extension, The University of Wisconsin under the direction of George F. Hanson, Director of the Geological Survey, and in cooperation with the Department of Soil Science of the College of Agricultural and Life Sciences, and the U.S. Soil Conservation Service. This study was a part of a state-wide and nationwide cooperative program of soil survey begun in 1899.

The investigation was under the immediate supervision of F. D. Hole, Professor of Soil Science and Geography, and Chairman of the Soil Survey Division. C. J. Milfred, Assistant Professor of Soil Science, was Field Party Chief throughout the four years of the survey, 1963-1966. The project was planned cooperatively with the following individuals: G. F. Hanson, Director of the Geological and Natural History Survey; R. D. Sale, in charge of the Cartographic Division of the Wisconsin Geological and Natural History Survey; Professor L. E. Engelbert, then chairman of The University of Wisconsin Department of Soil Science; and A. J. Klingelhoets, State Soil Scientist of the U.S. Soil Conservation Service. The purpose of the project was to determine the characteristics, potentialities, and pattern of distribution of the soils in the light of modern soil science.

Reconnaissance and semi-detailed surveys were made of the soils on contact aerial photographs and U.S. Geological Survey topographic

quadrangles. Reference was made to scattered detailed soil mapping by J. A. Steingraeber and other soil scientists of the U.S. Soil Conservation Service. Field work was done by R. J. Allan, G. A. Borchardt, E. J. Ciolkosz, F. D. Hole, J. E. Langton, A. O. Lind, C. J. Milfred, G. W. Peterson, R. O. Radke, and W. Wells. Cartography was executed by D. M. Brophy, M. L. Czechanski, J. T. Liu, and R. D. Sale.

C. J. Milfred compiled and edited the data for the soil map. F. D. Hole served as editor and illustrator of the text. Photographs are by the authors.

Acknowledgments

Appreciation is expressed to Jerome L. Riedy, Jefferson County Agricultural Agent, and the Jefferson County Board for making office space available for the field soil scientists during the summers of the survey. G. B. Lee of the College of Agricultural and Life Sciences; and A. J. Klingelhoets, P. H. Carroll, R. S. Fox, and J. A. Steingraeber of the U.S. Soil Conservation Service served with the authors on field reviews and soil correlation workshops concerned with the soil survey.

Acknowledgment for critical review of this report is made to George F. Hanson, Director of the Geological and Natural History Survey; and to R. J. Muckenhirn, Chairman of the Department of Soil Science; and to A. J. Klingelhoets, R. E. Fox, and Keith Kreger of the U.S. Soil Conservation Service; to Jerome L. Riedy, County Agricultural Agent; and to Johannes Bouma of the Geological and Natural History Survey.

Previous Reports

Whitson, *et al* (1916) published a Soil Survey of Jefferson County which consisted of a colored soil map (1: 62,500) and accompanying 79-page report. There were two editions — one published by the Wisconsin Geological and Natural History Survey and one by the U.S. Department of Agriculture (Geib et al, 1914) — differing slightly in format and content.

Direction for using the soil map. To use the soil map of Jefferson County, the reader orients himself with respect to road, streams, numbered sections and townships. For example, one can follow Highway 26 southwest of Fort Atkinson to a large body of soil number 10a, shown in a striped yellow color. This is in the southwest part of Section 4 and west part of Section 9 in Township 5 North, Range 14 East (note in the margins of the map the symbols T.N., and R.E.). The soil number 10a refers the reader to the legend at the left side of the map where unit 10 is defined briefly as "Oshtemo and Boyer sandy

loams and loamy sands (formed in sandy outwash deposits)." The letter "a" indicates slopes of 0 to 6 percent gradient.

This is an example of a grouping called a soil association. Twenty-five soil associations are shown on the soil map and are listed in Table 8. The soils of a given association are typically found together in the landscape and grade into each other.

The soil key in Table 2 can be used along with the map to identify the soils. By means of the soil map the user may locate himself on a soil body. With a spade he can expose the soil to a depth of about 3 feet or more and note the characteristics of the horizons (Figure 25). Using his observations of the soil layers (Figures 2 and 3) as a guide, he can find the proper name of the soil in the soil key. The soil map tells where soils occur together in a given part of the county, and the soil keys (Table 2; Figures 28-34), together with soil descriptions in Chapter VI, tell how to distinguish these soils. Silt loam, sandy loam, and other textures may be recognized by carefully rubbing soil between the fingers, as described in the glossary under the heading "field grading of soil texture." Analytical data are given in Tables 9, 10, and 11.

Where to find detailed soil maps (*scale, 4 in. = 1 mile*). This publication does not contain detailed 1:15,840 soil maps of Jefferson County. These have been made on aerial photographs by soil scientists of the U.S. Soil Conservation Service and may be viewed in the office of that agency, pending USSCS publication of a detailed map and report of the county.

Figure 4. Views of Aztalan State Park — (top) Temple mound and stockade, Indian village restoration. (bottom) Official explanation of the site as given on a tablet erected by the Wisconsin State Historical Society.

II. JEFFERSON COUNTY HISTORY AND RESOURCES

The Wisconsin Territorial Legislature organized Jefferson County from part of Milwaukee County, and designated the present boundaries in 1836. It was named in honor of Thomas Jefferson, third president of the United States. In 1856, a tier of five towns was added from Dodge County, but this action was repealed in 1858.

Prior to European settlement, the lands now contained in Jefferson County were occupied by various Indian tribes, including a people who built a stockaded village at Aztalan (Figure 4). French fur traders worked in the area in the decade before establishment of the county.

The European settlers inherited from the American Indians a rolling, fertile landscape of hills and wetlands surrounding a number of lakes (Figure 18). The fertile upland soils had deepest dark topsoils west of the Rock River because prairie fires set by Indians (Curtis, 1959) suppressed tree growth and extended the prairie here and there into forest. Fires fanned by west winds were often stopped by the river, which thus protected forests and forest soils to the east from the effects of burning. Mineral soils proved to be very productive of grain crops. Some of the extensive wetlands, which supported a variety of wildlife, were drained and farmed, including peat and muck bodies that were developed for truck crops.

Settlers moved in rapidly after completion of the land surveys and opening up of land sales in Milwaukee in 1839. The population of the county rose from 468 in 1836 to 15,317 in 1850, 34,789 in 1900, 43,069 in 1950, and 51,700 in 1964. The number of farms varied from 2835 in 1860 to 3453 in 1900, 3170 in 1935, 2934 in 1950 and 2238 in 1964. Corresponding figures for average size of farm were 99.8, 97.7, 104.9, and 134.5 acres (Ebling, 1936, 1946, 1954 and 1958; U.S. Dept. of Commerce, Bur. of Census, 1964).

The Rock River Claim Company was instrumental in establishing the village of Hebron, where the company constructed the first sawmill in 1836, and the city of Ft. Atkinson. The company brought Dwight Foster, David Bartlett and William Pritchard in the same year to organize the town. Watertown was founded at the same time at a rapids on the Rock River by Timothy Johnson, from Connecticut.

The construction in 1850 of the Indian Ford Dam on the Rock River beyond the southwest corner of Jefferson County, and the raising of the dam in 1917, converted a wild rice marshland, famous for abundant migratory wildfowl, into shallow Lake Koshkonong that now covers 10,480 acres.

Subsistence agriculture, well supplemented by fishing and hunting,

prevailed until about 1845. Thereafter, sawmills at waterpower sites were converted to flour mills, and frame houses replaced log shelters. Many early settlers, of English and Irish stock, settled primarily in open country south of the Scuppernong and Bark Rivers, and to the north in sections lying west of the Rock River. They came to raise livestock and wheat, the most important crop in the period (1850-1880). The Faville brothers began cheesemaking at Lake Mills. Milo Jones brought pure-bred Devon cattle to Ft. Atkinson. Charles Phillips of Lake Mills, raised Jersey cows, which he supplied with red clover hay. Among German immigrants of the 1840s were hop growers and geese "stuffers", and Carl Schurz, the famous educator. German immigrant farmers took up dense maple and oak forest lands lying east and north of the Rock and Scuppernong Rivers. The bitter winter of 1855-1856, when Lake Michigan froze from shore to shore, discouraged fruit and tobacco culture in the county (Ebling, 1939, 1954, 1958). The development of the dairy industry began in 1870. In 1873, W. D. Hoard, an immigrant to Ft. Atkinson from Madison County, New York, began publishing *Hoard's Dairyman*, a magazine that has given national leadership to the dairy industry ever since. Still today, the Hoard's Dairyman Farm near Ft. Atkinson serves as a demonstration and experimental unit for production practices recommended by the magazine.

The idea of building a canal between the Rock River and Lake Michigan was encouraged by a governmental land appropriation, but was nevertheless entirely abandoned by 1842. Plank roads in the 1840s and railroads, beginning operation in the 1850s, met major needs for transportation. The present network of highways, including Interstate Highway 94 and subsidiary state, county, and township highways, facilitates the flow of vehicular traffic in all seasons.

In 1964, 2238 farms, averaging 134.5 acres each, were worked by as many operators. Of these men, 683 also worked off the farm more than 100 days in a year. They were a part of the labor force of 12,983 employees of whom 54 percent were in manufacturing, 18 percent in retail trade, 12 percent in services, and the remainder in transporta-

Figure 5. Muck farmland near Palmyra, with the Kettle Moraine on the horizon. Soils in the foreground are of the Lapeer series.

tion, utilities, wholesale trade, finance, insurance, construction, etc. In 1963 retail establishments had $68,464,000 worth of trade including sales of food and drink, automotive trade, lumber, hardware and farm equipment sales, gasoline station trade, and general merchandise and apparel sales. Wholesale trade amounted to $42,393,000. Sand, gravel and crushed limestone production was valued at $227,647. Income from sale of agricultural products amounted to $23,962,000 of which 72 percent was from sale of livestock and livestock products, 25 percent from sale of dairy products, poultry, eggs and crops, and 3 percent from sale of products of forests, nurseries and greenhouses. The 73,151 cattle and calves on farms included 38,477 milk cows. Hogs and pigs numbered 29,000; sheep and lambs, 3590; chickens, 240,000. Of the 300,960 acres of farmland (83.4 percent of the land area of the county), 82 percent was in cropland and about three fifths of this cropland was harvested. About 40 percent of this harvested cropland was used to raise corn for all purposes, somewhat less acreage for hay (mostly alfalfa), about 20 percent for small grains (largely oats), and less than one percent for soybeans. Mint, sweet corn, potatoes, carrots, onions, and sod are the principal crops on muck farms (Figure 5). Unpastured woodland and pastured woodland each occupied about 12,000 acres, making a total of 25,000 acres of farm woodlands, or 8 percent of the area of farmland (Figure 22).

From 1947 to the present, the College of Agricultural and Life Sciences has conducted research on dairy breeding and dairy beef on an experimental farm north of Lake Mills. This farm was given to The University of Wisconsin by the family of Emmons Blaine, Jr., a grandson of James G. Blaine, a U.S. Secretary of State, and Cyrus McCormick, inventor of the reaper.

Water resources include annual precipitation, ground water, lakes, streams, and wetlands. Of the 30 inches of mean annual rainfall, nearly 23.4 inches are transpired and evaporated and 6.6 inches run off, overland or as ground-water discharge to streams (Cotte *et al.*, 1970). Nearly all (99.5%) of the water held in natural storage is underground. Wells in Cambrian sandstone may yield 500 to 2000 gallons per minute, 100 to 250 gpm in St. Peter sandstone, and 10 to 5000 gpm in glacial sand and gravel. Pumpage of ground-water at each of the municipal water pumpage centers in the county is in the range of 0.1 to 5 million gallons per day. The ground-water supplies virtually all drinking water in the county and feeds springs, streams, and lakes, particularly in seasons of low levels of surface water. Artesian flowing wells (Figure 19) are not uncommon, and have been developed in many lowlands, deriving water from bedrock layers or from glacial drift (Weidman and Schultz, 1915). The 34 natural lakes and

impoundments, of which 25 are named, have a mean depth of 11 feet (the range is 3 to 56 feet), 95 miles of shoreline, and 14,173 acres of area. About 36 percent of the length of the shorelines is along wetlands, 9 percent are frontages of lots with dwellings, and 1.5 percent are on parklands. The 38 streams, of which 21 are named, total 2886 acres and 291 miles in length, of which 80 percent are provided by the Rock and Crawfish Rivers (Figure 18). These two rivers are navigable by light boat in all but driest seasons. The mean stream gradient is 5.6 feet per mile (range 0.3-14.2). Runoff water carrying soil from bare fields and ditches promotes carp infestation and winterkill in lakes and streams (Poff, *et al.*, 1968). Of the four dams supplying hydro-electric power in the county, two principal ones provide a generating capacity of 300 KW. Wetlands covered nearly 77,000 acres according to the Bordner Survey of 1939, but only 68,000 acres in 1956, as reported by the Department of Natural Resources. The 153,200 acres of wetlands (65,050 acres of peats and mucks and the rest mineral soils) shown on the soil map are not subdivided in relation to present degree of artificial drainage.

Recreational activities in the county include swimming, boating, water skiing, fishing, hunting, snowmobiling, and some winter skiing. About 5000 resident licenses for hunting and 8000 for fishing are sold annually (Poff, *et al.*, 1968). Trails for horseback riding and hiking are available in the portion of the Southern Kettle Moraine State Forest that lies southeast of Palmyra, where about 5000 visitors come each year. The 123-acre Aztalan State Park on the Crawfish River has picnic facilities and is visited by about 40,000 persons annually (Wis. Leg. Bur., 1966).

The Faville prairie, a 60-acre parcel in the state system of scientific areas, lies on the west bank of the Crawfish River south of Waterloo. It is a rare remnant of native prairie that was protected from cultivation and grazing by the efforts of Aldo Leopold, The University of Wisconsin Arboretum Committee, and the former owners, Philip E. and Eleanor B. Miles who donated the tract to The University in memory of pioneer botanist Stoughton W. Faville. Use of this prairie is largely restricted to scientific studies by botanists, ornithologists, ecologists, and other natural resource specialists.

The fertile, easily workable and naturally well-watered soils of the county constitute a great natural resource. Their varied slopes and local high water table present difficulties for soil erosion control, water management, and protection of rivers and lakes from sedimentation and eutrophication, but enhance the aesthetic quality of the landscape. The nature of the soil resources is the subject of subsequent chapters.

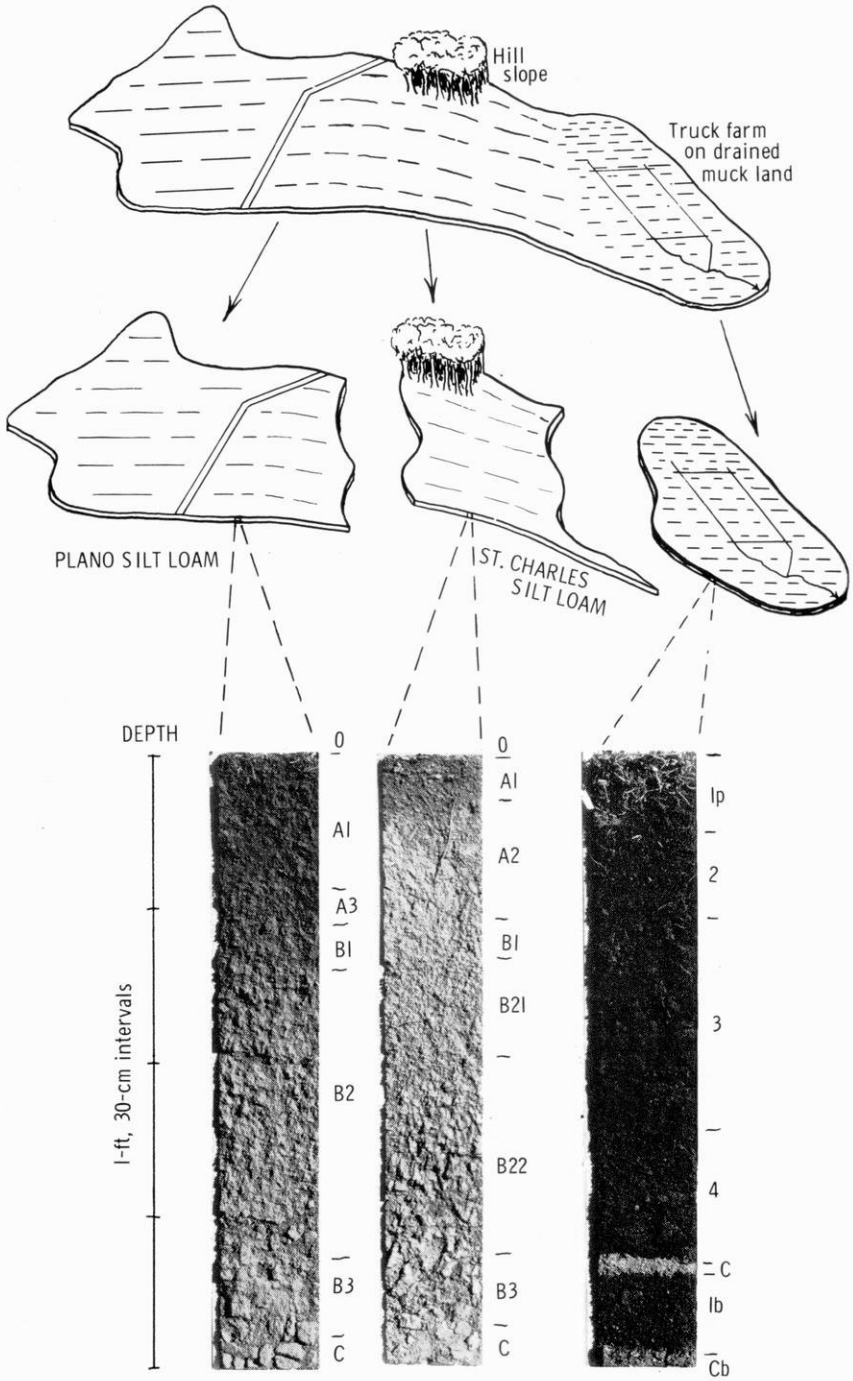


Figure 6. The diagram shows, in descending order, a segment of a landscape extending from an upland to an adjacent body of muck in a lowland; three soil bodies that constitute the landscape; and corresponding soil profiles.

III. CLASSIFICATION OF SOILS

Individual soils are pieces of the jig-saw puzzle that underlies what we call the landscape (Figure 6). Similar bodies of soil are called by the same name. For example, all bodies of Plano silt loam look very much the same in cross section (Figures 6 and 7). Soil characteristics such as number and arrangement of horizons, the color, texture, structure, consistence, and reaction (acidity) of each are briefly discussed in Chapter VI. Here, names of individual soils are given as they will appear in subsequent chapters, and these soils are grouped into a scientific soil classification.

Classification of soils is based chiefly on characteristics as seen in a vertical section through the soil body. This section is called the soil profile (Figures 6 and 25), and its layers are called soil horizons. During the course of thousands of years the soils have formed from deposits called soil parent materials.

Eight Major Groups of Soils

In Jefferson County eight major kinds of soils (Figure 7) are found which may be briefly designated by the following names from the new soil classification (see Appendix C, Table 12, and Soil Survey Staff, 1960, 1967) and by terms (in parentheses) derived from an older classification (USDA, 1938; Thorp and Smith, 1949):

1. The Hapludolls and Argiudolls (prairie or Brunizem soil group) have a dark surface soil as deep or deeper than plow depth (7 inches) over a dark brown subsoil. This soil group is not extensive in Jefferson County. An example is the Plano silt loam (Figure 6), which is acid to a depth of about four feet, where limy glacial till is encountered. This soil was observed near the county line just north of Lake Koshkonong. Other soils of the group are Griswold loam north of Whitewater; and Lorenzo sandy loam and the deeper Warsaw loam (Front Cover picture) east of Palmyra.

2. The Mollic Hapludalfs (deciduous forest-prairie transitional soils; Gray-Brown Podzolics-Brunizems) differ from the Hapludalfs (deciduous forest soils) by having a fairly thick (up to 7 inches) dark topsoil over the pale layer mentioned under (3) below. This kind of soil is widespread in cultivated land of the county. It includes some bodies of Dodge, Lapeer, and St. Charles soils of the deciduous forest soil group. Batavia silt loam (Figure 7) is a true intergrade and represents this group of soils.

3. The Hapludalfs (deciduous forest soil group; Gray-Brown Podzolic soils), where unplowed, are made up of a thin forest litter layer over a thin (about three-inch) black surface soil over a pale layer

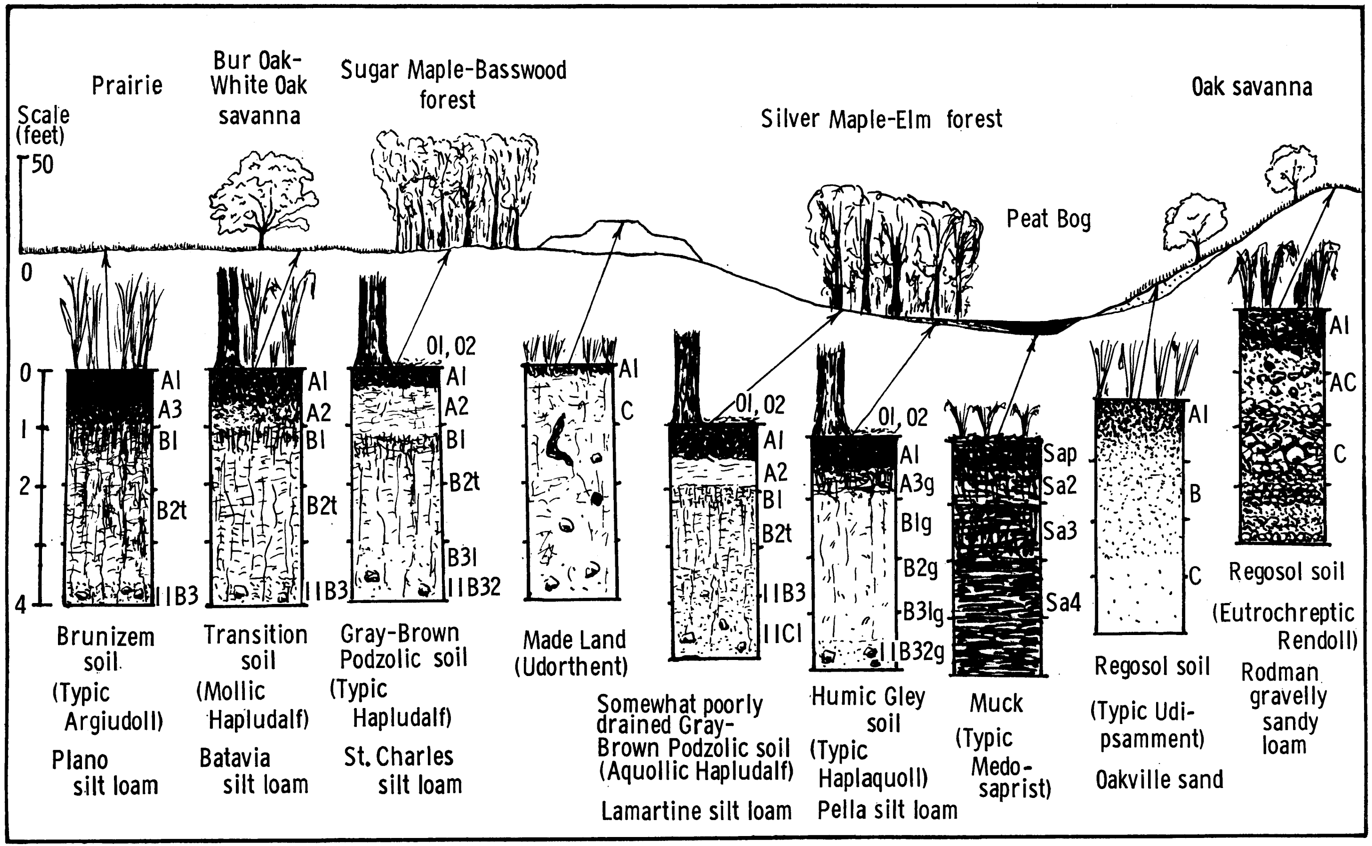


Figure 7. Nine representative soil profiles of Jefferson County, Wisconsin, with landscape positions indicated (terms in parentheses are from the new USDA Comprehensive Soil Classification).

which, at a depth of about 15 inches, rests on a brown, more clayey subsoil. The acid surface soil and subsoil are underlain at 2 to 4 feet by limy, glacial drift. The St. Charles silt loam (Figure 7) is an example of this and is found under forests of sugar maple and basswood *(Acer saccharum, Tilia americana).*

4. The Aquollic Hapludalfs (foot-slope, deciduous forest soils; Gray-Brown Podzolics) are somewhat poorly drained. This group differs from the third group of soils (no. 3 above) in having rusty and gray-colored spots that are prominent in the subsoil and faint in the pale subsurface soil. These are quite productive soils because they receive more water than the ridgecrest soils, but are not subject to prolonged ponding. Lamartine silt loam is an example of this group of soils.

5. A group of relatively recent soils (Entisols) includes: (a) alluvial and overwash soils (Fluvents) that occur in small patches on foot-slopes and stream banks; and (b) man-made-land (Orthents) that consists of soil materials piled up by early inhabitants, as at the Aztalan Indian village site, and by the present population in the form of landfills widely distributed over the county.

6. The Haplaquolls (lowland, marshy, black mineral soil group; Humic Gleys) are poorly drained and lie in flats and hollows that are ponded in wet seasons, unless artificially drained. A thick black topsoil rests on a bluish-gray, somewhat rusty, spotted subsoil, Many acres of this wet soil group have been drained for raising corn and other crops. Where marshy conditions still prevail, waterfowl and other wildlife are usually abundant. Pella silt loam is an example of this group of soils.

7. The Histosols (Bog soils, peats, and mucks) are naturally very poorly drained, soft organic soils of lowlands. Tamarack trees present picturesque clumps of dark spires on many wild bogs in the county. Large acreages of peat have been drained and gradually converted to muck soils under cultivation for truck crops.

8. Psamments and Eutrochrepts (sand and gravel Regosols group) are most prominent south and east of Palmyra in the Kettle Moraine. Stony, gravelly hills are occupied by skeletal Rodman soils associated with Oakville sand on lower-lying flanks of the ridges.

Soil Key

Terminology used in classifying soils according to texture (proportion of sand, silt, and clay) of various horizons, and degree of wetness or dryness is explained in the glossary under the heading of Field Grading of Soil Texture.

Table 1 lists the soils of Jefferson County under three main headings: excessively drained and droughty Entisols and Inceptisols; well-drained Alfisols, Mollisols, and intergrades between them; poorly and very poorly drained Mollisols, Inceptisols, and Histosols. The first group includes young soils and soils that have formed in unstable environments. The soils of the second group reflect the dominating influence of climate and the original vegetation. Examples are Alfisols

TABLE 1.
A GENERAL CLASSIFICATION[1] OF SOIL SERIES OF JEFFERSON COUNTY, WISCONSIN

ENTISOLS, INCEPTISOLS
Udipsamments, Udorthents, Eutrochrepts (Regosols)
Hennepin, Oakville, Rodman, Salter, Shiocton

ALFISOLS, MOLLISOLS

Hapludalfs, Ochraqualfs (Gray-Brown Podzolics)		**Mollic Hapludalfs** (Gray-Brown Podzolic-Brunizems
Busseyville	Lapeer	Batavia
Boyer	Matherton	Tichigan
Brady	McHenry	**Argiudolls** (Brunizems)
Camden	Metea	Aztalan
Casco	Mosel	Elburn
Del Rey	Oshtemo	Fabius
Dodge	St. Charles	Griswold
Fox	Saylesville	Hochheim
	Sisson	Lisbon
Hebron	Spinks	Lorenzo
Kendall	Theresa	Martinton
Kibbie	Wasepi	Plano
Knowles	Waterloo	Warsaw
Lamartine	Whalan	

MOLLISOLS, INCEPTISOLS, HISTOSOLS

Argiaquolls, Haplaquolls, Calciaquolls, Humaquepts (Humic Gleys)		**Fibrists, Saprists** (Bog soils)
		Peats
Brookston	Montgomery	Mucks
Colwood	Navan	
Harpster	Pella	
Keowns	Sebewa	
Kokomo	Will	
Milford		

[1]Two systems of soil classification are used in this generalized table (1) that: of Baldwin, Kellog and Thorp (1938) revised by Thorp and Smith in 1949; (2) and the new classification of the Soil Conservation Service, USDA (1960, 1967). In the table the terms in parentheses come from the old classification.

FOOTNOTES FOR TABLE 2

[1] In the table two sets of soils names are given, for example: "Plano silt loam (Typic Argiudoll)". The first name designates the specific soil type. The name in parentheses is a more general term taken from the new soil classification of the Soil Conservation Service, USDA (1960, 1967).

[2] Parent materials are inorganic and organic initial materials from which soils form. Where the soil forms from two layers or strata, these two materials are referred to as (I) surface materials and (II) substrata, respectively.

[3] Solum (A + B horizons) of well drained soils.

[4] Drainage condition of a soil, in its natural state, refers to the degree of aeration, which ranges from very poor in an undrained peat to excessive in the crest of a sand dune.

[5] Entisols include regosolic soils over unconsolidated materials. These soils have scarcely any B horizon. Because of their small acreage in the county, Fluvents (Alluvial soils) are not listed in the table.

[6] Alfisols (Gray Brown Podzolics), Mollisols (Brunizems) and Inceptisols (Brunizems and Brown Forest soils) are found in well-drained, moderately well-drained, and somewhat poorly drained landscape positions, and exhibit mottling in the C horizon if at all, in the C and lower B horizons, and in the C, B, and lower A horizons, respectively.

[7] Aquolls and Aquepts (Humic Gley soils) are naturally poorly and very poorly drained soils, usually in depressions. The A_1 horizon is dark and is underlain by a gleyed subsoil.

[8] Histosols (Bog soils or organic soils) with an abundance of fibers that are relatively undecomposed are called Fibrists (peats). Histosols that are weathered to a soft paste are Saprists (mucks). Both are naturally very poorly drained.

[9] This soil is not in the legend of the soil map of Jefferson County but is mentioned and described in the text.

[10] This is a tentative soil series, proposed in this publication.

TABLE 2. TABULAR KEY TO THE SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Parent Material[2]			Thickness of solum[3] (inches)	Probable original vegetation (Forest, Prairie)	drier ← Soils Arranged According to Degree of Natural Drainage[4] → wetter					
Surface Materials[2]		Substrata[2]			Excessively drained	Well drained	Moderately well drained	Somewhat poorly drained	Poorly to very poorly drained	
Texture	Thickness (inches)	Characteristics			Entisols, etc. (Regosolic soils)[5]	Alfisols, Mollisols, Inceptisols[6] (Gray-Brown Podzolic, Brunizem and Brown Forest soils)			Aquolls and Aquepts[7] (Humic Gley soils)	Fibrists, Saprists[8] (Peats and Mucks)
SOILS ON GLACIAL TILL UPLANDS										
Silt loam	30 to 50	Sandy loam to loam calcareous glacial till	> 40	F		St. Charles silt loam (Typic Hapludalf)		Kendall silt loam (Aeric Ochraqualf)	Pella silt loam and silty clay loam (Typic Haplaquoll) Harpster silt loam and silty clay loam (Typic Calciaquoll)	Peats and Mucks
				F-P		Batavia silt loam[9] (Mollic Hapludalf)				
				P		Plano silt loam (Typic Argiudoll)		Elburn silt loam (Aquic Argiudoll)		
	20 to 36	Loam calareous glacial till	24 to 40	F		Dodge silt loam (Typic Hapludalf)		Lamartine silt loam (Aquollic Hapludalf)	Brookston loam, silt loam, silty clay loam (Typic Argiaquoll) Kokomo loam, silt loam, silty clay loam (Typic Argiaquoll)	
				P				Lisbon silt loam (Aquic Argiudoll)		
		Sandy loam to loam highly calcareous glacial till		F		Theresa silt loam (Typic Hapludalf)				
		Sandy loam calcareous glacial till				McHenry silt loam (Typic Hapludalf)				
		Calcareous glacial drift on limestone bedrock at 20" to 40"				Knowles silt loam (Typic Hapludalf)				
Silt loam to Sandy loam	< 20	Calcareous glacial till drift on limestone bedrock	20 to 40	F		Whalan sandy loam to silt loam (Typic Hapludalf)				Peats and Mucks
		Sandy loam calcareous glacial till				Lapeer sandy loam to silt loam (Typic Hapludalf)				
				P		Griswold sandy loam to silt loam[9] (Typic Argiudoll)				
		Sandy loam highly calcareous glacial till	12 to 20			Hochheim sandy loam to silt loam (Typic Argiudoll)				
	< 10	Sandy loam to loam calcareous glacial till	6 to 12	F-P	Hennepin sandy loam to silt loam (Typic Eutrochrept)					
Sandy loams and sands	18 to 36	Loam and Sandy loam calcareous glacial till	35 to 45	F		Metea loamy sand and sandy loam (Arenic Hapludalf)				
SOILS ON GLACIAL OUTWASH UPLANDS AND FLATS										
Silt loam	30 to 50	Sand and gravel calcreous glacial outwash	42	F			Waterloo silt loam[10] (Typic Hapludalf)	Busseyville silt loam[10] (Aeric Ochraqualf)	Milford silt loam[10] and silty clay loam (sand and gravel substratum phase) (Typic Haplaquoll)	Peats and Mucks
Silt Loam to sandy loam	< 20 silt < 42 coarse loams	Sandy and Gravel calcareous glacial outwash	20 to 42	F		Fox sandy loam to silt loam (Typic Hapludalf)			Sebewa sand loam and silt loam (Typic Argiaquoll) Will sandy loam and silt loam (Typic Haplaquoll)	
				F-P				Matherton sandy loam and silt loam (Udollic Ochraqualf)		
				P		Warsaw sandy loam to silt loam (Typic Argiudoll)				
	< 20		12 to 20	F		Casco sandy loam to silt loam (Typic Hapludalf)				
				P		Lorenzo sandy loam to silt loam (Typic Argiudoll)		Fabius sandy loam to silt loam (Aquic Argiudoll)		
Loams to loamy sands	20 to 40	Sand and gravel calcareous glacial outwash	20 to 40	F		Boyer sandy loam to loamy sand (Typic Hapludalf)		Wasepi loam to loamy sand (Aquollic Hapludalf)	Gilford sandy loam to loam (Typic Haplaquoll)	
	40 to 60		40 to 60			Oshtemo sandy loam to loamy sand (Typic Hapludalf)		Brady loam to sandy loam (Aquollic Hapludalf)		
	< 15	Gravel and cobble calcareous glacial outwash	6-18	P	Rodman sandy loam to silt loam (Typic Hapludoll, Rendollic Eutrochrept)					
Sands and loamy sands	< 70	Sand eolian deposit	65 to 85		Spinks sand and loamy sand (Psammentic Hapludalf)					
			30 to 40		Oakville sand and loamy sand (Typic Udipsamment)					
SOILS ON GLACIO-LACUSTRINE FLATS										
Silt loam	24 to 36	Fine sand and silt glaciolacustrine deposits, calcareous below 40 inch depth	40 to 60	F		Camden loam to silt loam (Typic Hapludalf)				Peats and Mucks
Loams	< 18	Silt and clay calcareous glaciolacustrine deposits	20 to 40	P				Martinton loam to silt loam (Aquic Argiudoll)	Montgomery loam to silty clay loam (Typic Haplaquoll)	
				F-P				Tichigan loam to silt loam (Aquollic Hapludalf)		
				F		Saylesville loam to silt loam (Typic Hapludalf)		Del Rey loam to silt loam (Aeric Ochraqualf)		
	18 to 36					Hebron sandy loam to silt loam (Typic Hapludalf)		Mosel sandy loam to silt loam (Aquollic Hapludalf)	Navan sandy loam to silt loam (Typic Argiaquoll)	
				P				Aztalan sandy loam to silt loam (Aquic Argiudoll)		
	< 36	Fine sand and silty glaciolacustrine deposits calcareous above 40 inch depth		F		Sisson sandy loam to silt loam (Typic Hapludalf) Salter sandy loam to silt loam (Typic Eutrochrept)		Kibbie sandy loam to silt loam (Aquollic Hapludalf) Shiocton sandy loam to silt loam (Aquollic Eutrochrept)	Colwood sandy loam to silt loam (Typic Haplaquoll) Keowns sandy loam to silt loam (Mollic Haplaquept)	

(Gray-Brown Podzolics) and Mollisols (Brunizems). The third group of soils differs from the second in exhibiting characteristics impressed by wet conditions. Haplaquepts (Humic Gley soils) are wet mineral soils and Histosols (Bog soils) are wet organic soils. There are transitions between these categories, such as Mollic Hapludalfs (intergrades between Gray-Brown Podzolic and Brunizem soils).

Table 2 is a detailed key to the soils of the county. In it the soils are arranged from the sandiest and stoniest (below and to the left) to the siltiest (above), with a column for organic soils (peat and muck) on the right. The driest soils are on the left and the wettest soils on the right of this table. The soil classification is based on soil profile descriptions (Chapter VI), which are a source of valuable information necessary for planning use and management of soils, and for studying their origins and potentialities.

The organic surface layers of the soils of Jefferson County are briefly characterized in Chapter VI, which also includes profile descriptions of peats and mucks. Because most of the county has been put under plow or intensive grazing, few areas are left where the natural surficial leaf litter and humus are undisturbed as described for forest soils by Wilde, *et al* (1949).

Soils occur in the landscape in groupings called "soil associations," which are geologic and ecologic in origin. The 25 of these that are shown on the soil map are listed with acreages, including area of water, in Table 8. Chapter VII discusses soil geofraphy and presents three soil keys for use in the field in conjunction with landscape sketches and the soil descriptions of Chapter VI.

IV. INTERPRETIVE RATINGS OF THE SOILS FOR VARIOUS USES

Modern land use planning takes into account the characteristics and geographic distribution of soils. Tables that indicate limitations and productivity estimates for the soils are presented in this chapter.

Limitations for Various Uses

Table 3 indicates degrees of limitations — from slight to very severe — of the soil types for agricultural crops, pasture, forestry (mixed hardwoods and red pine), industrial sites, sites for homes with on-lot sewage disposal, transportation routes, and recreational uses (camping and hiking). Limitations for soil associations listed in the legend of the soil map can be determined from the ratings for component soil types. These ratings can be helpful in avoiding costly mistakes in land use, such as the installation of septic tank, sewage-disposal systems on wet, low-lying soils subject to seasonal flooding, or planting trees on soils that have restricted drainage.

Information on current average annual yields of crops (including hay) on the soils of the county is available (Beatty, *et al.* 1966) from the Department of Soil Science at the College of Agricultural and Life Sciences in Madison, and from the County Agricultural Agent and the Soil Conservation Service in Jefferson. Soil productivity varies from very low on the droughty Rodman and Oakville soils to very high on the deep silty St. Charles soil. The range of crops that can be grown successfully increases with level of productivity. Also available from the same agencies are tables of estimated annual growth yields per acre (in board feet) of well-stocked forests, both hardwood and conifer, on representative soils of Jefferson County.

Wildlife Potentials

Many species of wildlife range over a wide variety of soils, from peat bogs to dry sand and gravel ridges. The factors limiting population of animals in relatively undisturbed areas of Jefferson County include: (1) successional stage of vegetation, (2) natural soil fertility, (3) frequency of occurrence of ecological tension zones such as those between wet and well-drained soils, and (4) hunting pressure.

In general, diversity of vegetative cover is favorable to wildlife. The borders of small peat bogs, for example, provide a wide variety of plant communities. Under native plant cover, soil associations which are intricate patterns of contrasting soils provide more ecologic transition zones than do soil associations that consist of extensive bodies of

TABLE 3. SEVERITY[1] OF LIMITATIONS OF SOIL TYPES FOR VARIOUS USES IN JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit)	Soil map symbol[2]	Agricultural cultivated crops[3]	Pasture (Legume-grass)	Forestry		Industrial sites	Home sites[4] with septic tank system	Transportation routes[5]	Recreation[6]	
				Mixed hardwoods	Red pine[t] (plantations)				Campsites	Hiking terrain
Aztalan loam	17	Moderate (when drained)	Slight	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Batavia silt loam	(1)	Slight (A slope) to moderate B,C slope)	Slight	Slight	Slight	Slight	Slight (A,B slopes)	Moderate[s]	Moderate[s]	Moderate
Boyer sandy loam	10	Moderate	Moderate	Severe+	Moderate	Slight	Moderate'	Slight	Slight	Slight
Brady loam	12h	Moderate (when drained)	Slight	Moderate#	Very severe#	Moderate#	Severe	Moderate#	Moderate#	Moderate#
Brookston silt loam	6	Moderate (when drained)	Moderate (when drained)	Severe#	Very severe#	Severe#	Severe#	Severe#	Severe#	Severe#
Busseyville silt loam	12g	Moderate (when drained)	Slight	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Camden silt loam	16	Slight (A,B slopes) to moderate (C slope)	Slight	Slight	Moderate	Moderate[s]	Moderate	Severe[s]	Moderate[s]	Moderate
Casco loam	9	Moderate (A slope) to severe (steeper slopes)	Moderate	Moderate+	Severe+	Slight	Moderate' (A-C slopes)	Slight	Slight (A,B slopes)	Slight
Colwood silt loam	22	Moderate (when drained)	Moderate (when drained)	Severe#	Very severe#	Severe#	Severe#	Severe#	Severe#	Severe#
Del Rey silt loam	18	Moderate (when drained)	Moderate	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#

TABLE 3. SEVERITY[1] OF LIMITATIONS OF SOIL TYPES FOR VARIOUS USES IN JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit)	Soil map symbol[2]	Agricultural cultivated crops[3]	Pasture (Legume-grass)	Forestry		Industrial sites	Home sites[4] with septic tank system	Transportation routes[5]	Recreation[6]	
				Mixed hardwoods	Red pinet (plantations)				Camp-sites	Hiking terrain
Dodge silt loam	1	Slight (A slope) to moderate (B,C slopes)	Slight	Slight	Slight	Slight	Slight	Slight	Moderate (A-C slopes)	Moderate (A-C slopes)
Elburn silt loam	5	Slight (when drained)	Slight	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Fabius loam	12h	Moderate (when drained)	Slight	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Fox silt loam	9	Moderate (A-C slopes)	Moderate	Slight+	Slight+	Slight	Moderate(A-C slopes)	Slight	Moderate[8]	Moderate
Gilford loam	13h	Moderate (when drained)	Moderate (when drained)	Severe#	Very severe#	Moderate#	Severe#	Severe#	Severe#	Severe#
Griswold loam	(2)	Moderate (A-C slopes)	Moderate	Moderate+	Moderate+	Slight	Slight (A, B slopes)[7]	Slight	Slight (A,B slopes)	Slight (A-C slopes)
Harpster silt loam	6	Moderate (when drained)	Moderate (when drained)	Severe#	Very severe#	Moderate#	Severe#	Severe#	Severe#	Severe#
Hebron loam	14	Moderate (A-C slopes)	Slight	Moderate	Moderate	Moderate	Moderate (A-C slopes)	Moderate	Slight (A,B slopes)	Slight (A-C slopes)
Hennepin sandy loam	4	Severe	Moderate	Severe+	Moderate+	Slight	Slight (A, B slopes)[7]	Moderate	Slight (A,B slopes)	Slight (A-C slopes)
Hochheim loam	4	Slight (A) to moderate (B,C slopes)	Slight	Slight	Moderate	Slight	Slight (A, B slopes)	Slight	Slight (A,B slopes)	Slight

TABLE 3. SEVERITY[1] OF LIMITATIONS OF SOIL TYPES FOR VARIOUS USES IN JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit)	Soil map symbol[2]	Agricultural cultivated crops[3]	Pasture (Legume-grass)	Forestry		Industrial sites	Home sites[4] with septic tank system	Transportation routes[5]	Recreation[6]	
				Mixed hardwoods	Red pine[t] (plantations)				Camp-sites	Hiking terrain
Kendall silt loam	5	Moderate (when drained)	Slight	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Keowns loam	23	Moderate (when drained)	Moderate (when drained)	Severe#	Very severe#	Severe#	Severe#	Severe#	Severe#	Severe#
Kibbie silt loam	19	Moderate (when drained)	Slight	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Knowles silt loam	7	Moderate (A-C slopes)	Slight	Moderate+	Moderate+	Moderate*	Severe*	Moderate*	Moderate (A-C slopes)	Moderate (A-C slopes)
Kokomo silt loam	6	Moderate (when drained)	Moderate (when drained)	Severe#	Very severe#	Severe#	Severe#	Severe#	Severe#	Severe#
Lamartine silt loam	5	Moderate (when drained)	Slight	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Lapeer loam	2,3,4	Moderate (A-C slopes)	Moderate	Moderate+	Slight+	Moderate	Slight (A, B slopes)	Slight	Slight (A, B slopes)	Slight
Lisbon silt loam	5	Moderate (when drained)	Slight	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Lorenzo sandy loam	(9)	Moderate (A, B slopes)	Moderate	Severe+	Very severe+	Slight	Moderate (A-C slopes)	Slight	Slight (A, B slopes)	Slight
McHenry silt loam	1	Slight (A slope) to moderate (B-C slopes)	Slight	Slight	Moderate	Slight	Slight (A, B slopes)	Slight	Moderate (A-C slopes)	Moderate (A-C slopes)
Martinton loam	18	Moderate (when drained)	Moderate	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#

TABLE 3. SEVERITY[1] OF LIMITATIONS OF SOIL TYPES FOR VARIOUS USES IN JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit)	Soil map symbol[2]	Agricultural cultivated crops[3]	Pasture (Legume-grass)	Forestry		Industrial sites	Home sites[4] with septic tank system	Transportation routes[5]	Recreation[6]	
				Mixed hardwoods	Red pine[t] (plantations)				Camp-sites	Hiking terrain
Matherton loam	12g,h	Moderate (when drained)	Slight	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Metea sandy loam	3	Moderate (A-C slopes)	Moderate	Severe+	Slight	Slight	Slight (A, B slopes)	Slight	Slight (A, B slopes)	Slight (A-C slopes)
Milford silt loam	13g	Moderate (when drained)	Moderate (when drained)	Severe#	Very severe#	Severe#	Severe#	Severe#	Severe#	Severe#
Montgomery silt loam	21	Moderate (when drained)	Moderate (when drained)	Severe#	Very severe#	Severe#	Severe#	Severe#	Severe#	Severe#
Mosel loam	17	Moderate (when drained)	Slight	Moderate	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Mucks	25	Moderate (when drained)	Very severe#	Very severe#	Very severe#	Very severe#	Very severe#	Very severe#	Very severe#	Very severe#
Navan loam	20	Moderate (when drained)	Moderate (when drained)	Severe#	Very severe#	Severe#	Severe#	Severe#	Severe#	Severe#
Oakville loamy sand	11	Severe+	Moderate+	Very severe+	Moderate+	Slight+	Moderate' (A-C slopes)	Slight	Moderate (A, B slopes)	Moderate (A-C slopes)
Oshtemo loamy sand	10	Moderate (A-C slopes)	Moderate+	Moderate+	Slight	Slight	Moderate (A-C slopes)	Slight	Moderate (A-C slopes)	Moderate (A-C slopes)
Peats	25	Severe (when drained)	Very severe#	Very severe#	Very severe#	Very severe#	Very severe#	Very severe#	Very severe#	Very severe#
Pella silt loam	6	Moderate (when drained)	Moderate (when drained)	Severe#	Very severe#	Moderate#	Severe#	Severe#	Severe#	Severe#

TABLE 3. SEVERITY[1] OF LIMITATIONS OF SOIL TYPES FOR VARIOUS USES IN JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit)	Soil map symbol[2]	Agricultural cultivated crops[3]	Pasture (Legume-grass)	Forestry		Industrial sites	Home sites[4] with septic tank system	Transportation routes[5]	Recreation[6]	
				Mixed hardwoods	Red pine[t] (plantations)				Camp-sites	Hiking terrain
Plano silt loam	(1)	Slight (A slope) to moderate (B C slopes)	Slight	Slight	Moderate	Slight	Slight (A, B slopes)	Moderate[s]	Moderate (A-C slopes)	Moderate (A-C slopes)
Rodman gravelly loam	9	Severe +	Severe +	Very severe +	Severe +	Slight	Moderate[r] (A-C slopes)	Moderate[b]	Moderate (A-C slopes)	Slight[a]
Salter loam	16	Slight (A slope) to moderate (B C slopes)	Slight	Moderate	Slight	Moderate	Moderate (A-C slopes)	Severe	Moderate (A-C slopes)	Moderate (A-C slopes)
Saylesville silt loam	15	Moderate (A-C slopes)	Slight	Slight	Moderate	Moderate	Moderate (A-C slopes)	Moderate	Moderate (A-C slopes)	Moderate (A-C slopes)
St. Charles silt loam	1	Slight (A slope) to moderate (B C slopes)	Slight	Slight	Slight	Slight	Slight (A, B slopes)	Moderate	Moderate (A-C slopes)	Moderate (A-C slopes)
Sebewa loam	13h	Moderate (when drained)	Moderate (when drained)	Severe #	Very severe #	Moderate #	Severe #	Severe #	Severe #	Severe #
Shiocton loam	19	Moderate (when drained)	Slight	Moderate #	Very severe #	Moderate #	Severe #	Moderate #	Moderate #	Moderate #
Sisson silt loam	16	Slight (A, B slopes)	Slight	Slight	Moderate	Moderate	Moderate (A-C slopes)	Severe[s]	Moderate (A-C slopes)	Moderate (A-C slopes)
Spinks loamy snd	11	Severe +	Moderate +	Severe +	Moderate	Slight	Moderate[r] (A-C slopes)	Slight	Moderate (A, B slopes)	Moderate (A, B slopes)

TABLE 3. SEVERITY[1] OF LIMITATIONS OF SOIL TYPES FOR VARIOUS USES IN JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit)	Soil map symbol[2]	Agricultural cultivated crops[3]	Pasture (Legume-grass)	Forestry		Industrial sites	Home sites[4] with septic tank system	Transportation routes[5]	Recreation[6]	
				Mixed hardwoods	Red pine[4] (plantations)				Camp-sites	Hiking terrain
Theresa silt loam	1,2	Slight (A slope to moderate (B C slopes)	Slight	Slight	Moderate	Slight	Slight (A, B slopes)	Slight	Moderate (A-C slopes)	Moderate (A-C slopes)
Tichigan silt loam	18	Moderate (when drained)	Slight	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Warsaw loam	(9)	Slight (A slope to moderate (B C slopes)	Moderate	Severe +	Moderate +	Slight	Moderate' (A-C slopes)	Slight	Moderate	Moderate
Wasepi sandy loam	12h	Moderate (when drained)	Moderate	Moderate#	Very severe#	Moderate#	Severe#	Moderate#	Moderate#	Moderate#
Waterloo silt loam	8	Slight (A slope) to moderate (B C slopes)	Slight	Slight	Slight	Slight	Slight (A, B slopes)	Moderate	Moderate (A-C slopes)	Moderate (A-C slopes)
Whalan loam	7	Moderate (A-C slopes)	Moderate	Moderate +	Moderate +	Moderate*	Severe*	Moderate*	Slight (A, B slopes)	Moderate (A-B slopes)
Will loam	13h	Moderate (when drained)	Moderate (when drained)	Severe#	Very severe#	Moderate#	Severe#	Severe#	Severe#	Severe#

FOOTNOTES FOR TABLE 3

[1] Soil ratings for the various uses are given in terms of four degrees of severity of limitations: slight, moderate, severe, and very severe. Kinds of limitations include: stoniness, shallowness, impeded drainage, hilliness, and droughtiness.

[2] Each map symbol number stands for a soil association in the legend of the soil map. In the second column on the left, a number without parentheses represents a soil association that specifically cites the soil name in the first column of the table. A number within parentheses represents a soil association that does not cite the soil in question, but that actually includes small areas of it.

[3] Refer to Beatty, *et al* (1966) for productivity estimates for specific crops in bushels or tons per acre. Slope letters mean: A, 0-2%; B, 2-6%; C, 6-12%.

[4] A septic tank system is used requiring drainage of effluent into soil. Care should be taken to avoid contamination of lakes, streams, and sources of well water.

[5] See Table 4 for more information on engineering properties of soils.

[6] Soil ratings for campsites and hiking terrain are based on the assumption that nearly levely, loamy, well-drained soils are best. In neither case is the proximity of a lake or river or presence of vistas taken into consideration in making the soil ratings. These ratings may be adjusted for effects of local topography.

\# Wet conditions in this soil unit are unfavorable for the use indicated.

* Shallowness to bedrock is an unfavorable condition with respect to engineering uses of this soil.

\+ Droughtiness because of coarse texture of the soil profile or shallowness to bedrock is a limiting factor in this instance.

/ Coarseness of substratum may permit too rapid movement of liquid wastes to nearby wells, streams, and lakes, resulting in pollution.

[a] Rolling to hilly topography is a favorable factor in this instance.

[b] Hilly topography is an unfavorable condition in this instance.

[s] Siltiness of the soil is unfavorable in this instance.

[t] Mollisols (Brunizems or prairie soils) that are well drained will need inoculationwith mycorrhizae before conifer tree growth will be successful.

similar soils. In much of the county's farmland, the maintenance of strips of brush and the preservation of wild woodlands and wetlands create the multiplicity of conditions that is helpful to wildlife.

Engineering Characteristics

The accelerating pace of construction of highways, buildings, dams and other structures requires careful evaluation of soils of sites under consideration, to avoid needless expense and waste through failure of soils to support the weights and pressures placed upon them.

Representative engineering data for soils are presented in Table 4. More information can be obtained from technical manuals (Wisconsin State Highway Commission, 1964; Soil Conservation Service, 1969). Highways remain in good condition for relatively long periods of time on well-drained, permeable soils like Rodman gravelly sandy loam and Oakville loamy sand. Roads deteriorate rapidly wherever they are improperly laid (Figure 8) on somewhat poorly or poorly drained soils like Matherton loam and Pella silt loam and peats and mucks. It is an accepted practice that a detailed soil map be made especially for engineering uses along any major road right-of-way before road construction begins and at a dam site or building site before plans are completed and approved. Detailed soil maps are also recommended for lots on which on-site sewage-disposal systems are to be installed. The soil map accompanying this bulletin should be used principally for general land use planning and as a guide for a more detailed study of soils at the site of each proposed structure and installation.

Figure 8. Cracks in pavement indicate failure of the poorly drained underlying silty soil to provide stable support in seasons of high water table and frost action.

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data				Frost hazard	Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Aztalan loam	0-15	Loam	ML	A-4	100-90	85-75	65-55	25	12	.63-2.0	.18-.22	Mod.	N-Low
17	15-30	Loam	ML	A-4	100-90	85-75	65-55	43	23	.63-2.0	.16-.20	Low	S-High
	30+	Silt and clay	GL	A-7	.....	100-90	100-90	35	16	.20-.63	.16-.20	Mod.	
Batavia silt loam	0-12	Silt loam	CL or ML	A-6	.....	100-95	100-90	32	10	.63-2.0	.20-.24	High	N-Low
1	12-45	Silty clay loam	CL	A-7	.....	100-95	100-90	41	20	.63-2.0	.16-.20	Mod.	S-Low
	45+	Sandy loam	SM	A-2	90-80	80-70	35-25	38	19	2.0-6.3	.08-.12	Low	
Boyer sandy loam	0-18	Sandy loam	SM	A-2	100-90	90-80	35-25	....	Non-Pl	2.0-6.3	.10-.14	Low	N-Low
10	18-30	Sandy loam	SM	A-2	90-80	80-70	35-25	....	Non-Pl	2.0-6.3	.08-.12	Low	S-Low
	30+	Sand & gravel	SP	A-3	100-90	90-70	5-1	....	Non-Pl	6.3-20.	.03-.05	Low	
Brady loam	0-15	Loamy sand	SM	A-2	100-95	95-85	25-20	....	Non-Pl	2.0-6.3	.06-.10	Low	N-Low
12h	15-45	Sandy loam	SM	A-2	100-95	95-85	35-25	....	Non-Pl	2.0-6.3	.08-.12	Low	S-Low
	45+	Sand	SP	A-3	100-95	95-85	5-1	....	Non-Pl	6.3-20.	.03-.05	Low	
Brookston silt loam	0-15	Silt loam	CL or ML	A-7	100-95	100-90	100-90	32	10	.63-2.0	.20-.24	High	N-Low
6	15-30	Clay loam	CL	A-7	100-90	95-85	65-55	50	28	.63-2.0	.16-.20	Mod.	S-High
	30+	Loam	ML	A-4	100-90	95-85	65-55	41	19	.63-2.0	.16-.20	Low	

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data				Frost hazard	Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Busseyville silt loam	0-12	Silt loam	CL or ML	A-6	.....	100-90	100-90	32	10	.63-2.0	.18-.22	High	N-Low
12g	12-45	Silty clay loam	CL	A-7	.....	95-85	95-85	45	22	.63-2.0	.16-2.0	Mod.	S-Mod.
	45+	Sand & gravel	SP	A-3	100-90	90-70	5-1	....	Non-Pl	6.2-20.	.08-.12	Low	
Camden silt loam	0-15	Silt loam	CL or ML	A-6	.....	100-95	100-90	32	10	.63-2.0	.20-.24	High	N-Low
16	15-30	Silty clay loam	CL	A-7	.....	100-95	100-90	41	20	.63-2.0	.16-.20	Mod.	S-Low
	30+	Sandy loam	SM	A-2	90-80	80-70	35-25	....	Non-Pl	2.0-6.3	.08-.12	Low	
Casco loam	0-8	Loam	ML	A-4	100-90	90-80	75-65	25	12	.63-2.0	.18-.22	Mod.	N-Low
9	8-18	Clay loam	CL	A-7	100-90	90-80	75-65	42	24	.63-2.0	.16-.20	Mod.	S-Low
	18+	Sand and gravel	GP-GM	A-1	40-30	35-25	10-5	....	Non-Pl	6.3-20.	.02-.04	Low	
Colwood silt loam	0-8	Silt loam	ML-CL	A-7	.....	100-90	100-90	32	10	.63-2.0	.20-.24	High	N-Low
22	8-30	Silt loam	CL	A-6	.....	100-90	95-85	36	17	.63-2.0	.16-.20	Mod.	S-High
	30+	Silt and sand	ML	A-4	.....	100-90	95-85	20	2	.63-2.0	.16-.20	High	
Del Rey silt loam	0-10	Silt loam	CL or ML	A-4	.....	100-90	100-90	32	10	.20-.63	.18-.22	High	N-Low
18	10-24	Silty clay	CH	A-7	.....	100-90	100-90	43	23	.20-.63	.12-.16	Mod.	S-High
	24+	Silty clay loam	CL	A-6	.....	100-90	100-90	30	13	.20-.63	.16-.20	Mod.	

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data				Frost hazard	Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dodge silt loam	0-12	Silt loam	CL or ML	A-4	.....	100-95	100-95	32	10	.63-2.0	.18-.22	High	N-Low
1	12-36	Silty clay loam	CL	A-7	.....	100-95	100-95	50	29	.63-2.0	.16-.20	Mod.	S-Mod.
	36+	Loam	ML	A-4	90-80	80-70	65-55	20	7	.63-2.0	.16-.20	Low	
Elburn-silt loam	0-12	Silt loam	CL or ML	A-4	.....	100-90	95-85	32	10	.63-2.0	.20-.24	High	N-Low
5	12-45	Silty clay loam	CL	A-7	.....	100-90	95-85	43	19	.63-2.0	.16-.20	Mod.	S-High
	45+	Sandy loam	SM	A-2	100-90	90-80	35-25	20	7	2.0-6.3	.08-.12	Low	
Fabius loam	0-8	Loam	ML	A-4	100-90	90-80	75-65	25	12	.63-2.0	.18-.22	Mod.	N-Low
12h	8-18	Clay loam	CL	A-7	100-90	90-85	75-65	42	24	.63-2.0	.16-.20	Mod.	S-Low
	18+	Sand and gravel	GP-GM	A-1	40-30	35-25	10-5	....	Non-Pl	6.3-20.	.02-.04	Low	
Fox silt loam	0-12	Silt loam	CL or ML	A-4	100-95	100-90	100-90	32	10	.63-2.0	.18-.22	High	N-Mod.
9	12-30	Clay loam	CL	A-7	100-95	100-90	90-80	27	11	.63-2.0	.16-.20	High	S-Low
	30+	Sand and gravel	GP-GM	A-1	50-40	40-30	10-5	....	Non-Pl	6.3-20.	.08-.12	Low	
Gilford loam	0-15	Loam	ML	A-4	100-90	85-75	65-55	25	12	.63-2.0	.18-.22	Mod.	N-Low
13h	15-45	Sandy loam	SM	A-2	100-95	95-85	35-25	....	Non-Pl	2.0-6.3	.08-.12	Low	S-Mod.
	45+	Sand	SP	A-2	100-95	95-85	5-1	....	Non-Pl	6.3-20.	.03-.05	Low	

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data				Frost hazard	Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Griswold loam	0-12	Loam	ML	A-4	100-90	80-70	65-55	25	12	.63-2.0	.18-.22	Low	N-Low
(2)	12-30	Sandy clay loam	SC	A-6	95-85	80-70	55-40	25	10	.63-2.0	.14-.18	Low	S-Low
	30+	Sandy loam	SM	A-2	90-80	80-70	35-25	....	Non-Pl	2.0-6.3	.08-.12	Low	
Harpster silt loam	0-12	Silt loam	CL or ML	A-7	100-95	100-90	100-90	32	10	.63-2.0	.20-.24	High	N-Low
6	12-40	Silty clay loam	CL	A-6	100-95	100-95	100-90	50	28	.63-2.0	.16-.20	Mod.	S-High
	40+	Silt loam	CL	A-6	100-95	100-95	100-90	41	19	.63-2.0	.18-.22	High	
Hebron loam	0-15	Loam	ML	A-4	100-90	95-85	65-55	25	12	.63-2.0	.16-.20	Mod.	N-Low
14	15-30	Loam	ML	A-4	100-90	95-85	65-55	46	25	.63-2.0	.16-.20	Low	S-Mod.
	30+	Silty clay loam	CL	A-6	.....	100-90	100-90	36	18	.20-.63	.16-.20	Mod.	
Hennepin sandy loam	0-8	Sandy loam	SM	A-4	100-90	90-80	35-25	....	Non-Pl	2.0-6.3	.10-.14	Mod.	N-Low
4	8-15	Sandy loam	SM	A-4	100-90	80-70	35-25	....	Non-Pl	2.0-6.3	.10-.16	Low	S-Low
	15+	Sandy loam	SM	A-2	100-90	80-70	35-25	....	Non-Pl	2.0-6.3	.08-.12	Mod.	
Hochheim loam	0-8	Loam	CL or ML	A-4	100-90	95-85	65-55	25	12	.63-2.0	.18-.22	High	N-Low
4	8-18	Clay loam	CL	A-7	100-90	95-85	70-60	44	25	.63-2.0	.16-.20	Mod.	S-Mod.
	18+	Sandy loam	SM	A-2	90-80	80-70	35-25	15	3	.63-2.0	.10-.14	Low	

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data				Frost hazard	Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Kendall silt loam	0-12	Silt loam	CL or ML	A-6	.....	100-95	100-90	32	10	.63-2.0	.20-.24	High	N-Low
5	12-45	Silty clay loam	CL	A-7	.....	100-95	100-90	39	19	.63-2.0	.16-.20	Mod.	S-High
	45+	Sandy loam	SM	A-2	100-95	95-85	35-25	5	....	2.0-6.3	.10-.14	Low	
Keowns loam	0-10	Silt loam	ML	A-4	.....	100-90	100-90	32	10	.63-2.0	.18-.22	High	N-Low
23	10-24	Fine sandy loam	ML	A-4	.....	100-90	60-50	36	17	.63-2.0	.14-.18	High	S-High
	24+	Silt and sand	ML	A-4	.....	100-90	95-85	20	2	.63-2.0	.10-.14	High	
Kibbie silt loam	0-12	Silt loam	CL or ML	A-4	.....	100-90	95-85	32	10	.63-2.0	.20-.24	High	N-Low
19	12-30	Loam	CL	A-6	.....	100-90	65-55	36	17	.63-2.0	.16-.20	Mod.	S-High
	30+	Silt and Sand	ML	A-4	.....	100-90	85-75	20	2	.63-2.0	.16-.20	High	
Knowles silt loam	0-12	Silt loam	CL or ML	A-4	.....	100-90	95-85	32	10	.63-2.0	.18-.22	High	N-Low
7	12-30	Silty clay loam	CL	A-6	.....	100-90	95-85	46	25	.63-2.0	.16-.20	Mod.	S-Mod.
	30+	Dolomite (rock)	.....	.....	.....	.....	.....	....	....	.....	.....	.....	
Kokomo silt loam	0-15	Silt loam	CL or ML	A-7	100-95	100-90	100-90	32	10	.63-2.0	.20-.24	High	N-Low
6	15-30	Clay loam	CL	A-7	100-90	95-85	65-55	50	28	.63-2.0	.16-.20	Mod.	S-High
	30+	Loam	ML	A-4	100-90	95-85	65-55	41	19	.63-2.0	.16-.20	Low	

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data				Frost hazard	Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Lamartine silt loam	0-12	Silt loam	CL or ML	A-4	.....	100-90	100-90	32	10	.63-2.0	.20-.24	High	N-Low
5	12-36	Silty clay loam	CL	A-7	.....	100-90	95-85	50	29	.63-2.0	.16-.20	Mod.	S-High
	36+	Loam	ML	A-4	90-80	85-75	65-55	18	4	.63-2.0	.16-.20	Low	
Lapeer loam	0-10	Loam	ML	A-4	100-90	85-75	65-55	25	12	.63-2.0	.18-.22	Low	N-Low
2,3,4	10-36	Sandy clay loam	SC	A-6	100-90	95-85	50-40	25	10	.63-2.0	.14-.18	Low	S-Low
	36+	Sandy loam	SM	A-2	90-80	80-70	35-25	....	Non-Pl	2.0-6.3	.08-.12	Low	
Lisbon silt loam	0-12	Silt loam	CL or ML	A-4	.....	100-90	100-90	32	10	.63-2.0	.20-.24	High	N-Low
5	12-36	Silty clay loam	CL	A-7	.....	100-90	95-85	50	29	.63-2.0	.16-.20	Mod.	S-High
	36+	Loam	ML	A-4	90-80	85-75	65-55	18	4	.63-2.0	.16-.20	Low	
Lorenzo sandy loam	0-8	Loam	ML	A-4	100-90	90-80	75-65	25	12	.63-2.0	.18-.22	Mod.	N-Low
(9)	8-18	Clay loam	CL	A-7	100-90	90-85	75-65	42	24	.63-2.0	.16-.20	Mod.	S-Low
	18+	Sand and gravel	GP-GM	A-1	40-30	35-25	10-5	....	Non-Pl	6.3-20.	.03-.04	Low	
McHenry silt loam	0-12	Silt loam	CL or ML	A-4	.....	100-90	80-70	32	10	.63-2.0	.18-.22	High	N-Low
(1)	12-36	Clay loam	CL	A-7	100-90	95-85	70-60	42	24	.63-2.0	.16-.20	Mod.	S-Low
	36+	Sandy loam	SM	A-2	90-80	80-70	35-25	....	Non-Pl	2.0-6.3	.08-.12	Low	

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data				Frost hazard	Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Martinton loam	0-10	Silt loam	CL or ML	A-4	.....	100-90	100-90	32	10	.20-.63	.18-.22	High	N-Low
(18)	10-24	Silty clay	CH	A-7	.....	100-90	100-90	43	23	.20-.63	.12-.16	Mod.	S-High
	24+	Silty clay loam	CL	A-6	.....	100-90	100-90	30	13	.20-.63	.16-.20	Mod.	
Matherton loam	0-10	Loam	ML	A-4	100-90	100-90	70-60	25	12	.63-2.0	.18-.22	Mod.	N-Low
12g, h	10-30	Clay loam	CL	A-7	100-90	100-90	85-75	30	16	.63-2.0	.16-.20	Mod.	S-Mod.
	30+	Sand and gravel	GP-GM	A-1	50-40	40-30	10-5	....	Non-Pl	6.3-20.	.02-.04	Low	
Metea sandy loam	0-20	Sandy loam	SM	A-2	100-95	100-90	35-25	....	Non-Pl	2.0-6.3	.10-.14	Low	N-Low
(3)	20-30	Sandy clay loam	SC	A-4	100-95	100-90	50-40	25	10	.63-2.0	.14-.18	Low	S-Low
	30+	Sandy loam	SM	A-2	100-90	95-85	35-25	....	Nno-Pl	2.0-6.3	.08-.12	Low	
Milford silt loam	0-12	Silt loam	CL or ML	A-7	100-95	100-90	100-90	32	10	.63-2.0	.20-.24	High	N-Low
13g	12-30	Silty clay loam	CL	A-7	100-95	100-90	85-75	50	28	.63-2.0	.16-.20	Mod.	S-High
	30+	Sand and gravel	GP	A-1	50-40	40-30	5-1	....	Non-Pl	6.3-20.	.02-.04	Low	
Montgomery silt loam	0-10	Silt loam	CL or ML	A-6	.....	100-95	100-90	32	10	.63-2.0	.18-.22	High	N-Low
21	10-24	Clay	CH	A-7	.....	100-95	100-90	64	38	.20-.63	.12-.16	Mod.	S-High
	24+	Silty clay loam	CL	A-6	.....	100-95	100-90	36	17	.20-.63	.16-.20	Mod.	

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data					Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)	Frost hazard	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mosel loam	0-15	Loam	ML	A-4	100-90	85-75	65-55	25	12	.63-2.0	.18-.22	Mod.	N-Low
17	15-30	Loam	ML	A-4	100-90	85-75	65-55	30	14	.63-2.0	.16-.20	Low	S-High
	30+	Silt and clay	CL	A-7	.....	100-90	100-90	36	17	.20-.63	.16-.20	Mod.	
Mucks													
25		Organic soil with extremely high available water capacity, frost hazard, and corrosivity potential.											
Navan loam	0-15	Loam	CL or ML	A-4	100-90	95-85	65-55	25	12	.63-2.0	.18-.22	Mod.	N-Low
20	15-30	Loam	CL or ML	A-6	100-90	90-80	65-55	30	14	.63-2.0	.16-.20	Low	S-High
	30+	Silt and Clay	CL	A-7	.....	100-90	100-90	36	17	.06-.20	.16-.20	Mod.	
Oakville loamy sand	0-8	Loamy sand	SM	A-2	100-95	95-85	25-20	....	Non-Pl	6.3-20.	.06-.10	Low	N-Low
11	8-15	Sand	SP	A-3	100-95	95-85	5-1	....	Non-Pl	6.3-20.	.04-.06	Low	S-Low
	15+	Sand	SP	A-3	100-95	95-85	5-1	....	Non-Pl	6.3-2.0	.03-.05	Low	
Oshtemo loamy sand	0-15	Loamy sand	SM	A-2	100-95	95-85	25-20	....	Non-Pl	2.0-6.3	.06-.10	Low	N-Low
10	15-45	Sandy loam	SM	A-2	100-95	95-85	35-25	....	Non-Pl	2.0-6.3	.08-.12	Low	S-Low
	45+	Sand	SP	A-3	100-95	95-85	5-1	....	Non-Pl	6.3-20.	.03-.05	Low	

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data				Frost hazard	Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Peats													
25		Organic soils with extremely high available water capacity, frost hazard, and corrosivity potential.											
Pella silt loam	0-12	Silt loam	CL or ML	A-7	100-95	100-90	100-90	32	10	.63-2.0	.20-.24	High	N-Low
6	12-40	Silty clay loam	CL	A-6	.....	100-95	100-90	50	28	.63-2.0	.16-.20	Mod.	S-High
	40+	Silt loam	CL	A-6	.....	100-95	100-90	41	19	.63-2.0	.18-.22	High	
Plano silt loam	0-12	Silt loam	CL or ML	A-6	.....	100-95	100-90	32	10	.63-2.0	.20-.24	High	N-Low
(1)	12-45	Silty clay loam	CL	A-7	.....	100-95	100-90	50	28	.63-2.0	.16-.20	Mod.	S-Low
	45+	Sandy loam	SM	A-2	90-80	80-70	35-25	41	19	2.0-6.3	.08-.12	Low	
Rodman gravelly loam	0-10	Gravelly loam	SM	A-2,	80-70	80-70	50-40	....	Non-Pl	2.0-6.3	.10-.16	Low	N-Low
9	10+			A-4									
		Sand, gravel, and Cobbles	GP or GW	A-1	50-40	40-30	5-1	....	Non-Pl	20+	.02-.04	Low	S-Low
Salter loam	0-12	Loam	ML	A-4	.....	100-90	65-55	25	12	.63-2.0	.18-.22	High	N-Low
16	12-30	Fine sandy loam	ML	A-4	.....	95-85	50-40	36	17	.63-2.0	.10-.14	High	S-Mod.
	30+	Silt and sand	ML	A-4	.....	95-85	85-75	20	2	.63-2.0	.10-.14	High	

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data				Frost hazard	Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Saylesville silt loam	0-10	Silt loam	CL or ML	A-4	.....	100-95	100-90	32	10	.63-.20	.18-.22	High	N-Low
15	10-24	Clay	CH	A-7	.....	100-95	100-90	64	38	.20-.63	.12-.16	Mod.	S-Mod.
	24+	Silty clay loam	CL	A-6	.....	100-95	100-90	36	17	.20-.63	.16-.20	Mod.	
St. Charles silt loam	0-12	Silt loam	CL or ML	A-4	.....	100-95	100-90	32	10	.63-2.0	.18-.22	High	N-Low
1	12-45	Silty clay loam	CL	A-6	.....	100-95	95-85	39	19	.63-2.0	.16-.20	Mod.	S-Low
	45+	Sandy loam	SM	A-2	100-90	90-80	35-25	....	Non-Pl	2.0-6.3	.08-.12	Low	
Sebewa loam	0-12	Loam	ML	A-6	100-90	75-65	65-55	25	12	.63-2.0	.18-.22	Low	N-Low
13h	12-30	Sandy clay loam	SC	A-6	100-90	90-80	50-40	25	10	.63-2.0	.12-.16	Low	S-High
	30+	Sand and Gravel	GP-GM	A-1	45-35	40-30	10-5	....	Non-Pl	6.3-20.	.02-.04	Low	
Shiocton loam	0-10	Loam	ML	A-4	.....	100-95	80-70	25	12	.63-2.0	.18-.22	High	N-Low
19	10-30	Fine sandy loam	ML	A-4	.....	100-95	50-40	....	Non-Pl	.63-2.0	.12-.16	High	S-Mod.
	30+	Silt and sand	ML	A-4	.....	100-95	90-80	....	Non-Pl	.63-2.0	.10-.14	High	
Sisson silt loam	0-12	Silt loam	CL or ML	A-4	.....	100-95	95-85	32	10	.63-2.0	.18-.22	High	N-Low
16	12-30	Heavy loam	CL	A-6	.....	100-90	80-70	46	26	.63-2.0	.16-.20	Mod.	S-Mod.
	30+	Silt and sand	ML	A-4	.....	100-90	80-60	19	3	.63-2.0	.10-.14	High	

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data				Frost hazard	Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Spinks loamy sand	0-12	Loamy sand	SM	A-2	.....	100-90	25-20	....	Non-Pl	6.3-20.	2.0-3.0	Low	N-Low
11	12-30	Loamy sand	SM	A-2	.....	100-90	25-20	....	Non-Pl	6.2-20.	2.0-3.0	Low	S-Low
	30+	Sand and sandy bands	SP-SM	A-2	.....	100-90	25-20	....	Non-Pl	2.0-6.3	2.0-3.0	Low	
Theresa silt loam	0-12	Silt loam	CL or ML	A-4	.....	100-95	100-90	32	10	.63-2.0	.18-.22	Low	N-Low
1,2	12-30	Clay loam	CL	A-7	.....	100-90	70-60	35	18	.63-2.0	.16-.20	Mod.	S-Mod.
	30+	Sandy loam	SM	A-2	80-70	70-60	35-25	21	6	.63-2.0	.10-.14	Mod.	
Tichigan silt loam	0-10	Silt loam	CL or ML	A-4	100-95	100-90	95-85	32	10	.63-2.0	.18-.22	High	N-Low
18	10-24	Clay	CH	A-7	.....	100-95	100-90	69	38	.20-.63	.12-.16	Mod.	S-Mod.
	24+	Silty clay loam	CL	A-6	.....	100-95	100-90	45	22	.20-.63	.16-.20	Mod.	
Warsaw loam	0-12	Loam	CL or ML	A-6	100-90	95-85	70-60	25	12	.63-2.0	.18-.22	Mod.	N-Low
(9)	2-30	Clay loam	CL	A-7	100-90	95-85	85-75	50	50	.63-2.0	.16-.20	Mod.	S-Low
	30+	Sand and gravel	GP	A-1	50-40	40-30	5-1	....	Non-Pl	6.3-20.	.03-.04	Low	
Wasepi sandy loam	0-10	Sandy loam	SM	A-2, A-4	95-85	70-60	40-30	....	Non-Pl	2.0-6.3	.12-.16	Low	N-Low
12h	10-30	Sandy loam	SM	A-2	90-80	65-55	35-25	....	Non-Pl	2.0-6.3	.08-.12	Low	S-Mod.
	30+	Sand and gravel	GP	A-1	50-40	40-30	5-1	....	Non-Pl	6.3-20.	.02-.04	Low	

TABLE 4. SOME PHYSICAL AND CHEMICAL ENGINEERING PROPERTIES OF MAJOR SOILS[1] OF JEFFERSON COUNTY, WISCONSIN

Name of soil type (or land unit) and soil map symbol[2]	Depth of sample from surface (average in inches)	Classification			Representative percentages passing sieve			Representative Data				Frost hazard	Corrosivity of buried pipes, concrete (N) or Steel (S)
		USDA texture	Unified	AASHO	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (.07mm)	Liquid Limit	Plasticity index	Permeability (in/hr)	Available water capacity (in./in.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Waterloo silt loam	0-12	Silt loam	CL or ML	A-4	100-95	100-95	100-90	32	10	.63-2.0	.18-.22	Low	N-Low
8	12-45	Silty clay loam	CL	A-6	100-95	100-95	95-85	39	19	.63-2.0	.16-.20	Low	S-Low
	45+	Sand and gravel	SP	A-1	100-95	95-85	95-85	....	Non-Pl	6.3-20.	.03-.05	Low	
Whalan loam	0-12	Loam	ML	A-4	100-90	80-70	70-60	25	12	.63-2.0	.16-.20	Mod.	N-Low
7	12-30	Clay loam	CL	A-6	100-90	95-85	70-60	50	28	.63-2.0	.16-.20	Mod.	S-Mod.
	30+	Dolomite(rock)	------	------	--------	--------	--------	----	----	------	------	------	
Will loam	0-12	Loam	CL or ML	A-6	100-95	100-90	80-70	25	12	.63-2.0	.18-.22	Low	N-Low
13h	12-30	Clay loam	CL	A-7	100-95	100-90	85-75	50	28	.63-2.0	.16-.20	Mod.	S-Mod.
	30+	Sand and gravel	GP	A-1	50-40	40-30	5-1	....	Non-Pl	6.3-20.	.02-.04	Low	

[1] Refer to Soil Conservation Service, 1969, "Wisconsin Soils, Their Properties and Uses," USDA, Madison, Wisconsin.
[2] See footnote number 2, Table 3.
*Soils that are classified *somewhat poorly, poorly,* and *very poorly* drained under natural conditions.
#Soil that is shallow (20 to 42 inches) to limestone bedrock.

V. FACTORS OF SOIL GENESIS

How do soils differ and how were they formed? Differences are seen when frost heaving breaks up roads on one soil but not on another (Figure 8). Some soils have deep, dark and others thin or light colored surface soil horizons (Figure 7); some are sandy and others clayey; some are wet and some are droughty; some are deep and some are shallow. Most soil differences in Jefferson County may be traced to variations in underlying geologic materials, topography, and native vegetation. The maps in this section of the report help explain the formation of the soils of the county.

Geological Formations

Bedrock. Bedrock of Jefferson County (Figure 9) is important to soil genesis in at least three ways: (1) as the original source of much of the lime (carbonates of calcium and magnesium), gravel, and fine earth in the soils and the glacial drift under them into which plant roots extend; (2) as a locally obstructing material that restricts both natural drainage of soil and plant root development; and (3) as a partially obstructing material which in places has cracks down which soil has washed and plant roots have extended for considerable distances. Limestone bedrock appears at the surface in a few places in the county. A quarry is located southeast of Ft. Atkinson. Where depth to bedrock is only 2 to 3 feet, Knowles and Whalan soils have been mapped. Figure 10 shows estimated depths to bedrock (see Alden, 1918; Higgins, 1968). Two sandstones underlie portions of the western half of the county. The narrow band of Cambrian sandstone lies at the bottom of a buried valley leading from the vicinity of Jefferson to Lake Koshkonong. The Waterloo quartzite, of Precambrian age, outcrops in northwestern Jefferson County (Figure 11) and has features such as scratches and polished surfaces formed by the continental glaciers that advanced over the area more than 14,000 years ago. The low-lying quartzite exposure is actually the top of an ancient hill almost entirely buried by sediments (Ostrom, 1967).

Surficial deposits. The unconsolidated deposits include glacial ice-laid till, melt-water-deposited outwash (Figure 12), lake-laid fine sediments, sands, and associated accumulations of peat and wind-blown cover silts. The mineral materials were derived from bedrock of the county and the region to the northeast including areas of Precambrian rocks in the Canadian Shield. An unusually reddish (5YR 4/4) glacial till in a drumlin hill on the west county line at the I-94 highway is thought to have been derived by the glacier from reddish residual materials at the base of the St. Peter sandstone; with

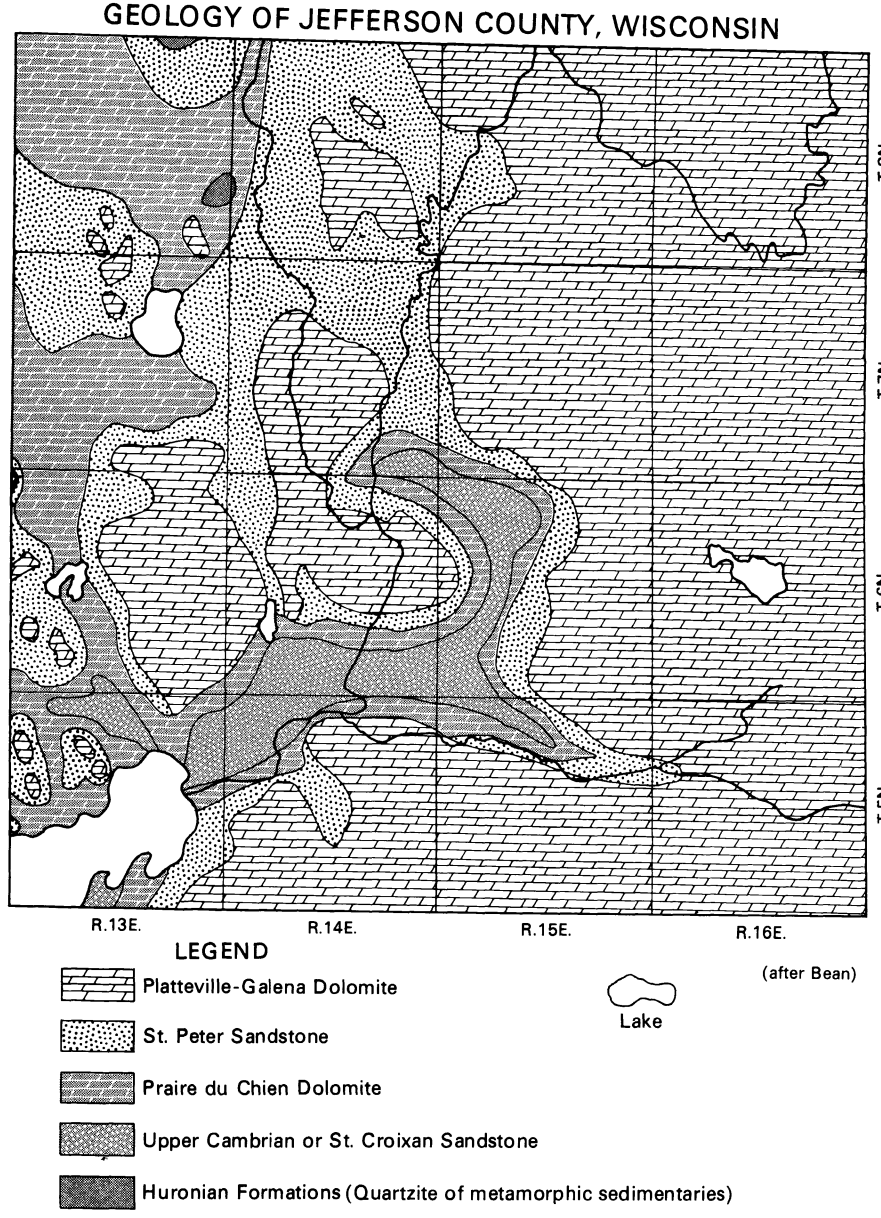
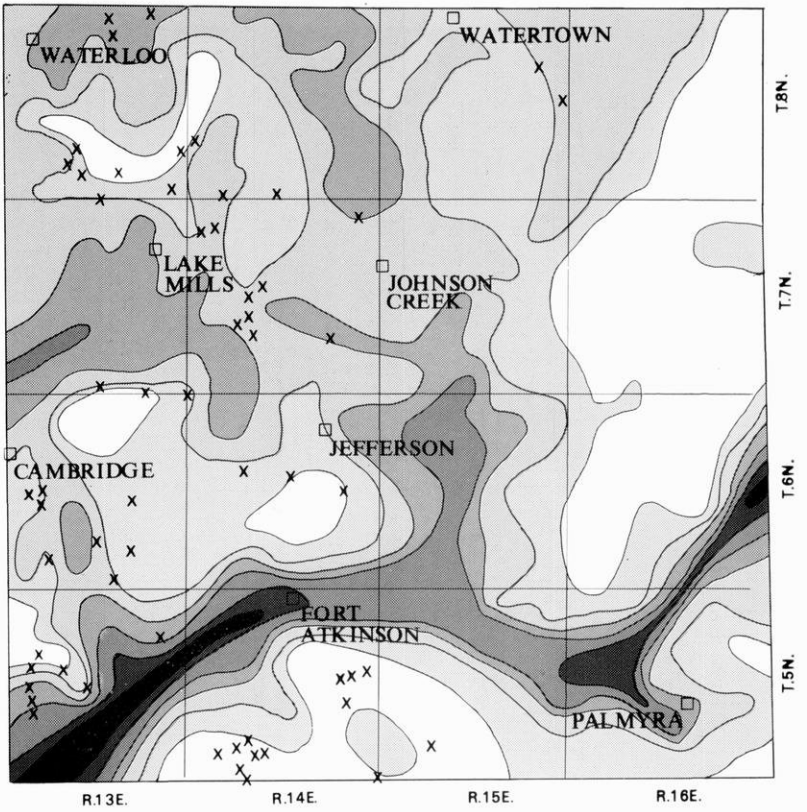


Figure 9. Geology of Jefferson County.

GENERALIZED ISOPACH MAP OF PLEISTOCENE GLACIAL DRIFT, JEFFERSON COUNTY, WISCONSIN



LEGEND: DRIFT THICKNESS

less than 50 ft.	200 - 250 ft.
50 - 100 ft.	250 - 300 ft.
100 - 150 ft.	more than 300 ft.
150 - 200 ft.	X Bedrock outcrop

by A. Lind, after Alden (1918), U.S.G.S. Topog. Quad. Series (Madison, Rockford sheets) and Higgins (1968)

Figure 10. Map showing general thickness of glacial drift.

this exception, the till of the county is remarkably uniform in color (light yellowish-brown: 10YR 6/4) and texture (sandy loam[1]). The till varies in carbonate content from 20 percent on the west where dilution of pulverized dolomite by sandstone debris is greatest, to nearly 50 percent toward the north and east over Platteville-Galena dolomite bedrock. About 96 percent of the carbonate is dolomite and the rest is calcite (Allan and Hole, 1968). Much of the till appears to be ice-reworked outwash. Content of boulders and stones is notable locally (Figures 11 and 13). Evidence indicates that a glacial lobe advanced southward from Green Bay across the county in Woodfordian time (Frye, Willman, and Black, 1965) about 15,000 years ago. Spruce wood collected during this soil survey from the base of a peat mount just south of the Scuppernong River yielded a C^{-14} date of 12,800 years $\pm$ 220 years in an analysis made at The University of Wisconsin Center for Climatic Research. A leached loess mantle (silt cover) on the glacial drift is particularly extensive in the northern half of the county (Figures 14 and 15). The mantle typically thickens from hillcrest to swale (Figure 15). Even where no wind-deposited silt cover is evident, some fine eolian material, as much as the equivalent of an 8-inch thick deposit, has washed down into the soil to a depth of about 2 feet (Borchardt, *et al.*, 1968). Sand coverings are extensive on flanks of hills and ridges of the Kettle Moraine belt, where Spinks and Oakville loamy sands formed (Figures 7, 31,

[1] Analyses of till from 24 drumlins showed: gravel ($>$ 2 mm) content, 27 percent; and of fine earth ($<$ 2 mm), 72 percent sand, 17 percent silt, and 11 percent clay. See Table 13.

Figure 11. A Waterloo Quartzite outcrop in northwestern Jefferson County.

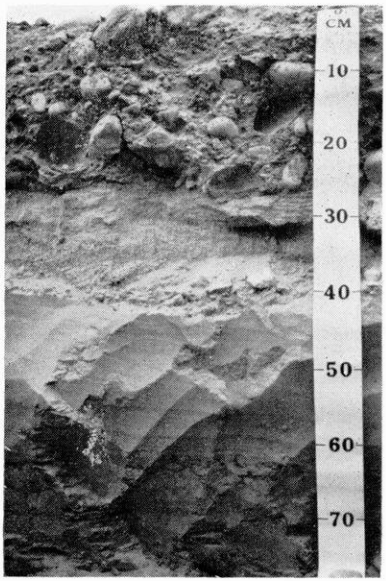
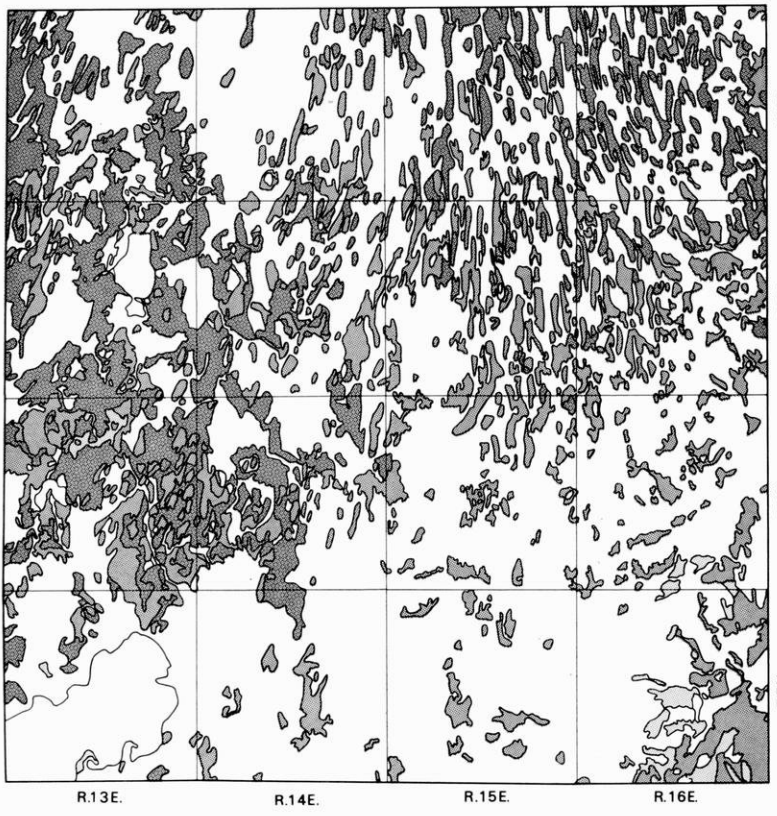


Figure 12. Cut in glacial drift showing 25 centimeters (10 inches) of glacial till over coarse sand and fine sand glacial outwash.

Figure 13. Field wall of stones cleared from the top of a drumlin hill.

EOLIAN DEPOSITS

ON UPLANDS OF JEFFERSON COUNTY, WISCONSIN



LEGEND (based on the soil map)

Moderately deep to deep (more than 20 in.) loess (soil map units 1,8)

2. Shallow (less than 20 in.) loess (soil map units 2,9)

3. Fine sand deposits (soil unit 11)

Lake

4. Areas of no loess or sand deposits or areas without extensive loess or sand deposits (soil map units 3, 4, 5 , 6, 7, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25)

Figure 14. Wind-blown deposits on uplands.

and 32) in association with Rodman gravelly soils (Figure 27) (also see Hole, 1956). Local alluvial deposits lie in patches along streams and on footslopes of drumlins. Many kettles contain fairly deep silty deposits. Clays of lacustrine basins are mineralogically similar to the clay in the till (Borchardt, *et al.,* 1968).

Topography and Land Forms

The most apparent geomorphic features of the county (Figure 16) are (1) a till plain studded with more than 300 north-south tapered hills, called drumlins and intervening wetland strips, bounded in the southeast by (2) a portion of the hilly Kettle Moraine, and interrupted (3) on the west by a north-pointing wedge of outwash plains, wetlands, and lakes, (4) slightly west of center by a Y-shaped pattern of wetlands along the Crawfish and Rock Rivers, and (5) on the south by a sinuous east-west belt of lowlands along the Bark and Scuppernong Rivers and Lake Koshkonong itself on the southwest.

In the vicinity of Palmyra at the southeastern corner of the county are large deposits of gravel in a landscape of hills (kames), deep pits (kettles), eskers (Figure 27), and crevasse fillings. This is part of the Kettle Moraine that was deposited in a relatively narrow space between the Green Bay glacial lobe on the west and the Lake Michigan lobe on the east. A series of discontinuous ridges forms an arc from Oconomowoc in Waukesha County to Jefferson to Lake Mills,

Figure 15. Road cut through loess-covered till showing thickening of leached loess covering down-hill (toward the foreground). The toposequence is from Theresa silt loam on the ridge to Dodge silt loam in the foreground.

and then extends due north. This constitutes the Lake Mills glacial recessional morainic system (Alden, 1918). South of Lake Koshkonong, a narrow strip of the northern flank of the Milton end moraine lies within the county. The drumlins, measuring from 800 to 6000 feet long and 15 to 160 feet high, were formed by the moving ice and deployed in a somewhat fan-shaped pattern (Figure 1) produced by the spreading of the glacial ice lobe. The average length of drumlin in the county is 3053 feet (with Standard Deviation of 1726 feet); breadth, 951 feet (445 ft. S.D.); and height, 48 feet (21 ft. S.D.). The average north-south spacing of the drumlins is 6097 feet or double their average length (Allan, 1967). The east half of a small drumlin lying three quarters of a mile south of Hebron and just west of the Bark River was apparently washed away by a sudden local flood of

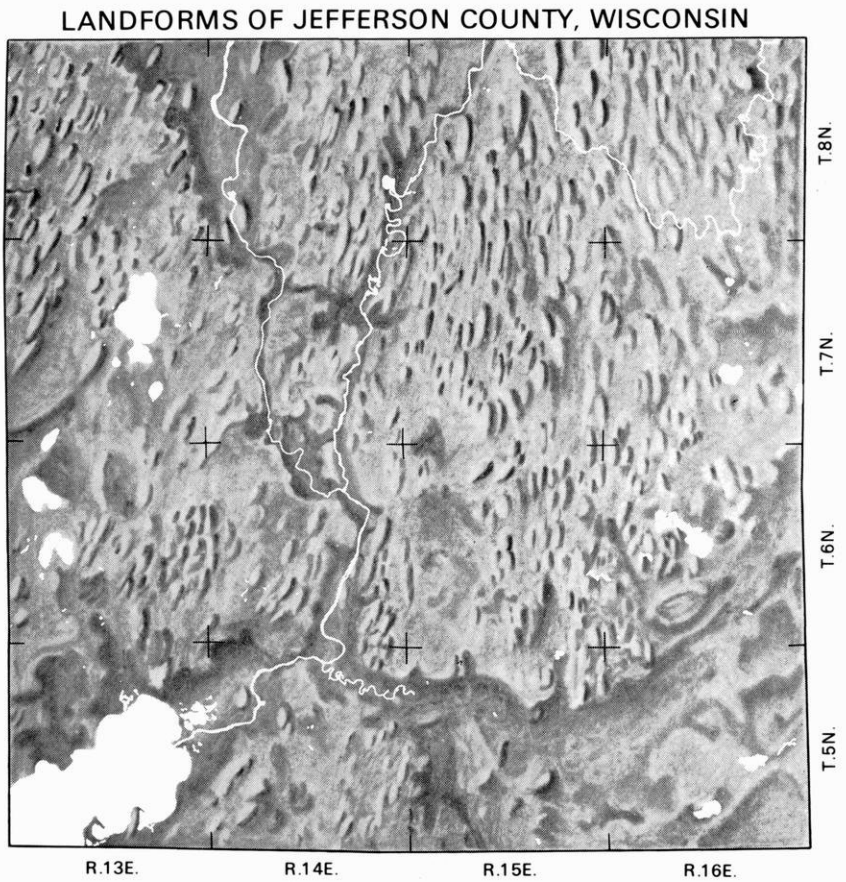
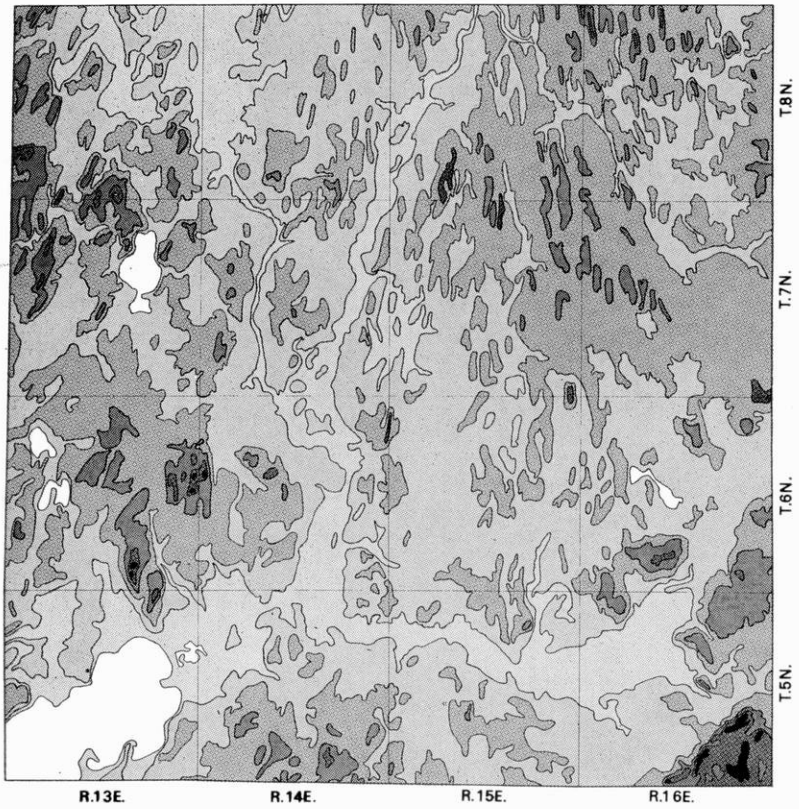


Figure 16. Land forms.

TOPOGRAPHY OF JEFFERSON COUNTY, WISCONSIN



LEGEND

750-800 ft.

800-850 ft.

850 900 ft.

900-950 ft.

950-1000 ft.

1000 - 1050 ft.

Lake

Elevation of highest point 1042 ft.

Elevation of lowest point 776 ft.

Total relief 266 ft.

This generalized map is based on U.S.G.S. Quadrangle sheets.

Figure 17. Topography.

glacial meltwaters. Ancient lakes once occupied the extensive modern sites of peats, mucks, and other wetland soils.

The generalized topographic map of the county (Figure 17) shows that relief is not great. It starts from 776 feet at the surface of Lake Koshkonong and rises to several feet above the 1000-foot contour line southeast of Palmyra in the Kettle Moraine, and on a drumlin three miles east of Watertown. The pattern of streams and lakes (Figure 18) and wetlands is typical of an imperfectly drained glaciated landscape. The sharp turns of the Rock River in the northern townships may be inherited from an angular pattern of crevasses in stagnant glacial ice through which the river first flowed about 13,000 years ago.

Ground-water recharge takes place in the till uplands and the ground-water moves downward toward areas of lower elevation that

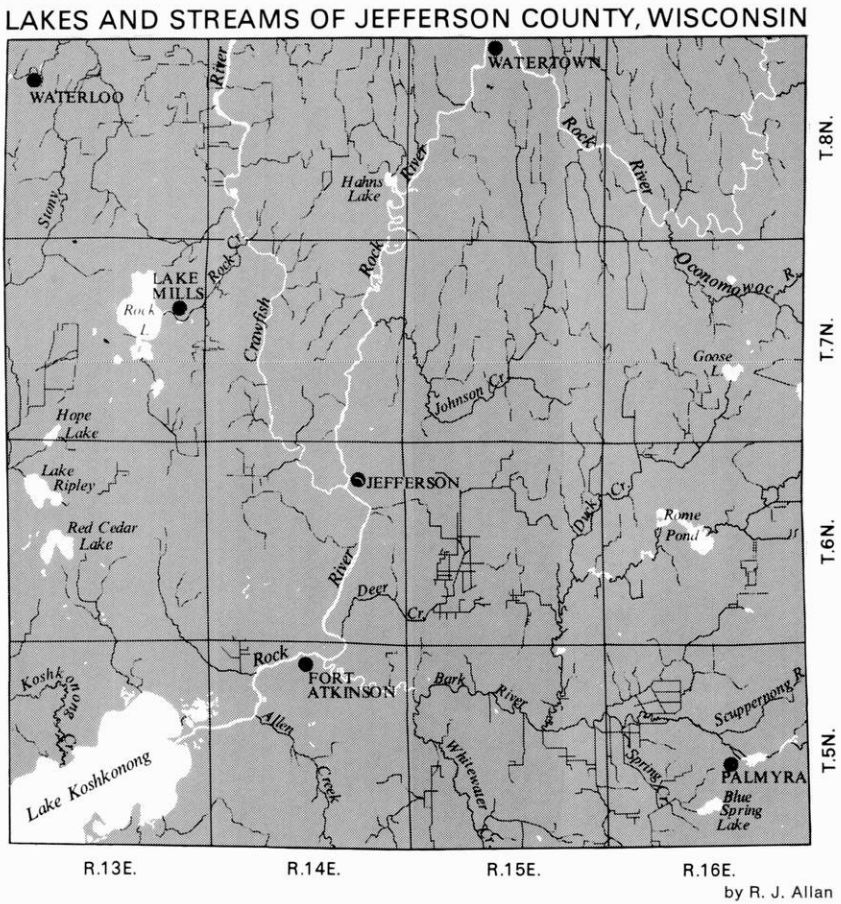


Figure 18. Lakes and streams.

in places are overlain with silty and clayey deposits of low permeability. This results in artesian conditions, particularly evident in the Scuppernong-Bark River Basin in southeastern townships where flowing wells (Figure 19) and springs are numerous and where peat mounds developed over some of the springs (Figure 20). For the most part, ground-water is hard and has a pH of 7.1 to 7.6[2]. Occasional reports of soil reaction more acid than pH 5.0 in wetlands may be ascribed to influence of acid oxidation products of local pockets of iron sulphide.

Climate

Jefferson County lies about 50 miles southeast of a north-west-trending, 10- to 30-mile wide "tension zone" boundary (Curtis, 1959) between the northern hardwood province and the prairie-forest floristic province. This boundary corresponds approximately to a climatic boundary between a northeastern zone of relatively cool, moist conditions and a southwestern zone that is warmer and drier (Borchert, 1950; Trewartha *et al,* 1967). The complex pattern of soils in the county, showing influence of both forest and prairie vegetation, is related to the southwestern climatic zone of Wisconsin.

Annual rainfall totals about 32 inches of which 20 inches falls in the warm season. The annual average temperature is about 47° F. with January and July averages of 18° F. and 72° F., respectively. In most years the first inch of snow has fallen by November 27. Snow covers the landscape approximately 95 days out of the year, and the average snowfall is about 40 inches (USDA, 1941). Average frost penetration in open fields is about the same depth. The normal frost-free season averages about 160 days. The last killing frost in the spring at Jefferson usually occurs by May 2 (Hole and Lee, 1955), although in 10 years out of a hundred, it can be expected to be as late as May 15. The first fall frost comes around October 10, but 10 percent of the time may come as early as September 25. Temperatures as high as 104° F. and as low as —33° F. have been recorded in the county. There are about 40 days each year with thunderstorms, some of which produce rainfall intensities as high as 2 inches per hour. Hail falls on the average of two days in a year. There are on the average, 110 clear days each year, and 15 days with dense fog. On a winter day there are on an average 4.3 hours of sunshine, with 43 percent of the possible sunshine. In summer, the corresponding figures are 10.2 hours of sunshine per day, representing 68 percent of the possible sunshine. Table 5 presents a climatological summary for Ft. Atkinson, Wisconsin.

[2] Personal communication from Dr. Gerald W. Lawton, State Hygiene Laboratory.

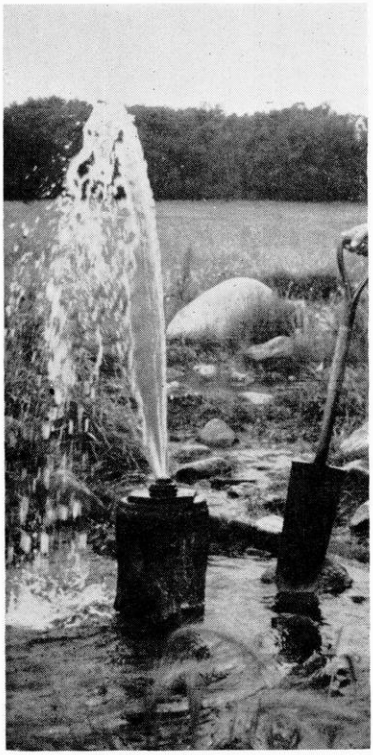


Figure 19. Flowing artesian well on the north side of the Scuppernong River basin in southeastern Jefferson County, Wisconsin.

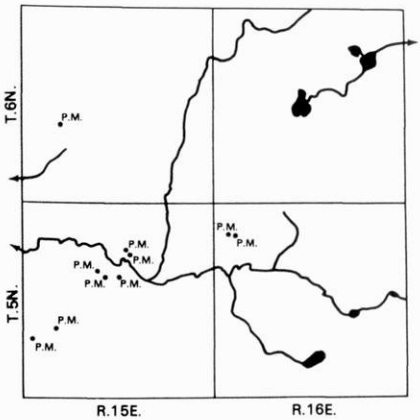


Figure 20. Location of 10 major peat mounds in the Scuppernong-Bark River basin of southeastern Jefferson County, Wisconsin.

TABLE 5. CLIMATOLOGICAL SUMMARY[1] FOR FORT ATKINSON, WISCONSIN.

LATITUDE 42°54′N
LONGITUDE 88°50′W
ELEV. (GROUND) 815 Feet

Means and Extremes for Period 1942-1959

Month	Temperature (°F)							Mean degree days**	Precipitation Totals (Inches)							Mean Number of Days					Month
									Snow and Sleet							Precip. .10 inch or more	Temperature				
																	Max.		Min.		
	Daily maximum	Daily minimum	Monthly	Record highest	Year	Record lowest	Year		Mean	Greatest daily	Year	Mean	Maximum monthly	Year	Greatest daily	Year		90° and above	32° and below	32° and below	0° and below	
(a)	18	18	18	18		18		18	18	18		18	18		18		18	18	18	18	18	
Jan.	28.5	11.0	19.8	58	1944	—33	1951	1400	1.32	1.70	1942	9.2	22.0	1951	8.0	1942	3	0	18	30	8	Jan.
Feb.	31.6	14.4	23.0	60	1954	—32	1959	1180	0.97	0.96	1948	4.5	9.5	1944	3.0	1950+	3	0	14	27	5	Feb.
Mar.	41.7	24.5	33.1	77	1945	—15	1943	990	1.79	1.65	1943	7.1	22.3	1959	8.0	1959	5	0	6	24	1	Mar.
Apr.	58.5	36.5	47.5	87	1942	10	1954	530	2.68	1.56	1951	0.4	3.0	1949	2.0	1949	6	0	*	11	0	Apr.
May	69.1	46.6	57.9	91	1953	27	1943	260	3.18	1.88	1945	0.1	1.0	1945	1.0	1945	7	*	0	2	0	May
June	78.2	57.5	67.9	98	1953	33	1945	80	3.87	3.21	1950	0	0	1945	0		8	3	0	0	0	June
July	83.1	61.5	72.3	98	1955	43	1945	10	3.90	3.52	1952	0	0		0		6	5	0	0	0	July
Aug.	81.9	60.4	71.2	100	1955	39	1950	10	3.37	2.79	1958	0	0		0		6	5	0	0	0	Aug.
Sept.	73.8	51.7	62.8	98	1955+	28	1942	140	3.03	2.55	1947	T	T	1942	T	1942	6	1	0	1	0	Sept.
Oct.	63.6	41.5	52.6	86	1953	18	1952	390	2.02	2.57	1951	0.1	1.0	1952	1.0	1952	4	0	0	6	0	Oct.
Nov.	44.8	28.4	36.6	77	1950	—14	1947	850	2.05	1.77	1952	2.7	11.6	1951	4.0	1951	5	0	5	20	1	Nov.
Dec.	31.9	16.4	24.2	61	1946	—20	1950	1260	1.58	2.20	1942	8.0	19.6	1951	6.0	1959	5	0	15	29	4	Dec.
Year	57.2	37.5	47.4	100	Aug. 1955	—33	Jan. 1951	7100	29.76	3.52	July 1952	32.1	22.3	Mar. 1959	8.0	Mar. 1959	64	14	58	150	19	Year

(a) Average length of record, years
T Trace, an amount too small to measure
** Base 65°F. H.C.S. Thom, Monthly *Weather Review*, January 1954
\+ Also on earlier dates, months, or years
* Less than one-half
[1] U.S. Department of Commerce, Weather Bureau in cooperation with the Wisconsin Crop Reporting Service. Climatography of the United States N. 20-47

PRE-SETTLEMENT DISTRIBUTION OF PLANT COMMUNITIES JEFFERSON COUNTY, WISCONSIN

Adapted from Zicker, 1955

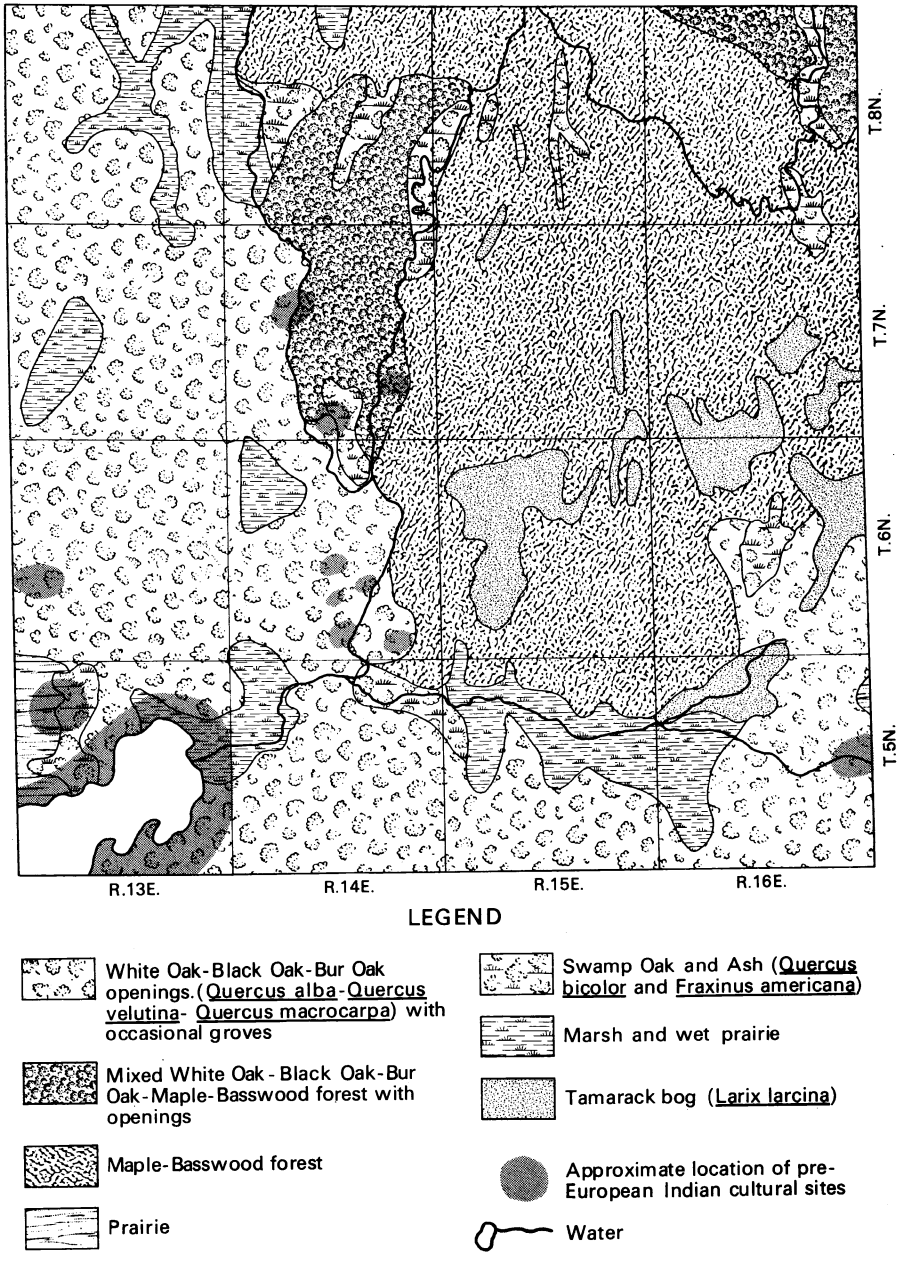


Figure 21. Presettlement distribution of plant communities, Jefferson County, Wisconsin.

Plants and Animals

The presettlement plant communities in Jefferson County (Figure 21, after Zicker, 1955) included a large body of maple-basswood *(Acer saccharum, Tilia americana)* forest in the northeast, and white oak-black oak-bur oak *(Quercus alba, Q. velutina, Q. macrocarpa)* open woodland to the south and west. The two major plant communities were interrupted by three kinds of wetland communities: tamarack bog *(Larix larcina)*, marsh and wet prairie, and swamp oak-ash *(Quercus bicolor, Fraxinus americana)*. In addition to small prairie stands in the numerous oak openings (Figure 23), two larger bodies of upland

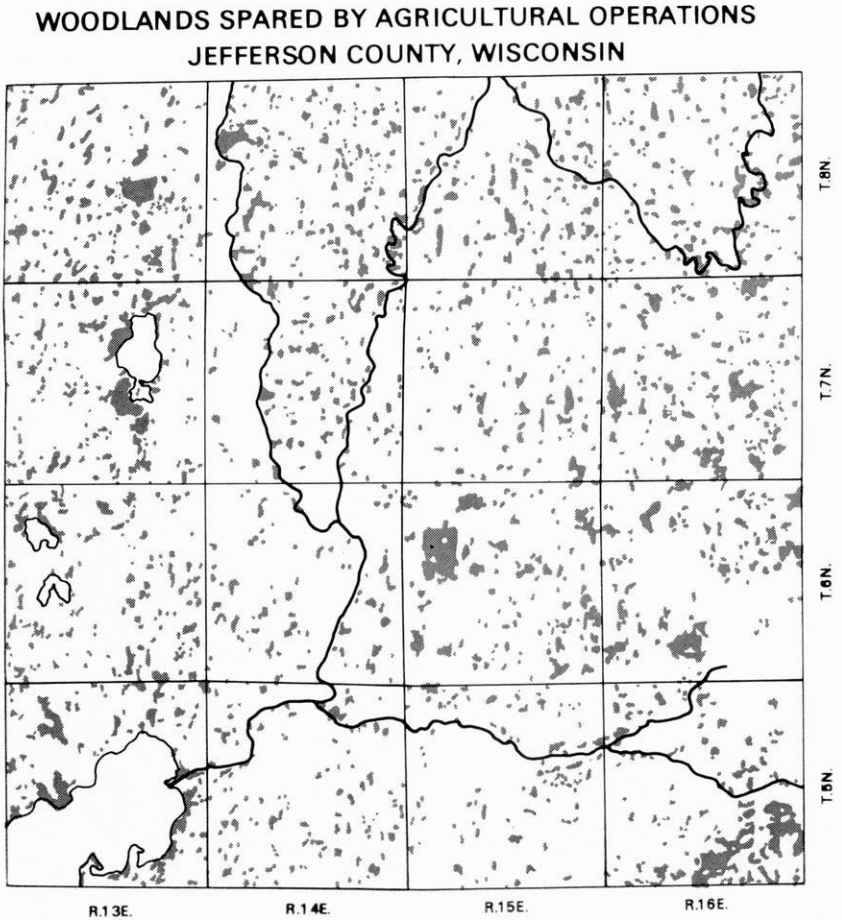


Figure 22. Distribution of woodlands.

prairie were present, judging by current soil profiles. Most presettlement cultural sites of American Indians are associated with the upland oak forest. This suggests that the Indians repeatedly set fires in southern and western townships where oaks and prairie survived the burning and where grazing by buffalo and deer must have continued. The Faville Prairie is a scientific area of 60 acres located four miles northeast of Lake Mills and is one of the largest existing remnants of unplowed prairie in Wisconsin.

To a considerable extent, the maple-basswood forest was protected from fire by barriers consisting of portions of the Rock River (Figure 18) and linear wetlands (see Soil Map). But some fire damage took place even in the maple-basswood community, judging by the recently increasing importance of sugar maple at the expense of red and white oak, butternut, slippery elm, and ironwood in six forest stands studied by K. T. Harper (1963) (Figure 22). Greater abundance in eastern townships of tip-up mounds ("cradle-knolls"; Milfred, *et al.*, 1967) caused by blowdown of trees in wind storms indicates that forest occupancy has lasted for many centuries.

The capacity of maple-basswood forest to cycle calcium and magnesium from soil to leaves and back to surface soil is greater than that of oak forest (Harper, 1963; Baxter, in Milfred, *et al.*, 1967; Baxter, 1969). This is indicated by data in Table 6. The presence of calcium stimulates biologic activity in the surface soil, which has a higher available nitrogen content under basswood and maple trees than under oak.

Activity of soil animals, notably earthworms in woodlands and ants in grasslands and sedgelands, has been important in mixing organic

Figure 23. Open grown oak trees on slopes of a drumlin in western Jefferson County, Wisconsin.

TABLE 6. REACTION AND NUTRIENT CONTENT OF SURFACE SOILS IN SELECTED STANDS OF MAPLE AND OAK TREES, JEFFERSON COUNTY, WISCONSIN*

Soil depth	pH		AVAILABLE NUTRIENTS, POUNDS PER ACRE (PARTS PER 2 MILLION)									
			Calcium		Magnesium		Potassium		Phosphorus		Nitrogen (in NO_3, NH_3)	
	Maple	Oak	Maple	Oak	Maple	Oak	Maple	Oak	Maple	Oak	Maple	Oak
0"-3"	6.2	5.5	4800	2500	640	620	160	170	70	60	56	30
3"-6"	5.8	5.0	2800	1400	460	475	116	118	50	55	30	26
0"-6"	6.0	5.2	3800	1900	550	550	140	140	60	57	44	28

*Adapted from a report by Harker (1963).

matter and mineral soil. By bringing up subsoil and depositing it on the surface in the form of "chimneys," crayfish have promoted porosity of mineral soils of wetlands. Activity of rodents and other burrowing mammals in soil has been greatest on well-drained sites, where these animals have brought sandy and gravelly material to the surface.

Man

Human beings have been responsible for a variety of disturbances of natural ecosystems (Bidwell and Hole, 1965), as already illustrated by the supposed fire-setting by American Indians and their building of mounds and erection of a stockade. Important changes in soils of Jefferson County have been initiated by settlers and their successors during the last 150 years: clearing, drainage, cultivation, use of fertilizers and other agricultural chemicals, accelerated erosion (Figure 24), and soil compaction. Land forming and earth moving in construction areas and filling of lowlands with waste are notable near cities. The natural vegetation and fauna have been replaced over most of the county by agricultural crops and livestock. Practices of dairy farming, which replaced the early wheat and livestock farming, have systematically returned plant nutrients and organic matter to the soil. Considerable progress has been made overall in good land use management since the County Soil and Water Conservation District started operations in 1947. It cannot be said, however, that people have done enough to adjust their activities to conserve and maintain soil and water resources of the area. For example modern mechanized canning crop production is currently accelerating soil and water losses from fields where the previously installed conservation practices are being abandoned.

Figure 24. Evidence of soil erosion of the Lapeer loam on a hillslope consists of exposed yellowish-brown B horizon (dark band on hill) circled by a band of darker soil (Ap horizon darkened by former Al horizon). The planting of corn up and down slope, as in this field, is contrary to accepted erosion control practices.

Effects of These Factors on a Typical Soil Catena

The factors of soil formation just discussed have affected landscapes of Jefferson County over a period of many thousands of years to produce the soils that support us today. Although the processes of incorporation of organic matter and leaching of carbonates have made many soils acid, soils are, for the most part, well supplied with plant nutrients[3] and are underlain by materials naturally high in content of lime.

A sequence or chain of soils from a hilltop to low ground nearby is called by the Latin word for chain, "catena". An example is the Dodge soil catena (Ciolkosz, 1967), which consists of the Dodge silt loam (pp. 81-82) on well-drained upper slopes, the somewhat poorly drained Lamartine silt loam (Figure 7 and pp. 94-95- on footslopes, and the poorly drained Pella silt loam and silty clay loam (Figure 7 and pp. 108-109) in depressions. All three soils have developed from two calcareous (limy) materials: 2 to 3 feet of loess over sandy loam glacial till. The till was deposited about 14,000 years ago and the loess somewhat later.

In the thousands of years during which these soils have been developing, the following changes, among others, have taken place: (1) lime has been leached from the upper soil horizons; (2) some iron has oxidized and has given the soil its brownish color; (3) organic matter has accumulated and made the surface soils dark, and helped mobilize some iron, contributing to the bluish-gray color of some subsoil; (4) clay has been moved by percolating water from the surface soil to the subsoil; (5) vegetation has cycled plant nutrients, producing a concentration of them in the topsoil; (6) runoff waters from upland soils have carried fine silt, clay, organic materials, and nutrients to lower lying soils in the depressions. Data in Tables 9 and 10 (pp. 148, 152) may be interpreted to support these statements.

Leaching of lime. Percolating rainwater over the millenia has leached carbonates out of the upper soil layers. Four of the factors influencing the leaching process are: (a) amount of water delivered to the soil surface, (b) amount of water percolating through the soil profile, (c) degree of acidity of the percolating water, and (d) seasonal upward movement of the water table in the soil, bringing bicarbonates close to the surface to counteract the leaching effected by natural weak acids. Concerning the first factor, we observe that, because of additions of runoff, the largest amount of water is delivered to the surface of the lowest-lying soil. This is the poorly drained Pella

[3] See Footnote on page 68.

silty clay loam at a forest site studied by Ciolkosz (1967). This soil is leached 22 inches. The somewhat higher-lying Lamartine silt loam is leached only 13 inches. The second factor seems to be most important in the upland soil — the well-drained Dodge silt loam — which is leached 35 inches. The presence of a clay pan in the Lamartine silt loam tends to limit percolation in that soil more than in the other two. Runoff waters, particularly that seeping out of the C horizon, are known to carry bicarbonates from the uplands to the lowlands in this region. We conclude that the third factor reduces the amount of leaching in the lower-lying soils. The fourth factor is most important in the Pella silty clay loam and to a lesser extent in the Lamartine soil (see Figure 7).

Oxidation of iron. Iron oxides provide pigments that give yellowish- and reddish-brown colors to soils. The subsoil (B horizon) of the well-drained Dodge silt loam is rather uniformly brown throughout because of free access of oxygen to the soil in dry seasons. In contrast, the subsoil of the Lamartine silt loam is mottled with patches of dark brown, yellowish-brown and gray, and the subsoil of the Pella silty clay loam is olive-gray with reddish-brown mottles. In these two wetter soils, conditions for oxidation occur less frequently than in the Dodge soil. Abundant organic compounds from the Al horizon favor the movement of iron compounds, which are in part leached away, leaving the soil gray, particularly in the A3g horizon of the Pella soil, and in part concentrated in brown mottles and small gravel-like iron concretions.

Accumulation of organic matter. Organic matter, the second major pigment in soils, provides the dark color in the surface soil and leaches down, darkening the iron stained clay films along cracks in the subsoil. The somewhat poorly drained Lamartine has about 1.3 times as much organic matter in a 6-foot depth as does the well-drained Dodge soil. This is probably because vegetation is more productive of humus at the better-watered Lamartine site, and because oxidation of organic matter is slower at this somewhat wet site. The poorly drained Pella soil profile contains about three times as much organic matter as the Dodge soil and twice that of the Lamartine. The Pella site is probably not so favorable to organic matter production as the Lamartine site, but is characterized by a slower rate of oxidation of the organic matter because of persistence of a high water table for considerable periods. The dark Al horizon thickens down-catena. The Al horizon of the Lamartine contains nearly twice as much organic matter as does that of the Dodge soil, and the Al of the Pella, five times as much as the Dodge. A slight accumulation of organic matter in the B22 horizon of the Lamartine is yet to be explained. The olive to bluish-gray color

of the subsoils at the two wetter sites is essentially the natural color of mineral particles, largely quartz, very slightly stained with organic matter or ferrous sulphide.

Downward movement of clay. Clay has been moved by percolating water out of the A1 and A2 horizons into the B horizon, particularly the B2 horizon in the Dodge and Lamartine soils, and into the A3 horizon in the Pella. In the first two soils, there is more than one-and-a-half times as much clay in most subsoil horizons than in the A horizon. The total volume of clay in the B horizon is several times that of the thinner surface soil in all three members of this catena. A significant proportion of this clay may have been deposited first on the ground surface by wind throughout the formation of the landscape (Borchardt, *et al.*, 1968). Depth to the horizon of greatest clay accumulation increases up-catena from 7 inches in the Elba to 25 inches in the Dodge soil. Some clay occurs as coatings on the walls of cracks in the B horizons of the Dodge and Lamartine soils.

Cycling of plant nutrients. Of the nutrients available to plants, exchangeable calcium is the most abundant (Tables 6, 10 and 11) and has been accumulated in the A1 horizon by a renewing supply from leaf litter and fine root decay that exceeds losses by leaching and plant feeding. The A1 horizons contain about twice the exchangeable calcium level as the subjacent horizons.

Action of runoff waters. Because of runoff of rainwater the Lamartine receives more water than does the Dodge, and the Pella more than the Lamartine. This probably explains, to a considerable extent, the down-catena increases in degree of base saturation and contents of clay and exchangeable magnesium in the A horizon. The abundance of small black manganese oxide concretions in the Pella profile may result from the increased solubility under reducing conditions of some compounds of manganese, and their precipitation in less soluble forms during cycles of wetting and drying. Ciolkosz (1967) found evidence for the lateral seepage from the Dodge soil into the Lamartine and Pella soils of water carrying enough dissolved silicon, aluminum, and magnesium to promote synthesis of montmorillonite clay, particularly in the Pella soil profile.

Although the free water, called soil solution[3], contains only small amounts of dissolved materials and these vary from season to season, it plays an important but little understood role in soil genesis. Ciolkosz (1967) concluded from his study of the soil solution in this catena that weathering in Dodge soil releases silicon, sodium, potassium, calcium, and magnesium at a faster rate than in the other less well-drained members of the catena. Seasonal rise of water table through the dolomitic glacial till in the Pella soil accounts for the high content of calcium and magnesium in the soil solution of this soil. Phytocycling brings up nutrients from subsoil to the surface in all three soils. Release of nutrients by decomposition of organic matter and by weathering of mineral particles during the late autumn, winter, and early spring recharges the soil solution with dissolved substances. Plants rapidly take up nutrients from the soil solution during the early part of the growing season. Dessication of the soil during the later part of the growing season results in an increase in content of soluble mineral matter in the soil solution.

[3] The amounts of plant nutrients in the soil solution in an acre-furrow slice of soil (2 million pounds, dry-weight) vary from place to place and season to season, but are low in comparison both to exchangeable or available nutrient supplies in the soil and to total nutrient reserves, as indicated by these representative estimates for a loess- and glacial drift-derived soil in Jefferson County:

Element	Total weight per acre-furrow-slice (lbs)	Weight of available elements per acre-furrow slice (lbs)	Representative Weights of dissolved elements in the soil solution in moist soil of an acre-furrow-slice (lbs)
N	3,000	100	20
P	800	60	0.1
K	34,000	200	0.2
Ca	8,000	2,000	2
Mg	6,000	500	1
Na	15,000	25	1
TOTAL	66,800	2,885	24.3

VI. SOIL PROFILE DESCRIPTIONS

Introduction

Each soil listed in the legend (Table 8) of the colored soil map is defined in this chapter on the basis of horizons observed in the vertical cross-section called the soil profile (Figure 25). The soil profile descriptions were made in pits dug to a depth of 3 to 5 feet in representative soil bodies. These descriptions have been arranged in alphabetical order. In many cases, exact locations are given for sites at which observations were made. In others, descriptions are based on observations at several sites.

A soil profile description provides important information for guiding management of land and water resources. The soil description is based on a scientific classification of soils (Thorp and Smith, 1949; Baldwin, *et al.*, 1938; Soil Survey Staff, 1951, 1970, and 1967). Soil Orders, such as Alfisol (Gray-Brown Podzolic) and Mollisol (Brunizem) are specific terms (see Appendix C) used by soil scientists in classifying soils throughout the world. Some soils are briefly defined in footnotes to Table 2. Technical terms used in the soil descriptions are explained in the glossary and in the Soil Survey Manual (Soil Survey Staff, 1951). As more soil research is done in the laboratory and in the field, more complete descriptions and data become available.

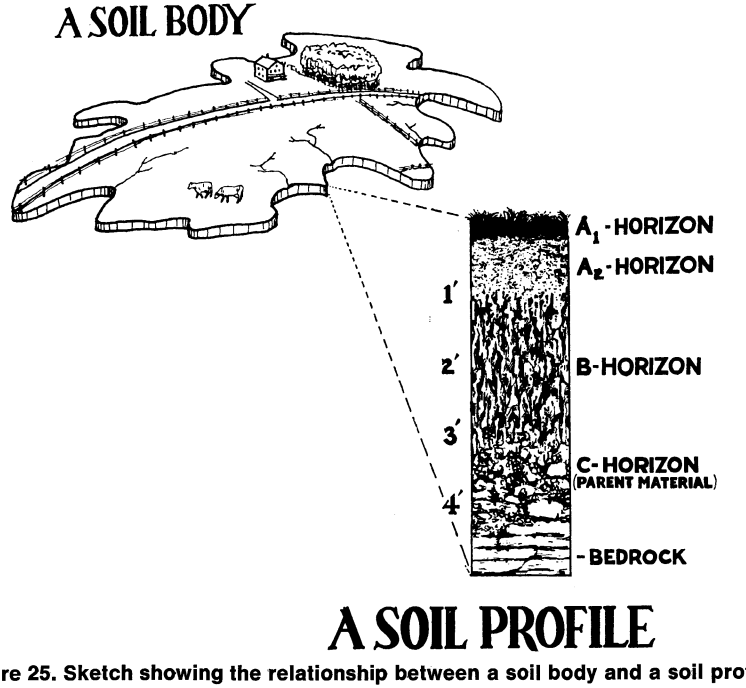


Figure 25. Sketch showing the relationship between a soil body and a soil profile.

Individual Soil Profile Description [4,5,6]

AZTALAN SERIES (Soil Map Unit 17)

General description. The Aztalan series includes somewhat poorly drained loam and silt loam soils formed in about two feet of loamy material over lake-laid silts and clays. These soils are usually found on nearly level, low-lying glacial lake plains.

Detailed description. This series includes somewhat poorly drained soils developed in 18 to 36 inches of loamy glacial outwash or beach deposits over calcareous glacio-lacustrine silts and clays. The original vegetation consisted of wet mesic, prairie species and scattered trees. These soils are classified as Mollisols (Brunizems), Aquic Arguidolls; fine-loamy, mixed, mesic family. The textural subsoil (Bt) begins at about 15 inches in the loamy material and extends down into the glacio-lacustrine substratum, with an average content of 18 to 25% clay. The dark colored surface soil (A1 horizon; mollic epipedon) is about a foot thick and plant roots are plentiful to a depth of 2 feet. Soil types include sandy loam, loam, and silt loam. Slope gradients are usually less than 3%. Associated soils include Mosel, the forest soil equivalent, the well-drained Hebron, and the poorly drained Navan; the loamy surficial material is either absent or less than 18 inches thick on soils of the Saylesville catena; soils of the Sisson and Salter catena are formed in deposits of lacustrine sand and silt. The following description is representative of this series in the county:

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Black (10YR 2/1) loam; weak fine granular and weak very fine subangular blocky structure; friable; many fibrous roots; neutral; abrupt smooth boundary.
A12	7-12	Very dark brown (10YR 2/2) loam; weak fine and medium subangular blocky structure; friable; many fibrous roots; neutral (pH 7.0); clear smooth boundary.
B1	12-16	Dark brown (10YR 4/3) loam with very dark grayish-brown (10YR 3/2) coatings; few fine faint dark yellowish-brown (10YR 4/4), gray (10YR 6/1) and yellowish-brown (10YR 5/8) mottles; moderate fine and medium subangular blocky structure; friable; fibrous roots common; neutral (pH 7.0); clear wavy boundary.
B21t	16-27	Olive-brown (2.5Y 4/4) and dark brown (10YR 4/3) heavy loam; common fine distinct dark yellowish-brown (10YR 4/4), gray (10YR 6/1) and yellowish-brown (10YR 5/6-5/8) mottles; moderate medium subangular blocky structure; firm; fibrous roots common; thin patchy clay films; neutral; abrupt smooth boundary.
IIB22t	27-37	Brown (10YR 5/3) heavy silty clay loam; many fine distinct yellowish-brown (10YR 5/6-5/8) and gray (10YR 6/1) mottles; weak coarse prismatic structure parting to moderate fine and medium subangular and angular blocks; slightly plastic, very firm; few fibrous roots and few fine taproots; thin patchy clay films on ped faces; mildly alkaline (pH 7.5); gradual smooth boundary.
IIB3	37-43	Dark Brown (7.5YR 4/4) and dark yellowish-brown (10YR 4/4) silty clay loam; common to many fine and medium dis-

[4] The color designations used in this chapter are for moist soil unless otherwise indicated.
[5] Type location refers to location of the official series description.
[6] Tentative series names proposed in this publication are: Busseyville, Milford, Waterloo.

		tinct light brownish-gray and yellowish-brown (10YR 6/2, 5/6 and 5/8) mottles; weak coarse prismatic structure parting under pressure to weak medium angular blocks; slightly plastic, very firm; few taproots; gray (5Y 5/1) films on vertical ped faces; mildly alkaline (pH 7.5); gradual wavy boundary.
IIC	43-60	Brown (7.5YR 5/4) and strong brown (7.5YR 5/6) silty clay loam with lenses of silt and silty clay; common medium distinct yellowish-brown and grayish-brown (10YR 5/1, 5/8, and 5/2) mottles; coarse platy structure inherited from laminated parent material, slightly plastic when wet; very firm when dry; streaks of powdery secondary carbonate extend down vertical joints; moderately calcareous.

Type location: Near Whitewater, Walworth County, Wisconsin.
Series proposed: Jefferson County, Wisconsin, 1966.
Source of name: Village of Aztalan, Jefferson County, Wisconsin.

BATAVIA SERIES (Included in Soil Map Unit 1)

General description. The Batavia series (Figure 6) includes well to moderately well drained deep (30 to 50 inches) silty soils under mixed prairie and forest vegetation.

Detailed description. This series includes well to moderately drained soils formed in 30 to 50 inches of silty covering (loess) over calcareous, sandy loam to loam glacial till. The original vegetation was scattered oak *(Quercus macrocarpa; Q. alba)* with a ground cover of prairie species *(Andropogon gerardi* and *A. scoparius* and associated plants). The presence of an A2 horizon is a result of the presence of the trees, and the dark, fairly thick A1 horizon reflects the presence of the prairie vegetation. These soils are classified as Alfisols intergrading to Mollisols (Gray-Brown Podzolic transitional to Brunizems), Mollic Hapludalfs; fine-silty, mixed, mesic family. The textural subsoil (Bt horizon) begins at a depth of about 18 inches and may continue to 5 feet, including part of the underlying glacial drift. This horizon has an average content of 18 to 35% clay and less than 5% sand. The dark A1 or Ap horizon is 6 to 10 inches thick and usually underlain by a somewhat lighter colored subsurface (A2) horizon. Slope gradients are 1 to 12%. Silt loam is the only soil type. Associated soils are members of the St. Charles, Plano and Dodge catenas. The following profile description is representative of this soil in the county:

Horizon	*Depth, Inches*	*Description*
Ap	0-9	Very dark grayish-brown (10YR 3/2) silt loam; weak medium and coarse granular structure; friable; abundant roots; neutral (pH 7.0); abrupt smooth boundary.
A2	9-12	Dark grayish-brown (10YR 4/2) to brown (10YR 5/3) silt loam; weak medium granular structure; firm; plentiful roots; worm casts and channel fillings of very dark grayish-brown (10YR 3/2); light gray (10YR 7/1 to 7/2) silt coatings when dry; neutral (pH 7.0); clear smooth boundary.
B1	12-17	Dark yellowish-brown (10YR 4/4) light silty clay loam; moderate fine subangular blocky structure; firm; plentiful roots; occasional very dark grayish-brown (10YR 3/2) channel fillings; silt coatings on peds are light gray (10YR 7/1 and 7/2) when dry; medium acid (pH 5.8); clear smooth boundary.
B21t	17-25	Dark yellowish-brown (10YR 4/4) silty clay loam; moderate to strong fine subangular blocky structure; firm; plentiful roots; few light gray (10YR 7/1 and 7/2, when dry) silt coatings; few very dark grayish-brown (10YR 3/2) and dark yellowish-brown (10YR 3/4) clay films; medium acid (pH 5.8); clear smooth boundary.

B22t	25-30	Brown (10YR 5/3) silty clay loam; moderate to strong fine and medium subangular blocky structure; firm; few roots; few light gray (10YR 7/1 and 7/2, when dry) silt coatings; moderately thick, continuous dark brown (10YR 4/3) clay films; medium acid (pH 5.8); clear smooth boundary.
B23t	30-45	Brown (10YR 5/3 and 5/3) light silty clay loam with few fine distinct very dark brown (10YR 2/2) and dark brown (7.5YR 4/4) mottles; moderate medium angular and subangular blocky structure; firm; few roots; numerous light gray (10YR 7/1 and 7/2, when dry) silt coatings; medium acid pH 6.0; clear smooth boundary.
IIB3t	45-50	Brown (10YR 5/3) and dark yellowish-brown (10YR 4/4) clay loam with few medium distinct very dark brown (10YR 2/2) and few fine faint pale brown (10YR 6/3) and dark brown (7.5YR 4/4) mottles; weak medium and coarse angular blocky structure; firm; few roots; few light gray (10YR 7/1 and 7/2, when dry) silt coatings; slightly acid (pH 6.3); clear smooth boundary.
IIC	50-60	Light yellowish-brown (10YR 6/4) cobbly sandy loam; massive; firm in place; friable when disturbed; a few faint mottles; calcareous (pH 8.4).

Type location: Stephenson County, Illinois (NW¼, NW¼, NE¼, NW¼, Sec. 8, T, 26 N., R. 8E.).
Series established: Kendall County, Illinois, 1941.
Source of name: Name of village in Kane County, Illinois.

BOYER SERIES (Soil Map Unit 10)

General description. The Boyer series includes droughty sandy and loamy soils 20 to 40 inches deep over calcareous glacial outwash.
Detailed description. This series includes well to excessively drained soils formed in 20 to 40 inches of loamy materials over calcarous glacial outwash with some gravel. The original vegetation was deciduous forest (oak, hickory, maple: *(Quercus, Carya, Acer).* These soils are classified as Alfisols (Gray-Brown Podzolics), Typic Hapludalfs; coarse-loamy, mixed mesic family. The textural subsoil (Bt horizon) begins at a depth of about a foot and continues down to 30 or 36 inches, with an average content of less than 18% clay and between 15 to 70-85% sand. A part of the Bt may be a sandy clay loam with up to 22% clay, but this finer textured portion is not more than 10 inches thick. Tongues of the Bt horizon may extend as much as a foot down into the underlying outwash or C horizon. Above the Bt is a sequence of thin dark A1, paler A2, and brown B1 horizons. Slope gradients range from 0 to 12% or even as steep as 40%. Soil types include loamy sands and sandy loams. Among associated soils are the deeper Oshtemo, the somewhat poorly drained Wasepi and Gilford, Spinks, and Lapeer soils. The following soil profile, typical of the series in Jefferson County, was made in the S.W. ¼, S.W. ¼ of Sec. 36, T. 6N., R. 13E on a 5% slope on a rolling outwash deposit adjacent to a drumlin.

Horizon	*Depth, Inches*	*Description*
A1	0-4	Very dark grayish-brown (10YR 3/2) sandy loam; very weak coarse granular to fine subangular blocky structure; very friable; mildly alkaline (pH 7.5); clear smooth boundary.
A2	4-7	Brown (7.5YR 5/4) and dark gray (10YR 4/1) loamy sand; very weak, medium subangular blocky structure; friable; mildly alkaline (pH 7.5); clear smooth boundary.

B21t	7-11	Brown to dark brown (7.5YR 4/4) sandy loam; weak medium angular blocky structure; friable; mildly alkaline (pH 7.5); clear smooth boundary.
B22t	11-17	Brown to dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; mildly alkaline (pH 7.5); clear smooth boundary.
B23t	17-22	Brown to dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; mildly alkaline (pH 7.5); clear smooth boundary.
B3	22-28	Brown to dark brown (7.5YR 4/4) loamy sand; very weak, medium to coarse subangular blocky structure; friable; mildly alkaline (pH 7.8); abrupt smooth boundary.
C	28	Light yellowish-brown (10YR 6/4) stratified medium and find sands; massive; loose; calcareous sandy outwash.

Type location: Clinton County, Michigan (S.E.¼, N.E.¼, N.E.¼ Sec. 6. T. 5N R. 1W).

Series established: Berrien County, Michigan, 1938.

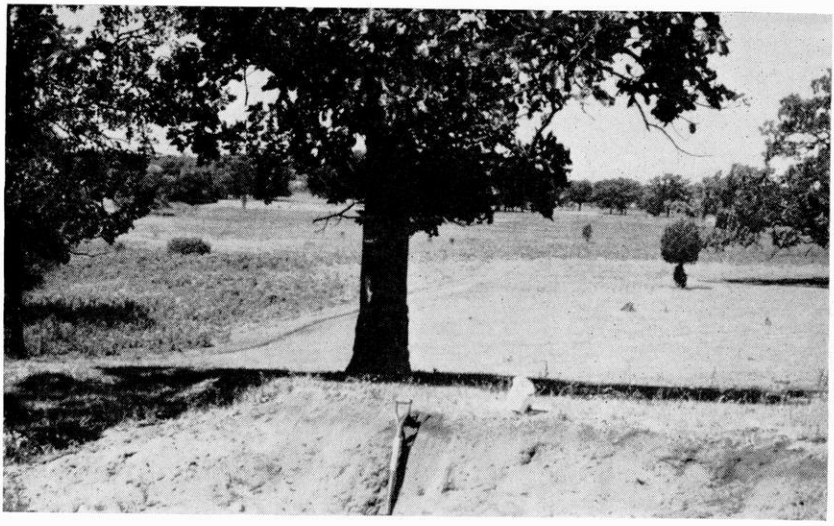
Source of name: Name of a school in Berrien County, Michigan.

BRADY SERIES (Soil Map Unit 12h)

General description. The Brady series includes somewhat poorly drained, deep, sandy loams overlying stratified calcareous sand and gravel at depths of 40 to 60 inches.

Detailed description. This series includes somewhat poorly drained soils formed in 40 to 60 inches of sandy loam materials overlying calcareous sandy outwash with some gravel. The original vegetation was deciduous forest (elm, ash, maple, oak, hickory; *Ulmus, Fraxinus, Acer, Quercus, Carya*). These soils are classified as Alfisols transitional to Mollisols (Gray-Brown Podzolics with a dark surface due to restricted drainage), Aquollic Hapludalfs; coarse-loamy, mixed, mesic family. The textural subsoil (Bt) begins at a depth of about 18 inches and continues downward to about 40 inches, with a subhorizon no more clayey than a sandy clay loam and that for less than 10 inches in thickness. The Bt horizon contains an average of less than 18% clay, and between 15 to 75-80% sand. Tongues of this horizon often extend down into the 11C horizon several inches. Slope gradients range from 0 to 6%. Surface textures include loamy sand, sandy loam, and loam. Among associated soils are the better-drained Oshtemo, more poorly drained Gilford, and the shallower Boyer and Wasepi soils; and the Fox and Lapeer soils. The following soil profile description is representative of this series.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Very dark gray (10YR 3/1) sandy loam; weak medium granular structure; very friable; numerous roots; slightly acid (pH 6.4); abrupt smooth boundary.
A2	8-11	Grayish-brown (10YR 5/2) loamy sand; weak coarse granular structure; very friable; numerous roots; medium acid (pH 5.8); clear smooth boundary.
B1	11-20	Brown (10YR 5/3) sandy loam, with common fine distinct yellowish brown (10YR 5/8) and light brownish-gray (10YR 6/2) mottles; weak fine subangular blocky structure; friable; numerous roots; about 2 percent gravel; strongly acid (pH 5.3); clear wavy boundary.



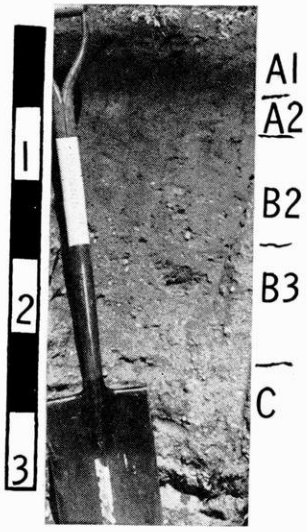


Figure 26. Boyer sandy loam — (above) View toward a wetland across a sand pit dug in Boyer sandy loam. Boyer sandy loam (left) developed in calcareous sand and gravel outwash with A and B horizons totaling 27 inches in thickness. Some clay has accumulated in the B.

B2t	20-36	Brown (7.5YR 4/4) heavy sandy loam, with common medium distinct light brownish-gray (10YR 6/2) mottles; weak coarse subangular blocky structure; slightly firm when moist, slightly sticky when wet; many fine roots; about 2 percent gravel; thin clay films on peds faces and in voids; strongly acid (pH 5.3); gradual wavy boundary.
B3g	36-53	Grayish brown (10YR 5/2) heavy loamy sand, with common medium distinct yellowish brown (10YR 5/8) mottles; very weak coarse subangular blocky structure; very friable; few fine roots; about 3 percent fine gravel; medium acid (pH 5.8); abrupt irregular boundary.
IIC	53-60	Grayish-brown (10YR 5/2) stratified sand and fine gravel; single grain; loose; calcareous outwash.

Type location: Branch County, Michigan (S.W.¼, S.W.¼, Sec. 15, T.7S., R.8W).
Series established: Van Buren County, Michigan, 1922.
Source of name: Name of a township in Kalamazoo County, Michigan.

BROOKSTON SERIES (Soil Map Unit 6)

General description. The Brookston series includes poorly drained silt loams and silty clay loams over loam glacial till that is calcareous at about 3 feet.
Detailed description. This series includes poorly drained soils formed in as much as 20 inches of silty material over the calcareous loam till. The carbonates have been leached from these soils to a depth of about 3 feet. The original vegetation was either lowland deciduous forest (elm, ash, maple; *Ulmus, Fraxinus, Acer*) or wet prairie species *(Andropogon, Calamagrostis, Spartina).* These soils are classified as wet Mollisols, Humic Gley soils: Typic Argiaquoll; fine-loamy, mixed, noncalcareous, mesic family. The textural subsoil (Btg) begins at a depth of about a foot and continues 2 feet. It is a bluish-gray somewhat mottled horizon which underlies a nearly black surface (A1) horizon about a foot thick. The Bt has an average content of 18 to 35% clay and less than 15% sand. The content of organic matter in the A1 horizon is about 10%, ranging from as much as 20% at the surface to 2% at the bottom. Slope gradients are less than 2%. Soil types include loam, silt loam, and silty clay loam. Associated soils are members of the Dodge catena: Dodge, Lamartine, Kokomo, and the dark equivalent of Lamartine called Lisbon. The following profile description is representative of this series.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Very dark gray (10YR 3/1) light silty clay loam; weak coarse granular structure; firm; cloddy when dry; many fine roots; neutral (pH 7.0); abrupt smooth boundary.
A12	8-14	Very dark gray (10YR 3/1) silty clay loam; common fine faint dark yellowish-brown (10YR 4/4) and dark gray (10YR 4/1) mottles; weak coarse subangular blocky breaking to moderate medium granular structure; friable; many roots; neutral (pH 7.0); clear wavy boundary.
B1tg	14-20	Dark gray (10YR 4/1) silty clay loam common fine faint dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure; firm; few fine roots; very dark gray (10YR 3/1) and gray (10YR 5/1) thin discontinuous clay films on ped faces and lining pores; neutral (pH 7.0); clear wavy boundary.
IIB21tg	20-31	Gray (N 5/0) clay loam, common fine distinct dark brown (10YR 4/3) and yellowish-brown (10YR 5/4 mottles; moderate medium subangular blocky structure; firm; very dark grayish-brown (10YR 3/2) filled root channels; very dark

		brown (10YR 2/2) silty clay loam material in old crayfish channels; dark gray (10YR 4/1) clay films on most peds and a few pores; neutral, (pH 7.0); gradual wavy boundary.
IIB22tg	31-40	Gray (10YR 5/1) clay loam, many medium distinct yellowish-brown (10YR 5/4 and 5/8) and dark yellowish-brown (10YR 4/4) mottles; moderate coarse subangular blocky structure; firm; few roots in upper part; very dark gray (10YR 3/1) thin discontinuous clay films on ped faces; many pebbles; neutral (pH 7.0); clear irregular boundary.
IIB3	40-46	Yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) clay loam, common medium distinct gray (10YR 4/1) mottles; weak coarse subangular blocky structure; firm; small irregular pockets of loamy material; many pebbles; neutral (pH 7.0); clear irregular boundary.
IIC	46-66	Brown (10YR 5/3) loam; massive; friable; dark yellowish-brown (10YR 4/4) and brown (7.5YR 5/4) thin clay films along old root channels and worm holes; fingers of gray (10YR 5/1) and very dark gray (10YR 3/1) silty clay loam as fillings and linings of old krotovinas; moderately alkaline; calcareous.

Type location: Howard County, Indiana S.W.¼, N.E.¼, Sec. 5, T.23N., R.4E.)
Series established: Name of village in White County, Indiana.
Source of name: Howard County, Indiana (S.W.¼, N.E.¼, Sec. 5, 2.23N.,

BUSSEYVILLE SERIES (Soil Map Unit 12g)

General description. The Busseyville series includes deep, somewhat poorly drained silty soils 3 to 4 feet deep over calcareous stratified sand and gravel.
Detailed description. This series includes somewhat poorly drained soils formed in 30 to 50 inches of silty material overlying calcareous outwash sand and gravel. The original vegetation was deciduous forest (elm, ash, maple, oak; *Ulmus, Fraxinus, Acer, Quercus).* The soils are classified as Alfisols (Grey-Brown Podzolics). Aeric Ochraqualfs; fine-silty, over sandy or sandy skeletal, mixed, mesic family. The faintly mottled textural subsoil (Bt) begins at a depth of about a foot and continues down to 4 or 5 feet. This horizon has an average content of 18 to 35% clay and more than 15% sand. The Bt extends downward into the underlying outwash. The horizon sequence above the Bt consists of a dark surface (A1) horizon, paler A2 horizon and brown B1 horizon. Slope gradients range from 1 to 6%. Associated soils include the other members of the catena, Waterloo and Milford soils, and members of the St. Charles and Fox catenas. The following soil profile description is representative of the series.

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Dark grayish-brown (10YR 4/2) silt loam; weak medium granular structure; friable; abundant roots; neutral (pH 7.0); abrupt smooth boundary.
A2	7-11	Grayish-brown (10YR 5/2) silt loam; moderate fine and medium granular structure; friable; plentiful roots; slightly acid to neutral (pH 6.5); clear smooth boundary.
B1	11-14	Brown (10YR 5/3) light silty clay loam; moderate fine subangular blocky structure; firm; plentiful roots; slightly acid; clear smooth boundary.
B21t	14-25	Grayish-brown (10YR 5/2) silty clay loam with common fine faint brown (10YR 5/3) mottles; moderate fine and medium subangular blocky structure with moderately thick continuous dark brown (10YR 4/3) clay films; few roots; few iron-

		manganese concretions; strongly acid (pH 5.3); clear smooth boundary.
B22t	25-41	Grayish-brown (2.5Y 5/2) silty clay loam with common medium distinct yellowish-brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure with moderately thick dark grayish-brown (10YR 4/2) clay films; firm; few roots; few iron-manganese concretions; medium acid (pH 5.8) clear smooth boundary.
B31	41-51	Mixed yellowish-brown (10YR 5/6) and gray (5Y 5/1) light silty clay loam; weak coarse subangular blocky structure with thin discontinuous gray (10YR 5/1) clay films; firm; few roots; few iron-manganese concretions; slightly acid (pH 6.4); clear smooth boundary.
IIB32	51-58	Mixed brown (7.5Y 5/6), yellowish-brown (10YR 5/6), and gray (5Y 5/1) loam to sandy loam with some fine gravel; weak coarse subangular blocky structure; friable; neutral (pH 7.0); abrupt, irregular boundary.
IIC	58-65	Grayish-brown (10YR 5/2), stratified sand and gravel; loose; calcareous.
Type location:		Jefferson County, Wisconsin.
Series proposed:		Jefferson County, Wisconsin, 1969.
Source of name:		Name of village, Jefferson County, Wisconsin.

CAMDEN SERIES (Soil Map Unit 16)

General description. The Camden series includes silty soils over stratified silts and sands that are calcareous below about 40 inches.

Detailed description. This series includes well-drained soils formed in 24 to 36 inches of silty covering over stratified deposits of calcareous sandy outwash and glacio-lacustrine fine sands and silts. The soils have been leached of carbonates to a depth of about 40 inches. The original vegetation was deciduous forest (oak, hickory, maple; *Quercus, Carya, Acer*). The soils are classified as Alfisols (Gray-Brown Podzolics), Typic Hapludalfs; fine-silty, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of about a foot and continues down to 3 or 4 feet. This horizon has an average content of 18 to 35% clay and less than 15% sand. Above the Bt horizon is a sequence of dark surface (A1) horizon and paler A2 horizon. Carbonates are present below 40 to 60 inches. Slope gradients are usually between 1 and 12%. Associated soils are members of the Sisson, Salter, and Waterloo catenas. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
A1	0-4	Very dark grayish-brown (10YR 3/2) silt loam; moderate fine and medium granular structure; friable; medium acid (pH 5.8); clear smooth boundary.
A21	4-10	Yellowish-brown (10YR 5/4) silt loam; moderate very fine to fine platy structure; friable; strongly acid (pH 5.3); clear smooth boundary.
A22	10-13	Yellowish-brown (10YR 5/4) silt loam; weak very fine subangular blocky structure; friable; strongly acid (pH 5.3); gradual smooth boundary.
B1t	13-17	Yellowish-brown (10YR 5/6) heavy silt loam; moderate fine subangular blocky structure; firm; continuous brown (10YR 4/3) clay films; medium acid (pH 6.0); clear smooth boundary.
B21t	17-27	Strong brown (7.5YR 5/6) silty clay loam; moderate fine and medium subangular blocky structure; firm; continuous brown (10YR 4/3) clay films; medium acid (pH 6.0); clear smooth boundary.

IIB22t	27-32	Brown (7.5YR 5/4) clay loam; moderate medium subangular blocky structure; firm; continuous dark brown (7.5YR 5/4) clay films; many sand grains; medium acid (pH 6.0); clear smooth boundary.
IIB31t	32-36	Brown (7.5YR 5/4) light clay loam; weak medium subangular blocky structure; firm; thin continuous dark brown (7.5YR 4/3) clay films; slightly acid (pH 6.4); clear wavy boundary.
IIB32t	36-55	Dark brown (7.5YR 4/4) sandy loam, fine gravel in lower part; weak coarse subangular blocky structure; friable; discontinuous dark brown (7.5YR 4/3) clay films; neutral (pH 7.0); clear wavy boundary.
IIC	55-60	Brown (10YR 4/3) stratified gravelly light sandy loam and loamy fine sand; massive; friable; neutral to calcareous.

Type location: Champaign County, Illinois (SE¼, SW¼, Sec. 21, T22N, R8E.)
Series established: Schuyler County, Illinois, 1930.
Source of name: Name of village in Schuyler County, Illinois.

CASCO SERIES (Soil Map Unit 9)

General description. The Casco series includes naturally well-drained, droughty, loamy soils developed under oak-hickory forest vegetation and shallow over limy sand and gravel.

Detailed description. This series includes naturally well-drained soils formed in 12 to 20 inches of sandy loam to silty material over calcareous glacial outwash sand and gravel. A sandy clay loam to clay loam textural B horizon (Bt) is present. Original vegetation was deciduous oak-hickory *(Quercus-Carya)* forest. These soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalf; fine-loamy over sandy or sandy skeletal, mixed mesic. The textural subsoil (Bt) begins at a depth of about 8 inches and continues downward to about 20 inches, with some tongues extending deeper into the underlying glacial outwash. The Bt contains an average of 18% to 35% clay and more than 15% sand. Dark clay films (cutans) are present on ped surfaces and in pores. Above the B horizon is a thin dark A1 and underlying paler A2 horizon, or, in plowed fields, a dark grayish-brown Ap, not dark enough to indicate a Brunizem (Argiudoll). Slope gradients range up to 45%. Soil types include sandy loams, loams and a few silt loams. Associated soils are Lorenzo, Fabius, Rodman, Oshtemo and Boyer. The following soil profile was observed on an undulating outwash plain in the NE¼, NW¼, Sec. 5, T7N, R14E, Jefferson County, Wisconsin. Analytical data are presented in Tables 9 and 11.

Horizon	*Depth, Inches*	*Description*
Ap	0-6	Very dark brown to very dark grayish-brown (10YR 2/2-3/2) loam; weak medium to fine granular structure; friable; slightly acid (pH 6.5); clear, smooth boundary.
B1t	6-11	Brown (10YR 4/3) light clay loam, with a few dark brown (10YR 3/3) coatings; channel fillings of Ap material are numerous; moderate medium subangular blocky structure; friable; neutral (p 7.0); clear, smooth buondary.
B21t	11-15	Dark brown (7.5YR 3/2) sandy clay loam with some very dark gray (10YR 3/1) coatings; moderate medium subangular blocky structure; friable; moderately alkaline (pH 8.0); clear smooth boundary.
B22t	15-17	Dark brown (7.5YR 3/2) to very dark grayish-brown (10YR 3/2) sandy clay loam; moderate medium subangular blocky structure; friable to firm; moderately alkaline (pH 8.0); clear, smooth boundary.

B3t	17-20	Dark brown (7.5YR 3/2) sandy clay loam, broken dolomite stones are light gray (10YR 7/2); massive; friable; many weathered dolomite stones present; moderately alkaline soil between coarse fragments of dolomitic; abrupt wavy boundary.
IIC	20-25	Brown (10YR 5/3) stratified loamy sand and gravel; loose; calcareous.

Type location: Sheboygan County, Wisconsin (SE cor., SE¼, Sec. 6, T14N, R20E).

Series established: Fairfield County, Ohio, 1956.

Source of name: Name of village in Kewaunee County, Wisconsin.

COLWOOD SERIES (Soil Map Unit 22)

General description. The Colwood series includes poorly drained soils developed in lowlands from calcareous silts and fine sands with loamy coverings in places. *Detailed description.* This series includes poorly and very poorly drained soils formed in calcareous stratified glacio-lacustrine silts and fine sands. These soils have been leached of carbonates to a depth of 36 to 40 inches. The original vegetation was lowland forest (maple, elm, cottonwood, alder; *Acer, Ulmus, Populus, Alnus*) with a ground cover of wet prairie species. The soils are classified as wet Mollisols (Humic Gley soils): Typic Haplaquoll; fine-loamy, mixed, non-calcareous, mesic family. The mottled textural subsoil (Btg) begins at a depth of about a foot and continues downward another foot or two, with an average content of 18 to 35% clay, and more than 15% sand. Above this horizon is a very dark brown Al (or Ap). Slope gradients are usually less than 2%. Soil types include silt loam, very fine sandy loam, and loam. A few inches of muck may be present on the surface. Associated soils are Keowns, Navan, and Montgomery series. The following soil profile description is representative.

Horizon	*Inches Depth,*	*Description*
Ap	0-9	Very dark brown (10YR 2/2) silt loam; moderate medium granular structure; friable; numerous roots; neutral (pH 7.0); abrupt smooth boundary.
A12	9-12	Very dark brown (10YR 2/2) light silt loam; moderate coarse granular structure; friable; numerous roots; neutral (pH 7.0); gradual wavy buondary.
IIB21tg	12-18	Light brownish-gray (10YR 6/2) heavy loam, with few coarse distinct yellowish-brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; coatings of very dark brown (10YR 2/2) on peds in upper part of horizon; numerous roots; neutral, (pH 7.0); gradual wavy boundary.
IIB22tg	18-36	Light brownish-gray (10YR 6/2) light silty clay loam, with thin strata of fine sandy loam; many coarse distinct yellowish-brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; many roots; few thin clay films; mildly alkaline (pH 7.5); abrupt wavy boundary.
IIIVCg	36-48	Gray (10YR 5/1) stratified silt, fine sand, and very fine sand; common medium distinct yellowish-brown (10YR 5/8) mottles; massive to single grain; friable to loose; few fine roots; calcareous.

Type location: Lapeer County, Michigan (SE¼, NW¼, NW¼, Sec. 34, T10N, R12E.).

Series established: Tuscola County, Michigan, 1926.

Source of name: Name of village in Tuscola County, Michigan.

DEL REY (Soil Map Unit 18)

General description. The Del Rey series includes somewhat poorly drained soils formed in lowlands from calcareous lake-laid silts and clays with thin, loamy coverings locally.

Detailed description. The series includes somewhat poorly drained soils formed in stratified calcareous glacio-lacustrine silts and clays with a cover of up to 18 inches of sandy material. These materials have been leached of carbonates to a depth of about 30 inches. Original vegetation was lowland deciduous forest (elm, maple, ash, alder; *Ulmus, Acer, Fraxinus, Alnus).* These soils are classified as Alfisols (Gray-Brown Podzolics): Aeric Ochraqualfs; fine, illitic, mesic family. The textural subsoil (Bt) horizon begins at a depth of about a foot and continues downward another foot, with an average content of more than 35% clay. Above this horizon is a sequence of dark, thin surface (Al horizon), paler A2 horizon, and transitional A3 horizon. Slope gradients are 0-6%. Associated soils are the Saylesville, Tichigan, Martinton, and Montgomery series. The following profile description is representative.

Horizon	*Depth, Inches*	*Description*
01 & 02	1½-0	Leaf litter with twigs, rather well decomposed.
A1	0-6	Very dark gray (10YR 3/1) light loam; moderate fine subangular blocky; friable; slightly acid (pH 6.8); clear wavy boundary.
A2	6-10	Grayish-brown (10YR 5/2) loam, with common fine distinct gray (10YR 6.1) and yellowish-brown (10YR 6/1) mottles; finely vesicular; very weak fine to medium platy structure; friable; medium acid (pH 5.8); abrupt wavy boundary. Some krotovinas are present (earthworm burrows filled with A1 colored material).
I,IIA3	10-13	Brown (10YR 5/3-5/2) heavy loam, with few fine distinct strong brown (7.5YR 5/6) mottles; weak very fine platy structure, friable; strongly acid (pH 5.4); abrupt, wavy boundary. Krotovinas present.
IIB21t	13-17	Brown (10YR 5/3) clay loam to silty clay loam with few faint gray (10YR 5/1) and strong brown (7.5YR 5/6) mottles; finely vesicular; moderate fine to medium subangular blocky structure; firm to friable; krotovinas of A1 colored material are present; medium acid (pH 5.8); abrupt wavy boundary.
IIB22t	17-25	Very dark grayish-brown (10YR 3/2) silty clay; with few fine distinct grayish-brown (10YR 5/2) and yellowish-brown (7.5YR 4/6) mottles; moderate medium prismatic parting to moderate coarse angular and subangular blocky structure; plastic; slightly acid (pH 6.5); abrupt, wavy boundary.
IIB3	25-31	Mottled silty clay loam; mottles are distinct and prominent, many fine and medium, with sharp and clear boundaries; 50% of the surface is pale brown (10YR 6/3), 30% is yellowish-brown (10YR 5/6), 20% has very dark brown coatings (10YR 3/2); weak fine to medium prismatic and moderate medium subangular blocky structure; slightly plastic; neutral (pH 7.0); abrupt, wavy boundary.
IIC	31-36	Light brownish-gray (2.5Y 6/2) silty clay loam with abundant medium distinct brownish-yellow (10YR 6/6-6/8) mottles; moderate medium platy to fine angular blocky; structure; firm; calcareous lacustrine silts and clays; 10% by volume light gray (10YR 7/1) deposits of secondary carbonates.

Type location: Iroquois County, Illinois.
Series established: Iroquois County, Illinois, 1940.
Source of name: Name of village in Iroquois County, Illinois.

DODGE SERIES (Soil Map Unit 1)

General description. The Dodge series includes well-drained soils formed in 2 to 3 feet of silty covering over calcareous loam glacial till.

Detailed description. This series includes well-drained soils formed in 20 to 36 inches loess overlying calcareous sandy loam to loam glacial till. Carbonates have been leached from these materials to a depth of about 4 feet. The original vegetation was deciduous forest (maple, basswood, oak, hickory; *Acer, Tilia, Quercus, Carya*). The soils are classified as Alfisols (Gray-Brown Podzolic soils), Typic Hapludalf; fine-silty mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of 1 foot and extends to 4 or 5 feet. In the upper 20 inches this horizon has an average content of 18 to 35% clay and less than 15% sand. Above the Bt horizon is a sequence of thin, dark colored surface (A1) horizon over a paler A2 horizon. Slope gradients are typically 2 to 12% but range from 0 to 20%. Associated soils include McHenry, St. Charles, and Theresa series. The silt loam is the only type. The soil profile was observed on a 14% slope under a forest of oak and maple (Ciolkosz, 1967). Analytical data are presented in Tables 9 and 10.

Horizon	*Depth, Inches*	*Description*
01 & 02	1-0	Oak and maple leaf litter; twigs and acorns overlying some partly decomposed organic debris.
A1	0-3½	Black to very dark brown (10YR 2/1-2/2) silt loam; weak fine to medium granular structure; friable; slightly acid (pH 6.6); abrupt wavy boundary.
A2	3½-8	Yellowish-brown (10YR 5/4-4/4) silt loam; weak fine to medium platy parting to weak fine subangular blocky structure; friable; finely vesicular; patchy white (10YR 8/2) silt coatings on ped faces; strongly acid (pH 5.2); abrupt smooth boundary.
A3	8-13	Brown (7.5YR 4/5) silt loam; weak to moderate subangular blocky structure; friable; finely vesicular; abundant pinkish-white (7.5YR 8/2) silt coatings on ped faces; very strongly acid (pH 4.9); abrupt smooth boundary.
B1	13-17	Brown (7.5YR 4/4-4/5) silt loam; weak to moderate fine to medium subangular blocky structure; friable; abundant dark brown (7.5YR 4/2) cutans and patchy pinkish-white (7.5YR 8/2) silt coatings on ped faces; very strongly acid (pH 4.7); clear smooth boundary.
B21t	17-24	Dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky parting to fine and very fine subangular blocky structure; friable; very abundant dark brown (7.5YR 4/2 cutans on ped faces; very strongly acid (pH 5.0); abrupt smooth boundary.
I & IIB22	24-30	Dark brown (7.5YR 4/4) silty clay loam; sand grains evident; moderate medium and coarse subangular blocky parting to moderate medium and fine subangular blocky structure; friable to firm; very abundant dark brown (7.5YR 4/2) cutans on ped faces; very strongly acid (pH 5.0); abrupt smooth boundary.
IIB23t	30-35	Dark brown (7.5YR 4/4-4/5) clay loam; moderate medium and coarse subangular blocky structures, friable to firm; very abundant dark brown (7.5YR 4/2) cutans on ped faces; strongly acid (pH 5.3); abrupt smooth boundary.

IIB24t	35-40	Dark brown (7.5YR 4/4-4/5) sandy clay loam; moderate coarse subangular blocky structure; friable; some dark brown (7.5YR 4/2) cutans on ped faces; neutral (pH 7.1); abrupt wavy boundary.
IIB31	40-45	Brown (10YR 5/3) sandy loam; weak fine to medium subangular blocky structure; friable; a few patchy cutans present, slightly calcareous, (pH 7.9); abrupt wavy boundary.
IIB32	45-49	Yellowish-brown (10YR 5/4) sandy loam; very weak fine to medium subangular blocky; structure; friable; a few patchy cutans present, clear irregular boundary; moderately calcareous (pH 8.2).
IIC	49-74	Light yellowish-brown (10YR 6/4) gravelly sandy loam; very weak medium platy; firm in places, friable when disturbed; a few patchy cutans present; very hard and cobbly; calcareous (pH 8.4).

Type location: Dodge County, Wisconsin (SE¼, NE¼, Sec. 22, T11N, R15E).
Series proposed: Dodge County, Wisconsin, 1951.
Source of name: Name of Dodge County, Wisconsin.

ELBURN SERIES (Soil Map Unit 5)

General description. The Elburn series includes deep silty, somewhat poorly drained soils overlying calcareous sandy loam to loam glacial till at 3 or 4 feet. *Detailed description.* This series includes somewhat poorly drained soils formed in 30 to 50 inches of silt covering over sandy loam to loam glacial till high in content of carbonates (calcite and dolomite). The original vegetation was wet mesic prairie (big blue stem and reed grass and associated plants: *Andropogon, Calamagrostis, Spartina*). These soils are classified as Mollisols (Brunizems): Aquic Argiudolls; fine-silty, mixed, mesic family. The subsoil (B) horizon begins at a depth of about a foot and continues down nearly a foot more. This horizon has an average content of 18 to 35% clay and less than 15% sandy. Above the B horizon is a sequence of black surface (A1) horizon, very dark A3 and/or B1. Slope gradients range from 0 to 7%. Soil types include silt loam and silty clay loam. Associated soils are Plano, Batavia, St. Charles, Dodge, and other members of these catenas. The following soil profile was observed on a 4% slope near the base of a drumlin in the SE¼, NW¼, Sec. 6, T8N, R16E., Jefferson County, Wisconsin.

Horizon	*Depth, Inches*	*Description*
Ap	0-11	Black (10YR 2/2) silt loam; moderate coarse to medium granular structure; friable; neutral (pH 7.0); abrupt smooth boundary.
A3	11-12	Very dark grayish-brown (10YR 3/2) light silty clay loam; moderate very fine subangular blocky structure; firm; neutral (pH 7.0); clear smooth boundary.
B21t	12-16	Grayish-brown (10YR 5/2) silty clay loam with a few fine distinct yellowish-brown (10YR 5/6) mottles; moderate fine subangular and angular blocky structure with many thin very dark grayish-brown (10YR 3/2) clay films on the surfaces of peds; firm; slightly acid (pH 6.5); clear smooth boundary.
B22t	16-24	Grayish-brown (10YR 5/2) light silty clay loam with a few medium distinct dark gray (10YR 4/1) and brown (10YR 4/3) mottles; moderate fine prismatic parting to moderate medium angular and subangular blocky structure; thin continuous clay film on peds; firm; slightly acid (pH 6.5) gradual smooth boundary.

B23t	24-35	Light brownish-gray (2.5Y 6/2) light silty clay loam with common medium distinct yellowish-brown (10YR 5/6) mottles; moderate medium prismatic parting to moderate medium angular blocky structure; thin patchy clay coatings on ped surfaces and in small channels of very dark gray (10YR 3/1) and dark gray (10YR 4/1); firm; moderately alkaline pH 8.0; gradual smooth boundary.
B31	35-45	Light brownish-gray (2.5Y 6/2) silt loam with common medium distinct yellowish-brown (10YR 5/8) mottles; massive with thin patchy dark gray (10YR 4/1) clay coatings in small channels; friable; moderately alkaline (pH 8.0); abrupt smooth boundary.
I & IIB32	45-53	Light brownish-gray (2.5Y 6/2) silt loam with many coarse distinct yellowish-brown (10YR 5/8) mottles; massive with a few thin patchy very dark gray (10YR 3/1) coatings in small channels; friable; moderately alkaline (pH 8.0); abrupt smooth boundary.
IIC	53-60	Brown (10YR 5/3) light loam; massive; friable; calcareous glacial till.

Type location: LaSalle County, Illinois (NW¼, SW¼, SW¼, SE¼, Sec. 15, T34N, R3E.).
Series established: Kendall County, Illinois.
Source of name: Name of village in Dane County, Illinois.

FABIUS SERIES (Soil Map Unit 12h)

General description. The Fabius series includes somewhat poorly drained soils, shallow to limy sand and gravel, and developed under prairie vegetation.
Detailed description. This series includes somewhat poorly drained soils formed in 12 to 20 inches of sandy loam to silt loam material over calcareous, glacial outwash. Original vegetation consisted of prairie species (big blue stem, *Andropogon,* and associated wet mesic prairie plants) with scattered oak (*Quercus*) trees. These soils are classified as Mollisols (Brunizems): Aquic Argiudolls; fine-loamy over sandy or sandy skeletal, mixed, mesic family. The textural subsoil (Bt) horizon begins at about 10 inches and continues downward to around 20 inches, with an average content of 18 to 35% clay, and more than 15% sand. Above this horizon is a dark colored surface (A1 or Ap) horizon. Slopes range from 2 to 6%. Types include sandy loam, loam, and silt loam. Associated soils are Matherton, Brady, and Wasepi series. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Very dark grayish-brown (10YR 3/2) sandy loam; weak fine granular structure; very friable; numerous roots; slightly acid (pH 6.2); abrupt smooth boundary.
A3	7-10	Brown (10YR 5/3) sandy loam; weak coarse granular structure; very friable; numerous roots; slightly acid (pH 6.3); clear smooth boundary.
B21t		Brown (10YR 5/3) heavy sandy loam, with common medium distinct grayish-brown (10YR 5/2) and dark yellowish-brown (10YR 4/4) mottles; weak medium subangular blocky structure; slightly firm; small amount of fine gravel; slightly acid (pH 6.5); clear wavy boundary.
B22t	12-18	Yellowish-brown (10YR 5/6) sandy clay loam, with common medium distinct grayish-brown (10YR 5/2) and dark yellowish-brown (10YR 4/4) mottles: weak medium subangular

		blocky structure; firm; about 5 percent gravel; slightly acid (pH 6.7); abrupt wavy boundary.
IIC	18-40	Pale brown (10YR 6/3) stratified gravel and coarse sand; single grain; loose; calcareous.

Type of location: Lapeer County, Michigan (NW¼, NE¼, Sec. 6, T6N, R12E).
Series proposed: Lapeer County, Michigan, 1964.
Source of name: Name of township in St. Joseph County, Michigan.

FOX SERIES (Soil Map Unit 9)

General description. The Fox series includes somewhat droughty soils developed from 20 to 42 inches of sandy loam to silt loam covering over limy soil and gravel.

Detailed description. This series includes well-drained soils formed in 20 to 42 inches of sandy loam to silt loam material over calcareous glacial outwash. The original vegetation was deciduous forest (oak, maple, basswood, hickory; *Quercus, Acer, Tilia, Carya*). These soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalfs; fine-loamy over sandy or sandy-skeletal, mixed, mesic family. The textural subsoil (Bt) horizon begins at about 12 inches and continues to about 36 to 42 inches. The upper 20 inches of the Bt has an average content of 18 to 35% clay, and more than 15% sand. The lowermost few inches of the solum often consist of a sticky dark brown B horizon which tongues down into the sandy and gravel substratum. Slope gradients are commonly between 2 and 12% but do reach 30%. Soil types range from sandy loam to silt loam. Associated soils are Casco, Rodman, and Oshtemo series. The following soil profile was observed, at the NW¼, SE¼, Sec. 27, T8N, R13E., Jefferson County. Laboratory data are presented in Tables 9 and 11.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Dark grayish-brown (10YR 4/2) silt loam; moderate fine granular and weak thin platy structure; very friable; mildly alkaline (pH 7.5); abrupt smooth boundary. (7-9" thick).
B1t	8-14	Brown (7.5YR 5/4) clay loam with coatings of brown (7.5YR 4/4 and 4/2); moderate to weak fine subangular blocky; friable; neutral (pH 7.1); clear smooth boundary (5-8" thick).
IIB21t	14-21	Brown (7.5YR 4/4) loam to sandy clay loam with dark brown (7.5YR 4/2 and 3/2) clay films; moderate medium subangular blocky; firm; medium acid (pH 5.8); clear smooth boundary (6-8" thick).
IIB22t	21-25	Brown (7.5YR 4/4) sandy clay loam to sandy clay with dark brown, brown and very dark gray (7.5YR 3/2, 4/2, and 3/0) clay films; moderate medium subangular blocky structure; firm; medium acid (pH 5.8); clear smooth boundary. (3-6" thick).
IIB23t	25-31	Dark brown (7.5YR 4/4) sandy clay loam to sandy clay with some strong brown (7.5YR 5/6) and black (7.5YR 2/0) coatings; moderate medium angular blocky structure; firm; mildly to moderately alkaline (pH 6.5-8.0); abrupt wavy boundary.
IIB3	31-39	Dark brown (7.5YR 3/2 and 4/4) sandy loam; moderate fine subangular blocky structure; friable; moderately alkaline (pH 8.0); clear wavy boundary. (6-10" thick).
IIIC	39-60	Brown (10YR 5/3) sand and gravel; loose; stratified calcareous glacial outwash.

Type location: Ozaukee County, Wisconsin (SE cor., Sec. 9, T9N, R12E.).
Series established: Columbia County, Wisconsin, 1911.
Source of name: Name of the Fox River, Columbia County, Wisconsin.

GILFORD (Soil Map Unit 13h)

General description. The Gilford series includes poorly drained sandy loam to loam soils that are 2 to 5 feet deep over calcareous sand and gravel.

Detailed description. This series includes poorly drained soils formed in 20 to 60 inches of loamy or sandy loam deposits over stratified calcareous sandy glacial outwash with some gravel. The original vegetation was a combination of lowland deciduous forest (elm, ash, maple; *Ulmus, Fraxinus, Acer*) or with a ground cover of wet prairie grasses (*Andropogon, Calamagrostis, Spartina*). The soils are classified as wet Mollisols (Humic Gleys): Typic Haplaquolls; coarse-loamy, mixed, noncalcareous mesic. The subsoil (Cambic B) horizon begins as a depth of about 15 inches and continues downward another foot or two, with an average content of less than 18% clay and between 50 and 85% sands. Overlying this horizon is a thick nearly black surface (A1) horizon. Slope gradients are less than 2%. Types range from loamy sand to loam. Associated soils are Sebewa and Will series and other members of these catenas. The following soil profile description is representative:

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Very dark gray (10YR 3/1) fine sandy loam; moderate granular structure; friable; slightly acid (pH 6.5); numerous roots; abrupt smooth boundary.
A12	8-16	Very dark gray (10YR 3/1) to dark gray (10YR 4/1) fine sandy loam; weak coarse granular structure; friable; numerous roots; slightly acid (pH 6.5); clear wavy boundary.
B21g	16-24	Dark gray (10YR 4/1) sandy loam; common fine faint dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few fine roots; neutral (pH 6.8); clear, wavy boundary.
B22g	24-32	Gray (N5/) sandy loam; common fine distinct dark brown (10YR 4/3) and yellowish-brown (10YR 5/4) mottles; weak coarse subangular blocky structure; friable; neutral (pH 7.0); abrupt irregular boundary.
IICg	32-40	Grayish-brown (10YR 5/2) stratified sand and gravel; loose; calcareous glacial outwash.

Type location: Tuscola County, Michigan.

Series established: Tuscola County, Michgian, 1926.

Source of name: Name of village in Tuscola County, Michigan.

GREENWOOD PEAT (Soil Map Unit 24,25)

See PEAT.

GRISWOLD SERIES (Included in Soil Map Units 2 and 3)

General description. The Griswold series includes somewhat droughty and shallow sandy loams over limy sandy loam glacial till.

Detailed description. This series includes well-drained soils formed in less than 20 inches of silty or loamy deposits over calcareous sandy loam glacial till. The soil is leached of carbonates to a depth of about 2 feet and the solum continues down to around 30 inches with an average content of 18 to 35% clay and more than 15% sand. Slope gradients range from 3% to 20%. Soil types range from sandy loam to silt loam. Associated soils are Lapeer and Theresa series. The following soil profile description is representative.

Horizon	Depth, Inches	Description
A1	0-8	Very dark brown (10YR 2/2) loam; moderate coarse to medium granular structure; friable; nearly neutral (pH 6.7); gradual smooth boundary.
A3	8-12	Dark brown (10YR 3/3) loam; moderate coarse to medium granular structure; friable; slightly acid (pH 6.5); clear smooth boundary.
B21t	12-23	Dark brown (10YR 3/3) above to dark yellowish-brown (10YR 4/4) below, sandy clay loam; weak medium to fine subangular blocky structure; firm; slightly acid (pH 6.3); gradual smooth boundary.
B22t	23-26	Dark yellowish-brown (10YR 4/4) sandy clay loam; massive; firm; neutral (pH 7.0); clear wavy boundary.
C	26-32	Yellowish-brown (10YR 5/4) to light yellowish-brown (10YR 6/4) sandy loam; massive; friable; calcareous glacial till.
Type location:		McHenry County, Illinois (NW¼, SW¼, SE¼, Sec. 16, T45N, R8E.).
Series proposed:		McHenry County, Illinois, 1955
Source of name:		Name of a lake, McHenry County, Illinois.

HARPSTER SERIES (Soil Map Unit 6)

General description. The Harpster series includes level poorly drained silty soils that are limy in the surface layer.

Detailed description. This series includes poorly to very poorly drained soils formed in 30 to 50 or more inches of silty material over calcareous glacial drift, usually till. In areas where the silty deposits are more than 50 inches thick, soil has characteristics similar to the Montgomery series. These soils are found on the lowlands between drumlins in areas of restricted internal drainage where the influx of bicarbonate-charged groundwater leads to development of a solum that is calcareous to the surface. The original vegetation was either lowland deciduous forest (elm, ash, silver maple; *Ulmus, Fraxinus, Acer*) or wet prairie grasses (*Calamagrostis, Spartina, Andropogon*) and associated plants. The soils are classified as wet Mollisols (Humic Gleys): Typic Calciaquolls; fine-silty, mixed, calcareous, mesic family. The texture of the solum is typically a uniform silty clay loam or silt loam over silty clay loam underlain by a coarser substratum (IIBg and IICg) horizons. The gleyed and mottled cambic B horizon has an average of 18 to 35% clay and less than 15% sand. Overlying it is a thick black surface (A1) horizon. Slope gradients are under 2%. Soil types are silt loam and silty clay loam. Associated soils are Pella, Brookston, Kokomo, and Montgomery and other members of their catenas. The following soil profile description is representative.

Horizon	Depth, Inches	Description
Apca	0-8	Black (N 2/0) silty clay loam; weak to moderate medium granular structure; friable; many snail shells; numerous roots; strongly calcareous; abrupt smooth boundary.
A12ca	8-15	Black (10YR 2/1) above to very dark gray (5Y 3/1) below silty clay loam; moderate medium granular to subangular blocky structure; firm; many snail shells; fewer small roots but many larger ones; strongly calcareous; clear wavy boundary.
B21g	15-25	Olive-gray (5Y 5/2) silty clay loam; moderate medium to coarse prismatic structure breaking into moderate to strong medium blocky peds; firm; some snail shells; moderately calcareous; gradual smooth boundary.

B22g	25-30	Grayish-brown (2.5Y 5/2) silty clay loam; common medium faint light yellowish-brown (10YR 6/4) mottles; weak coarse prismatic structure, breaking to medium angular blocky peds; very firm; some snail shells; moderately calcareous; clear smooth boundary.
B3g	30-46	Grayish-brown (2.5Y 5/2) silty clay loam with some stones; common medium faint light yellowish-brown (10YR 6/4) mottles; massive; very firm; moderately calcareous; abrupt smooth boundary.
IIC	46-52	Light yellowish-brown (10YR 6/4) and brownish-yellow (10YR 6/8) gravelly loam till; single grain; loose; moderately calcareous.

Type location: Ford County, Illinois (SE¼, NE¼, NE¼, Sec. 20, T23N, R7E).
Series established: Ford County, Illinois, 1929.
Source of name: Name of village in Ford County, Illinois.

HEBRON SERIES (Soil Map Unit 14)

General description. The Hebron series includes well-drained loams formed on nearly level to gently rolling land from 2 to 3 feet of loams over calcareous silts and clays.
Detailed description. This series includes well-drained soils formed in 18 to 36 inches of loamy material over calcareous glacio-lacustrine silts and clays. The soil is leached of carbonates to a depth of about 30 inches or into the underlying lacustrine materials. The original vegetation was deciduous forest (oak, hickory; *Quercus, Carya*). The soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalfs; fine-loamy, mixed, mesic family. The textural subsoil (Bt) begins at a depth of about 15 inches and continues downward another foot or two, with an average content 18 to 35% clay and more than 15% sand. Above this horizon is a sequence of thin dark surface (A1) horizon and paler A2 horizon (or plow layer, Ap), and a sandy loam to loam B1 horizon. Slope gradients range from 1 to 8% and are occasionally as steep as 20%. Associated soils include Sayles-ville, Del Rey, Aztalan, and Mosel series. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
A1	0-8	Very dark grayish-brown (10YR 3/2) loam; weak coarse sub-angular blocky to medium granular structure; friable; neutral (pH 7.0); abrupt smooth boundary.
A2	12-18	Grayish-brown (10YR 5/2) grading with depth to brown (10YR 5/3) loam; moderate medium platy structure; friable; slightly acid (pH 6.5); clear, wavy boundary.
B1t	8-12	Dark yellowish-brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; few thin patchy clay films; slightly acid (pH 6.3); clear, wavy boundary.
B21t	18-26	Dark yellowish-brown (10YR 4/4) clay loam; moderate to strong medium angular and subangular blocky structure; firm; continuous dark brown (10YR 4/3) coatings on ped faces; slightly acid (pH 6.5); clear smooth boundary.
IIB22t	26-30	Dark yellowish-brown (10YR 4/4) heavy silty clay loam; few medium distinct strong brown and brown (7.5YR 6/6 and 5/2) mottles; moderate medium angular blocky structure; firm; thin continuous clay films; mildly alkaline (pH 7.7); clear wavy boundary.
IIC	30-42	Light yellowish-brown (10YR 6/4) silty clay loam; many medium distinct brown and grayish-brown (10YR 5/6 and

5/2) mottles; weak coarse platy; friable; weakly stratified with thin layers of silt, very fine sand and clay below three feet; moderately calcareous.

Type location: Racine County, Wisconsin (NE¼, NW¼, Sec. 14, T4N, R22E.).

Series established: Jefferson County, Wisconsin, 1912.

Source of name: Name of village in Jefferson County, Wisconsin.

HENNEPIN SERIES (Soil Map Unit 4)

General description. The Hennepin series includes droughty, sandy loams and loams 6 to 18 inches thick over limy, stony, sandy loam to loam glacial till.

Detailed description. This series includes excessively drained and severely eroded soils in calcarous sandy loam or loam glacial till. Th solum consists of an A1 horizon which has been leached of carbonates underlain by a partially leached B horizon and unleached till. The original vegetation was deciduous forest (oak, hickory; *Quercus, Carya*) with some prairie grasses *(Andropogon)* and associated plants. The soils are classified as Inceptisols (Regosols): Typic Eutrochrepts; fine loamy to coarse loamy, mixed, mesic family. The subsoil (cambic B) horizon is a brown (10YR 4/3) sandy loam 3 to 6 inches thick. Analytical data for the profile that are presented in Tables 9 and 11 indicate this profile is in the coarse loamy family rather than fine loamy. This should be expected in areas of sandy loam till. Slope gradients are from 12 to 40%. Soil types include sandy loam, loam, and silt loam. Associated soils are Hochheim and Lapeer series. The following soil profile was observed in the NW¼, SE¼, Sec. 31, T5N, R14E, Jefferson County, Wisconsin.

Horizon	*Depth, Inches*	*Description*
A0	1½-0	Litter of grass and twigs.
A1	0-9	Black (10YR 2/1) with areas of very dark brown (10YR 2/2) sandy loam; weak fine granular structure; very friable; neutral (pH 7.0); numerous bleached quartz grains; clear wavy boundary.
B	9-12	Dark brown 10YR 3/4-4/4) with small areas of dark brown (7.5YR 4/2) sandy loam; very weak fine granular structure; very friable; calcareous (pH 8.0); clear smooth boundary.
C	12-24	Yellowish-brown (10YR 5/4) sandy loam; massive; friable; calcareous glacial till; cobbles are predominantly dolomite.

Type location: Shelby County, Illinois.

Series established: Shelby County, Illinois, 1932.

Source of name: Name of village in Putnam County, Indiana.

HOCHHEIM SERIES (Soil Map Unit 4)

General description. The Hochheim series includes droughty, shallow loams a foot or two thick over very limy, stony sandy loam to loam glacial till.

Detailed description. This series includes well-drained soils formed in less than 20 inches of silty to loamy covering over highly calcareous (50 to 60% $CaCO_3$ equivalent) glacial till. The upper 12 to 20 inches of the solum has been leached of carbonates and the reaction is near neutral. The original vegetation was deciduous forest (maple, basswood, oak; *Acer, Tilia, Quercus*). Because of the dark colored Ap horizon and thin solum, these soils are classified as Mollisols intergrading to Alfisols: Typic Argiudolls; fine-loamy, mixed, mesic family. In Jefferson County many bodies of Hochheim are actually Alfisols (Gray-Brown Podzolics) with a dark colored surface horizon: Mollic Hapludalfs, fine-loamy, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of about

a foot and continues downward another foot with an average content of about 18 to 35% clay and more than 15% sand. Above this horizon is a dark surface (A1) horizon and underlying gray to brown transitional A2, A3, B1 horizons. Slope gradients range from 2 to 30% with those between 8 and 20% most common. Soil types include sandy loam, loam, and silt loam. Associated soils are Lapeer, Theresa, and Hennepin series. The following soil profile was observed in th SE¼, SW¼, Sec. 11, T8N, R16E, Jefferson County, Wisconsin.

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Dark gray to dark grayish-brown (10YR 4/1-4/2) silt loam; weak fine to medium granular structure; friable; neutral (pH 7.0); abrupt smooth boundary.
IIB1t	7-9	Dark yellowish-brown (10YR 4/4) sandy clay loam; moderate fine subangular blocky structure with thick continuous very dark grayish-brown (10YR 3/2) coatings on the surfaces of peds; firm; moderately alkaline (pH 8.0); abrupt smooth boundary.
IIB2t	9-16	Brown to dark brown (7.5YR 4/3) clay loam; moderate medium subangular blocky structure with thick continuous very dark grayish-brown (10YR 3/2) coatings on the surfaces of peds; firm; moderately alkaline (pH 8.0); abrupt smooth boundary.
IIB3t	16-19	Dark yellowish-brown to yellowish-brown (10YR 4/4-5/4) sandy clay loam; massive with thick continuous dark brown (10YR 3/3) coatings in channels; friable calcareous; clear smooth boundary.
IIC1	19-23	Yellowish-brown to dark yellowish-brown (10YR 5/4-4/4) heavy sandy loam; massive; friable; calcareous; clear smooth boundary
IIC2	23-30	Light yellowish-brown to yellowish-brown (10YR 6/4-5/4) sandy loam; massive; friable; calcareous till.
Type location:		Dodge County, Wisconsin (NE¼, SW¼, Sec. 36, T13N, R17E).
Series proposed:		Dodge County, Wisconsin, 1955.
Source of name:		Name of a church in eastern Dodge County, Wisconsin.

HOUGHTON MUCK (Soil Map Units 24 and 25)

See Muck.

KENDALL SERIES (Soil Map Unit 5)

Genreal description. The Kendall series includes somewhat poorly drained deep silty soils, underlain by limy sandy loam glacial till at a depth of about 3½ feet. *Detailed description.* This series includes somewhat poorly drained soils formed in 30 to 50 inches of loess over calcareous, sandy loam glacial till. The original vegetation was deciduous forest (elm, maple, hickory, oak; *Ulmus, Acer, Carya, Quercus*). The soils are classified as Alfisols (Gray-Brown Podzolics): Aeric Ochraqualfs; fine-silty, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of about 15 inches and continues downward to include the upper 6 to 12 inches of the underlying till. The Bt horizon has an average content of 15 to 35% clay and less than 15% sand. Above this horizon is a sequence of dark surface soil (A1 or Ap) horizon, a paler subsurface (A2) horizon and a brown B1 horizon. Slope gradients range from 1 to 7%. Silt loam is the only type. Associated soils are Lamartine, Lisbon, and Elburn series. The following soil profile description is representative.

Horizon	Depth, Inches	Description
Ap	0-7	Dark grayish-brown (10YR 4/2) silt loam; weak medium granular structure; friable; abundant roots; neutral (pH 7.0); abrupt smooth boundary.
A2	7-11	Grayish-brown (10YR 5/2) silt loam; few fine faint yellowish-brown (10YR 5/4) mottles; moderate fine and medium granular structure; friable; many roots; slightly acid to neutral (pH 6.8); clear smooth boundary.
B1	11-13	Brown (10YR 5/3) light silty clay loam; few fine faint yellowish-brown (10YR 5/4) and gray (10YR 5/1) mottles; moderate fine subangular blocky structure; firm; many roots; slightly acid (pH 6.2); clear smooth boundary.
B21t	13-21	Grayish-brown (10YR 5/2) silty clay loam with common fine faint brown (10YR 5/3) mottles; moderate fine and medium subangular blocky structure with moderately thick continuous dark brown (10YR 4/3) clay films; few roots; few iron-manganese concretions; strongly acid (pH 5.3); clear smooth boundary.
B22t	21-39	Grayish-brown (2.5Y 5/2) silty clay loam with common medium distinct yellowish-brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure with moderately thick dark grayish-brown (10YR 4/2) clay films; firm; few roots; few iron-manganese concretions; medium acid (pH 5.8); clear smooth boundary.
B31t	39-45	Mixed yellowish-brown (10YR 5/6) and gray (5Y 5/1) light silty clay loam; weak coarse subangular blocky structure with thin discontinuous gray (10YR 5/1) clay films; firm; few roots; few iron-manganese concretions; slightly acid (pH 6.3); clear smooth boundary.
IIB32	45-51	Mixed brown (7.5YR 5/6), yellowish-brown (10YR 5/6), and gray (5Y 5/1) loam to sandy loam with some fine gravel; weak coarse subangular blocky structure; friable; neutral (pH 7.0); clear smooth boundary.
IIC	51-58	Pale brown (10YR 6/3) sandy loam with a few medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; calcareous glacial till.

Type location: Douglas County, Illinois (SE¼, NW¼, Sec. 36, T15N, R10E).
Series established: Kendall County, Illinois, 1941.
Source of name: Name of Kendall County, Illinois.

KEOWNS SERIES (Soil Map Unit 23)

General description. The Keowns series includes deep poorly drained loams on on level lowlands. They are limy at a depth of 1 to 2 feet.

Detailed description. This series includes poorly drained soils formed in stratified, calcareous glacio-lacustrine silt and fine sand. Some profiles are calcareous in the surface horizons and in other profiles the carbonates have been leached a foot or two. The original vegetation was a mixture of lowland dciduous forest (elm, silver maple, cottonwood, ash; *Ulmus, Acer, Populus, Fraxinus*) and lowland prairie grasses *(Calamagrostis, Spartina, Andropogon).* The soils are classified as wet Inceptisols (Humic Gleys) lacking a diagnostic argillic horizon: Mollic Haplaquepts; coarse-loamy, mixed, calcareous, mesic family. There is no evidence of an accumulation of clay in the subsoil (cambic B) horizon and it is often coarser textured than the overlying dark A1 horizon. Between 10 and 40 inches the solum has an average of less than 18% clay and more than 15% sand coarser than very fine sand. Slope gradients are under 2%. Soil types include silt

loams and fine sandy loams. Associated soils are Colwood, Navan, Montgomery and members of their respective catenas. The following soil profile was described in the SE¼ of Sec. 30, T5N, R16E, Jefferson County, Wisconsin. Analytica data are given in Tables 8 and 10.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Black (10YR 2/1) silt loam; moderate very fine and fine subangular blocky structure; friable; calcareous; clear smooth boundary.
A12	8-11	Black (10YR 2/1) silt loam; weak medium platy parting to weak very fine subangular blocky structure; friable; calcareous; abrupt irregular boundary.
B1g	11-16	Light brownish-gray (2.5Y 6/2) very fine sandy loam with a few fine faint olive-yellow (2.5Y 6/6) mottles; moderate medium to fine platy structure; friable; calcareous; abrupt wavy boundary.
B2g	16-24	Gray (5Y 6/1) very fine sandy loam with common distinct medium yellowish-brown (10YR 5/6) mottles and a few dark gray (10YR 4/1) stains on ped faces; weak coarse prismatic parting to moderate coarse platy parting to weak fine subangular blocky structure; friable; calcareous; abrupt smooth boundary.
Cg	24-48	Laminated light brownish-gray (2.5Y 6/2) fine sandy loam and light gray (2.5Y 7/2) silt; weak coarse prismatic parting to moderate coarse platy structure which is related to the original lamination of this material: yellowish-brown (10YR 5/6) mottles in the sandy laminae and coatings of light gray (10YR 7/1) secondary carbonates in pores and on major cleavages; very friable; calcareous.
Type location:		Dodge County, Wisconsin (NE¼, SE¼, Sec. 33, T9N, R14E).
Series proposed:		Washington County, Wisconsin.
Source of name:		Name of a crossroads settlement in Washington County, Wisconsin.

KIBBIE SERIES (Soil Map Unit 19)

General description. The Kibbie series includes deep somewhat poorly drained loams on fairly level lowlands. The soils are limy at a depth of about 2 to 4 feet. *Detailed description.* This series includes somewhat poorly drained soils formed in stratified calcareous silts and fine sands. The original vegetation was lowland deciduous forest (elm, ash, silver maple; *Ulmus, Fraxinus, Acer*). The soils are classified as Alfisols (Gray-Brown Podzolics): Aquollic Hapludalfs, fine-loamy, mixed, mesic family. The textural subsoil (Bt) has an average content of 18 to 35% clay and more than 15% sand coarser than very fine sand. Slope gradients range up to 6%. Associated soils are Shiocton and Mosel series and other members of their catenas. The following soil profile, for which analytical data are given in Tables 9 and 11, was observed in the NW¼, SE¼, NW¼, Sec. 1, T8N, R16E, Jefferson County, Wisconsin.

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Very dark brown (10YR 2/2) fine sandy loam; weak medium subangular blocky structure; friable; mildly alkaline (pH 7.5) abrupt smooth boundary.
A2	7-10	Dark gray (10YR 4/1) fine sandy loam with common fine distinct gray (10YR 6/1) and yellowish-brown (10YR 5/6) mottles; weak to moderate medium subangular blocky structure; friable; mildly alkaline (pH 7.5) abrupt smooth boundary.

B1	10-13	Brown (10YR 5/3) fine sandy loam with a few fine faint gray (10YR 5/1) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; neutral (pH 7.0); clear smooth boundary.
B21t	13-17	Brown to dark brown (10YR 4/3) heavy fine sandy loam with a few fine faint strong brown (7.5YR 5/6) mottles; moderate medium to coarse subangular blocky structure with some sandy coatings which are very pale brown (10YR 7/3) dry and grayish-brown (10YR 5/2) moist; friable; neutral (pH 7.0), clear smooth boundary.
B22t	17-22	Dark brown to dark yellowish-brown (10YR 4/3-4/4) sandy clay loam with a few fine distinct grayish-brown (10YR 5/2) and yellowish-red (5YR 4/6) mottles; moderate medium subangular blocky structure with a few patchy dark brown (10YR 3/3) clay coatings; firm; neutral (pH 7.0). Several 1 to 2 mm dark reddish-brown (5YR 2/2) concretions were observed; clear smooth boundary.
B3	22-25	Dark yellowish-brown (10YR 4/4-5/4) fine sandy loam with abundant medium distinct strong brown (7.5YR 5/6-5/8) and pale brown (10YR 6/3) mottles; very weak coarse subangular blocky structure; very friable; mildly alkaline (pH 7.5); abrupt smooth boundry.
C	25-40	Light brownish-gray (2.5Y 6/2) loamy fine sand with abundant medium distinct brownish-yellow (10YR 6/6-6/8) mottles; massive; very friable; stratified very fine, fine and medium sands; pH 7.5); becomes calcareous around 40 inches.

Type location: Lapeer County, Michigan.
Series established: Newton County, Indiana, 1943.
Source of name: Name of a village in Van Buren County, Michigan.

KNOWLES SERIES (Soil Map Unit 7)

General description. The Knowles series includes shallow silt loams only 2 to 3 feet deep over limestone bedrock.

Detailed description. This series includes well-drained soils formed in 20 to 36 inches of loess over glacial till which is underlain by limestone bedrock at a depth of 30 to 40 inches. The original vegetation was deciduous forest (oak, hickory, maple, basswood; *Quercus, Carya, Acer, Tilia*). The soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalf, fine loamy to fine silty, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of about a foot and extends downward into the underlying till. It has an average content of 18 to 35% clay and less than 15% sand. Above this horizon are a dark A1 and paler A2 horizon, or dark Ap. Slopes range from 1 to 18%. The silt loam is the only soil type. Associated soils are of the Whalan series. The following soil profile was observed in the SW¼, SE¼, Sec. 18, T6N, R14E, Jefferson County.

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Very dark grayish-brown (10YR 3/2) silt loam; moderate medium granular structure; friable; slightly acid (pH 6.5); abrupt smooth boundary.
B1t	7-14	Brown (10YR 4/3) silty clay loam with patchy dark yellowish-brown (10YR 3/4) coatings; moderate medium subangular blocky structure; friable; neutral (pH 7.0); clear smooth boundary.
B21t	14-18	Brown to dark brown (7.5YR 4/4) silty clay loam with thin, continuous dark brown (7.5YR 3/2) clay coatings; moderate

		to strong medium subangular blocky structure; firm; strongly acid (pH 5.5); clear smooth boundary.
B22t	18-28	Brown to dark brown (7.5YR 4/4) silty clay loam with continuous dark brown (7.5YR 3/2) clay films; strong coarse subangular blocky parting to medium subangular blocky structure; firm; strrongly acid (pH 5.0); clear smooth boundary.
IIB3t	28-33	Brown to dark brown (7.5YR 4/4) sandy clay loam with patchy dark brown (7.5YR 3/2) clay coatings; weak coarse subangular blocky structure; firm; moderately alkaline (pH 8.0); clear wavy boundary.
IIC	33-40	Pale brown (10YR 6/3) sandy loam; massive; friable; calcareous glacial till; abrupt smooth boundary.
IIIR	40-55	Dolomitic limestone bedrock.
Type location:		Dodge County, Wisconsin (NW¼, NW¼, Sec. 33, T13N, R17E).
Series proposed:		Dodge County, Wisconsin, 1959.
Source of name:		Name of Village in Dodge County, Wisconsin.

KOKOMO SERIES (Soil Map Unit 6)

General description. The Kokomo series includes poorly drained, silty soils overlying limy loam glacial till in low-lying landscape positions.
Detailed description. This series includes poorly drained soils formed in 2 or 3 feet of silty material over calcareous loam glacial till. Carbonates have been leached to a depth of 3 or 4 feet. The original vegetation was a mixture of lowland deciduous forest (elm, ash, maple; *Ulmus, Fraxinus, Acer*) and wet prairie species, *(Calamagrostis, Spartina, Andropogon).* The soils are classified as wet Mollisols (Humic Gleys): Typic Argiaquolls, fine, mixed, noncalcareous, mesic family. The textural subsoil (Btg) begins at a depth of about 15 inches and continues downward 2½ feet, with an average content of more than 35% clay. Overlying this horizon is a thick, very dark surface (A1) horizon. Slope gradients are less than 2%. Associated soils are Brookston and Pella series. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Very dark gray (10YR 3/1) silty clay loam; weak coarse granular structure; friable; slightly acid to neutral (pH 6.8); abrupt smooth boundary.
A12	8-17	Black (10YR 2/1) silty clay loam; weak to moderate fine subangular blocky structure; firm; slightly acid to neutral (pH 6.8); clear wavy boundary.
I&IIB21tg	17-30	Dark gray (2.5Y 4/0) silty clay loam to clay loam; weak to moderate coarse prismatic, parting to coarse angular blocky structure; very firm; thin coatings of very dark brown (10YR 2/2) on ped faces and in cracks in upper 3 or 4 inches; few, fine, distinct mottles of yellowish-brown (10YR 5/6-5/8) in lower 2 to 4 inches; thin clay films on numerous peds; neutral (pH 7.0); gradual wavy boundary.
IIB22tg	30-50	Dark gray (2.5Y 4/0) mottled with yellowish-brown (10YR 5/6-5/8) and dark yellowish-brown (10YR 4/4) clay loam; moderate coarse and very coarse angular blocky structure; very firm; thin to medium clay films on numerous peds; mildly alkaline (pH 7.5); abrupt irregular boundary.
IICg	50-60	Grayish-brown (10YR 5/2) loam with many, coarse distinct yellowish-brown (10YR 5/6-5/8) mottles massive; friable; calcareous glacial till.

Type location: Howard County, Indiana (NW¼, NE¼, Sec. 8, T23N, R4E).
Series established: Cass County, Indiana, 1952.
Source of name: Name of a city in Howard County, Indiana.

LAMARTINE SERIES (Soil Map Unit 5)

General discription. The Lamartine series includes somewhat poorly drained silty soils 2 to 3 feet deep over limy glacial till.

Detailed description. This series includes somewhat poorly drained soils formed in 20 to 36 inches of silty covering over stony calcareous loam to sandy loam glacial till. The original vegetation was deciduous forest (oak, elm, hickory, maple; *Quercus, Ulmus, Carya, Acer*). The soils are classified as Alfisols (Gray-Brown Podzolics): Aquollic Hapludalfs, fine-silty, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of about a foot and continues downward to 3 or 4 feet including part of the underlying till. This horizon has an average content of 18 to 35% clay and less than 15% sand. Above this horizon is a sequence of dark colored surface (A1) horizon, a paler subsurface (A2) horizon, and a dark brown B1 horizon. Slope gradients range from 0 to 6%. The silt loam is the only type. Associated soils are Lisbon, Kendall, and Elburn series. The following soil profile was observed on a 9% west slope on lower slopes of a drumlin in a forest in the SW¼, SE¼, SW¼, Sec. 12, T8N, R14E. Analytical data are given in Tables 9 and 10.

Horizon	*Depth, Inches*	*Description*
01, 02	2-0	Oak leaves, twigs, and acorns over partly decomposed leaves, twigs, and acorns.
A1	0-7	Black (10YR 2/1) silt loam; weak to moderate, fine to medium granular, and very fine subangular blocky structure; friable; slightly acid (pH 6.5); abrupt wavy boundary.
A2	7-11	Dark grayish-brown (10YR 4/2) silt loam; few fine faint yellowish-brown (10YR 5/4) mottles; weak thick platy parting to moderate very fine subangular blocky structure; friable; neutral (pH 6.8); abrupt smooth boundary.
B1t	11-13	Dark brown (10YR 4/3) silty clay loam; moderate very fine to fine subangular blocky; few fine faint yellowish-brown (10YR 5/8) mottles; few very dark brown (10YR 2/2) stains on ped faces; neutral (pH 6.9); friable; abrupt smooth boundary.
B21t	13-21	Dark grayish-brown (10YR 4/2) silty clay loam; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; common fine distinct yellowish-brown (10YR 5/6-5/8) mottles; patchy dark grayish-brown to dark gray (10YR 4/2-4/1) cutans on ped faces; neutral (pH 7.1); friable to firm; gradual wavy boundary.
B22t	21-30	Pale brown (10YR 6/3) silty clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; common medium distinct yellowish-brown to brownish-yellow (10YR 6/8-5/8) and fine faint gray (10YR 5/1) mottles; abundant dark grayish-brown (10YR 4/2) and patchy very dark brown (10YR 2/2) cutans on ped faces; neutral (pH 7.3); friable to firm; gradual wavy boundary.
I&IIB23t	30-33	Pale brown (10YR 6/3) loam; weak medium prismatic parting to moderate fine and medium subangular blocky structure; common medium distinct brownish-yellow (10YR 6/8) and gray (10YR 5/1) mottles; abundant dark gray to very dark gray (10YR 3/1-4/1) and patchy very dark brown (10YR 2/2)

		cutans on ped faces; moderately alkaline (pH 8.0); firm; abrupt smooth boundary.
IIB3	33-39	Light yellowish-brown (10YR 6/4) sandy loam; many medium distinct yellowish-brown (10YR 5/6-5/8) mottles; calcareous; friable; abrupt wavy to irregular boundary.
IIC	39-66	Light yellowish-brown (10YR 6/4) sandy loam; massive; many medium distinct yellowish-brown (10YR 5/6) mottles, friable; strongly calcareous glacial till.

Type location: Fond du Lac County, Wisconsin: (SE¼, NW¼, Sec. 17 T16N, R16E).
Series proposed: Dodge County, Wisconsin, 1953.
Source of name: Name of a village in Fond du Lac County, Wisconsin.

LAPEER SERIES (Soil Map Units 2, 3, and 4)[7]

General description. The Lapeer series includes well drained loams 2 to 3 feet deep, developed largely in limy sandy loam glacial till on hill crests and slopes.
Detailed description. This series includes well-drained soils formed in thin deposits (less than 20 inches) of loamy to silty material over calcareous sandy loam glacial till. The original vegetation was deciduous forest (oak, hickory, maple; *Quercus, Carya, Acer*). The soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalfs; fine-loamy, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of about a foot and continues downward to 30 or 40 inches with an average content of 18 to 35% and more than 15% sand. Above this horizon is a sequence of thin dark surface (A1) horizon, paler subsurface (A2) horizon, and brown B1 horizon. Slope gradients are usually between 2 and 20% but range up to 40%. Soil types include sandy loam, loam, and silt loam. Associated soils include Theresa, Metea, Hochheim, and Hennepin series. The following soil profile, for which analytical data are given in Tables 9 and 10, was observed in the NW¼, NE¼, SE¼, Sec. 16, T6N, R15E.

Horizon	*Depth, Inches*	*Description*
A1	0-3	Very dark brown (10YR 2/2) sandy loam; weak, fine, granular structure; very friable; strongly acid (pH 5.1); smooth clear boundary.
A2	3-10	Brown (10YR 5/3-4/3) sandy loam, weak medium, subangular blocky structure; very friable; few very dark brown (10YR 2/2) earthworm tubes; very strongly acid (pH 4.6); clear smooth boundary.
B1	10-12	Dark brown (7.5YR 4/4) sandy loam; moderate, fine, and medium, subangular blocky structure; friable; few thin patchy (10YR 5/3) coatings. Extremely acid (pH 4.1); clear smooth boundary.
B21t	12-17	Dark brown (7.5YR 4/4) sandy clay loam; strong, fine, and medium, subangular blocky structure; a few gray brown (10YR 5/2) coatings and a few thin patchy brown (7.5YR 4/3) clay films; firm; very strongly acid (pH 4.6); gradual smooth boundary.
B22t	17-28	Reddish brown (5YR 4/4) sandy clay loam; strong, fine, and medium, subangular blocky structure; thin patchy reddish-brown (5YR 4/3) clay films; firm; strongly acid (pH 5.1); gradual smooth boundary.

[7] Thin-solum Lapeer soils have a solum 18 to 24 inches thick and are transitional in character between the normal Lapeer series and the Hochheim and Hennepin series.

B3	28-35	Strong brown (7.5YR 5/6) sandy loam, weak, coarse, subangular blocky structure; thin patchy brown (7.5YR 4/4) clay films; coatings; friable; neutral (pH 7.0); gradual wavy boundary.
C	35-42	Light yellowish-brown (10YR 6/4) loamy sand; massive; friable; calcareous glacial till.

Type location: Lapeer County, Michigan (NW¼, NW¼, Sec. 34, T6N, R12E).

Series established: McHenry County, Illinois, 1960.

Source of name: Name of city in Lapeer County, Michigan.

LISBON SERIES (Soil Map Unit 5)

General description. The Lisbon series includes somewhat poorly drained black silty soils underlain at a depth of 2 or 3 feet by limy, stony, loamy glacial till. *Detailed description.* This series includes somewhat poorly drained soils formed in 20 to 36 inches of loess over calcareous sandy loam to loam glacial till. The original vegetation was wet mesic prairie (big blue stem and associated plants: *Andropogon, Calamagrostis, Spartina*). These soils are classified as Mollisols (Brunizems): Aquic Argiudolls; fine-silty, mixed, mesic family. The subsoil in this profile is a cambic B that begins at a depth of around 18 inches and continues downward another 30 to 36 inches, extending into the underlying till a few inches. The B horizon has an average content of 18 to 35% clay and less than 15% sand. The overlying horizons include a thick, dark surface (A1) horizon and a transitional A3 horizon. Typical profiles in the Lisbon series have an argillic (Bt) horizon, but this example does not have sufficient increase in clay content to meet the requirements of an argillic horizon (Table 8). Slope gradients range from 0 to 7%. Soil types are silt loam and silty clay loam. Associated soils are Lamartine and Elburn series, and other members of their catenas. The following soil profile, for which analytical data are given in Tables 9 and 11, was observed in the SW¼, SW¼, NW¼, Sec. 1, T8N, R15E.

Horizon	*Depth, Inches*	*Description*
Ap+	0-8	Very dark gray (10YR 3/1) light silty clay loam; moderate fine granular structure; friable; very slightly acid (pH 6.5); abrupt smooth boundary. This horizon is composed of fairly recent colluvial material, which has been thoroughly unified by cultivation.
A12	8-16	Black (10YR 2/1) silty clay loam; moderate to strong, medium and fine subangular blocky structure; firm; very slightly acid (pH 6.5); gradual smooth boundary.
A13	16-20	Very dark gray (10YR 3/1) silty clay loam; moderate to strong medium subangular blocky structure; firm; very slightly acid (pH 6.5); clear smooth boundary.
A3	20-23	Grayish-brown (2.5Y 5/2) silty clay loam with a few, fine faint yellowish-brown (10YR 5/8) mottles; moderate medium and coarse subangular blocky structure with a few very dark gray (10YR 3/1) coatings; firm; neutral (pH 7.0); clear smooth boundary.
B21	23-30	Light brownish-gray (2.5Y 6/2) silty clay loam with common, fine, distinct, yellowish-brown (10YR 5/4) mottles; moderate coarse subangular blocky structure with thin, patchy, very dark gray (10YR 3/1) coatings on ped surfaces, in root channels and fine pores; firm; neutral (pH 7.0); gradual smooth boundary.

B22	30-37	Light brownish-gray (2.5Y 6/2) heavy silt loam with many medium distinct yellowish-brown (10YR 5/4-5/6) mottles; moderate to weak coarse subangular blocky structure with patchy dark gray (10YR 4/1) coatings; firm; neutral (pH 7.0); abrupt smooth boundary.
IIB3	37-44	Light brownish gray (2.5Y 6/2) sandy loam with common, medium distinct yellowish-brown (10YR 5/6) mottles; massive with patchy dark gray (10YR 4/1) coatings in root channels and fine pores; friable; moderately alkaline (pH 8.0); gradual smooth boundary.
IIC	44-50	Pale brown (10YR 6/3) sandy loam with a few, medium, distinct strong brown (7.5YR 5/6) mottles and a few dark concretions; massive; friable; calcareous glacial till.

Type location: Boone County, Illinois.
Series established: Boone County, Illinois, 1935.
Source of name: Name of a village in Kendall County, Illinois.

LORENZO (Included in Soil Map Unit 9)

General description. The Lorenzo series includes naturally well drained loamy soils developed under prairie vegetation and shallow to limy sand and gravel.
Detailed description. This series includes well-drained, somewhat droughty soils formed in 12 to 20 inches of sandy loam to silt loam material over calcareous sand and gravel. A sandy clay loam to clay loam textural B horizon (Bt) is present. Original vegetation was oak savannah, that is, scattered oak trees and a ground cover of prairie grasses and forbs. These soils are classified as Mollisols (Brunizems) Typic Argiudoll; fine-loamy over sandy or sandy skeletal, mixed, mesic. The textural subsoil (Bt) begins at a depth of about 8 inches and continues downward about 16 inches, with some tongues extending down into the underlying glacial outwash sand and gravel. The B contains an average of about 18% to 35% clay and more than 15% sand. Dark organic stains and some clay films (argillans) are present on ped surfaces. Above the B horizon is a nearly black A1 horizon. Slope gradients are generally 2 to 12%, but include a range from 0 to 45%. Soil types include silt loam, loams, and sandy loams. Associated soils are the deeper Warsaw (Front Cover), Casco, Fabius, Rodman, Oshtemo, Boyer, and Oakville. The following soil profile was observed on an nearly level outwash plain in the NE¼, SE¼, NE¼, Sec. 12, T5N, R16E.

Horizon	*Depth, Inches*	*Description*
01	½-0	Grass litter, discontinuous.
Ap	0-12	Very dark brown (7.5YR 2/2-2/1) loam; moderate coarse to medium granular above to fine subangular blocky structure below; friable; nearly white sand grains observed; neutral (pH 7); abrupt smooth boundary.
B21t	12-17	Dark reddish-brown (5YR 3/2) loam above to clay loam below; moderate fine to coarse angular and subangular blocky structure; friable; slightly acid (pH 6.3); clear wavy boundary.
IIB22t	17-20	Dark reddish-brown (5YR 3/2-3/4) gravelly sandy clay loam; weak fine to medium subangular blocky structure; some dark cutans and organic stains present; friable; moderately alkaline (pH 8/0); clear wavy boundary.
IIB3	20-23	Dark yellowish-brown (10YR 3/4) gravelly loamy sand; single grain to very weak medium subangular blocky structure; very friable; dark organic stains and some cutans present on ped surfaces; moderately alkaline (pH 8.0); clear wavy to irregular boundary.

IIC	23-30	Brown (10YR 4/3-5/3) sand and gravel; single grain; stratified; loose; calcareous glacial outwash.

Type location: Will County, Illinois.

Series established: Will County, Illinois, 1951.

Source of name: Town in Will County, Illinois.

McHENRY SERIES (Soil Map Unit 1)

General description. The McHenry series includes moderately deep silt loams of good drainage developed over limy, stony, sandy loam glacial till.

Detailed description. This series includes well-drained soils formed in 20 to 36 inches of loess over calcareous sandy loam glacial till. The original vegetation was deciduous forest (oak, hickory; *Quercus, Carya*). The soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalfs; fine-loamy, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of about a foot and continues downward to around 3 or 4 feet with an average content of about 18 to 35% clay and more than 15% sand. Above this horizon is a sequence of dark-colored surface (0, A1 or Ap) horizons, paler subsurface (A2) horizon, and transitional B1 horizon. Slope gradients are usually 2 to 12% but can range up to 25%. The silt loam is the only type. Associated soils include Dodge, St. Charles, and Theresa series. The following soil profile, for which analytical data are given in Tables 8 and 9, was observed on a 6% slope in the SE¼, NE¼, Sec. 26, T6N, R13E.

Horizon	*Depth, Inches*	*Description*
Ap	0-6	Very dark grayish-brown (10YR 3/2) silt loam; weak medium granular structure; very friable; slightly acid (pH 6.4); abrupt smooth boundary.
A2	6-9	Brown (10YR 5/3) silt loam; weak medium platy structure; friable; slightly acid (pH 6.1); clear smooth boundary.
B1	9-13	Brown to dark brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; patchy light brownish-gray (10YR 6/2) silt coatings on ped surfaces; friable; medium acid (pH 5.8); clear smooth boundary.
B21t	13-18	Dark brown to dark yellowish-brown (10YR 4/3-4/4) heavy silt loam; moderate fine and medium subangular blocky structure; patchy silt coatings and thin patchy dark brown (10YR 3/3) clay films on ped surfaces; firm; medium acid (pH 5.6); gradual smooth boundary.
B22t	18-26	Dark brown to dark yellowish-brown (10YR 4/3-4/4) silty clay loam; moderate medium subangular blocky structure; thin continuous dark brown (10YR 3/3) clay films on ped surfaces; firm; strongly acid (pH 5.3); clear wavy boundary.
IIB23t	26-34	Dark brown (7.5YR 4/4) sandy clay loam; moderate coarse subangular blocky structure; thick patchy dark brown (7.5YR 3/2) clay films on ped surfaces and in channels; firm; medium acid (pH 6.0); clear smooth boundary.
IIB3t	34-40	Brown to dark brown sticky sandy loam; weak coarse subangular blocky structure; thick patchy clay films in channels; friable; neutral (pH 6.8); clear wavy boundary.
IIC	40-54	Pale brown to light yellowish-brown (10YR 6/3-6/4) sandy loam; massive; friable; calcareous glacial till.

Type location: McHenry County, Illinois.

Series established: McHenry County, Illinois, 1953.

Source of name: Name of McHenry County, Illinois.

MARTINTON SERIES (Soil Map Unit 18)

General discription. The Martinton series includes somewhat poorly drained black silt loam and loam soils underlain by very limy brown silt and clay.

Detailed description. This series includes somewhat poorly drained soils formed in glacio-lacustrine silts and clays. These soils may have up to 18 inches of loamy covering over the silts and clays. The original vegetation was wet mesic prairie (big blue stem, reed grass, cord grass, and associated plants: *Andropogon, Calamagrostis, Spartina*). These soils are classified as Mollisols (Brunizems) Aquic Argiudolls; fine, illitic, mesic family. The textural subsoil (Bt) horizon begins at a depth of about a foot and continues downward 2 more feet, with an average content of more than 35% clay. Above this horizon is a thick sequence of dark surface (A1 or Ap, and A3) horizons. Slope gradients are usually less than 3%. Types are silt loam and loam. Associated soils are Del Rey and Tichigan series. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Black (10YR 2/1) silt loam; moderate to weak fine granular structure; friable; medium acid (pH 5.8); abrupt smooth boundary.
A12	7-13	Black (10YR 2/1) heavy silt loam; strong fine to medium granular structure; friable; medium acid (pH 5.8); clear smooth boundary.
A3	13-17	Very dark brown (10YR 2/2) heavy silt loam; strong medium to coarse granular structure; friable; medium acid (pH 5.8); clear smooth boundary.
B21t	17-21	Dark grayish-brown (10YR 4/2) silty clay loam; strong fine subangular blocky structure with grayish-brown (10YR 5/2) continuous clay films; firm; medium acid (pH 5.8); clear smooth boundary.
B22t	21-27	Dark grayish-brown (10YR 4/2) silty clay with few fine prominent yellowish-brown (10YR 5/6 and 5/8) and light brownish-gray (2.5Y 6/2) mottles; moderate fine to medium angular and subangular blocky structure with grayish-brown (2.5Y 5/2) continuous clay films; firm; slightly acid (pH 6.3); clear smooth boundary.
B23t	27-35	Olive-gray (5Y 5/2) heavy silty clay loam with a few fine prominent yellowish-brown (10YR 5/6) mottles; weak medium to fine prismatic structure breaking to moderate to strong medium angular blocky structure with dark gray (5Y 4/1) continuous clay films; firm; slightly acid (pH 6.4); gradual smooth boundary.
B31t	35-42	Olive-gray (5Y 5/2) to gray (5Y 5/1) silty clay loam with common fine to medium distinct yellowish-brown (10YR 5/6 and 5/8) mottles; weak coarse angular blocky structure with olive-gray (5Y 5/2) clay films continuous on vertical surfaces; firm; mildly alkaline (pH 7.6); gradual smooth boundary.
B32	42-46	Olive (5Y 5/3) silt loam with common fine to medium distinct yellowish-brown (10YR 5/6 and 5/8) and gray (5Y 5/1) mottles; very weak coarse angular blocky structure with olive-gray (5Y 5/2) and olive (5Y 5/3) discontinuous clay films; friable; calcareous; clear smooth boundary.
C	46-60	Mixed gray (5Y 6/1 and 5/1) and yellowish-brown (10YR 5/4, 5/6, and 5/8) stratified silt loam and silty clay loam; moderate medium platy to fine angular blocky; friable; calcareous.

Type location: Iroquois County, Illinois (SE¼, SW¼, SE¼, Sec. 8, T25N, R14W.).

Series established: Iroquois County, Illinois, 1940.

Source of name: Name of village in Iroquois County, Illinois.

MATHERTON SERIES (Soil Map Units 12g and 12h)

General description. The Matherton series includes somewhat poorly drained, moderately deep loams over calcareous sand and gravel.

Detailed description. This series includes somewhat poorly drained soils formed in 20 to 42 inches of loamy material (the upper 20 inches may be silt loam), which is underlain by calcareous sand and gravel glacial outwash. The original vegetation was deciduous forest (elm, ash, oak, hickory; *Ulmus, Fraxinus, Quercus, Carya*). The soils are classified as Alfisols (Gray-Brown Podzolics): Udollic Ochraqualfs; fine-loamy over sandy skeletal, mixed, mesic family. The textural subsoil (Bt) horizon which begins at a depth of about a foot and continues downward to the underlying outwash has an average content of 18 to 35% clay and more than 15% sand. Above this horizon is a sequence of an organic matter enriched surface (0, A1, Ap) horizon and a paler subsurface (A2) horizon. Slope gradients are less than 5%. Soil types include silt loam, loam, and sandy loam. Associated soils are Fabius, Brady, and Busseyville series. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Very dark grayish-brown (10YR 3/2) sandy loam; weak medium granular structure; friable; slightly acid (pH 6.5); abrupt smooth boundary.
A2	8-12	Grayish-brown (10YR 5/2) sandy loam, with few fine distinct yellowish-brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; slightly acid (pH 6.5); clear wavy boundary.
B21t	12-20	Brown (10YR 5/3) sandy clay loam, with common medium distinct olive-brown (2.5Y 4/4) and many medium faint grayish-brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; slightly acid (pH 6.6); clear wavy boundary.
B22t	20-35	Grayish-brown (10YR 5/2) gravelly clay loam, with many medium distinct strong brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; common thin clay films on ped faces; neutral (pH 7.0); abrupt irregular boundary.
IIC	35-45	Light gray (10YR 7/1) stratified gravel and coarse sand; single grain; loose; calcareous; glacial outwash.

Type location: Shiawasee County, Michigan (SE¼, SW¼, SE¼, Sec. 21, T8N, R1E).

Series established: McHenry County, Illinois, 1960.

Source of name: Name of a village in Ionia County, Michigan.

METEA SERIES (Soil Map Unit 3)

General description. The Metea series includes well-drained sandy soils over calcareous sandy loam glacial till.

Detailed description. This series includes well-drained soils formed in 18 to 36 inches of fine to medium sands deposited over calcareous sandy loam glacial till. The original vegetation consisted of deciduous forest (oak, hickory; *Quercus, Carya*). The soils are classified as Alfisols (Gray-Brown Podzolics): Arenic

Hapludalfs; fine-loamy, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of 18 to 24 inches and continues on down into the underlying till, with an average content of 18 to 35% clay and more than 15% sand. Above this horizon is a sequence of A1 or Ap surface horizon and paler A2 horizon over a brown subsoil (B1) horizon. Slope gradients range from 1 to 7%. Soil types are sandy loam and loamy sand. Associated soils are Oshtemo and Lapeer series. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Dark grayish-brown (10YR 4/2) loamy sand to fine sandy loam; weak fine granular structure; very friable; neutral (pH 6.7); abrupt smooth boundary.
A2	8-16	Light yellowish-brown (10YR 6/4) loamy sand; weak very fine subangular blocky structure; very friable; medium acid (pH 5.7); gradual smooth boundary.
B1	16-23	Yellowish-brown (10YR 5/4) loamy sand; weak fine subangular blocky structure; very friable; strongly acid (pH 5.4); gradual wavy boundary.
B21	23-28	Yellowish-brown to dark yellowish-brown (10YR 5/4-4/4) loamy sand; weak medium subangular blocky structure; friable; strongly acid (pH 5.4); clear wavy boundary.
IIB22t	28-35	Brown to dark brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; thin continuous dark brown (10YR 3/3) clay films on ped surfaces; firm; medium acid (pH 5.8); gradual smooth boundary.
IIB23t	35-43	Brown to dark brown (7.5YR 4/4) sandy clay loam; moderate medium and coarse subangular blocky structure; thick patchy clay films; firm; medium acid (pH5.8); clear smooth boundary.
IIB3t	43-48	Dark yellowish-brown (10YR 4/4) sticky sandy loam; massive; thick patchy clay films in channels and bridging sand grains; firm to friable; neutral (pH 6.9); abrupt wavy boundary.
IIC	48-60	Light yellowish-brown (10YR 6/4) sandy loam; massive; friable; calcareous glacial till.

Type location: Fulton County, Indiana.
Series established: Fulton County, Indiana, 1941.
Source of name: Name of village in Cass County, Indiana.

MILFORD SERIES (Soil Map Unit 13g)

General description. The Milford series includes deep, poorly drained silt loams underlain at 3 to 4 feet by calcareous stratified sand with gravel.
Detailed description. This series includes poorly and very poorly drained soils developed in 30 to 50 inches of silt overlying stratified calcareous sand with gravel glacial outwash and/or glacio-lacustrine deposits. The original vegetation was a mixture of lowland deciduous forest (elm, ash, maple; *Ulmus, Fraxinus, Acer*) and wet prairie species (*Calamagrostis, Spartina, Andropogon*). The soils are classified as wet Mollisols (Humic Gleys): Typic Haplaquolls; fine, mixed, noncalcareous, mesic family. There is no differential clay accumulation in the subsoil (Cambic B horizon), and this soil has more than 35% clay throughout the silty portion of the solum. Above the B horizon is a thick black surface (A1, Ap) horizon. Soil types are silt loam and silty clay loam. Slope gradients are less than 2%. Associated soils are Sebawa, Will, Pella, and Montgomery, and other members of their catenas. This series can have fine textured silts and sands in the C horizon, but as mapped in Jefferson County it has been restricted to areas with coarse textured outwash as IIC material. The following description is representative of the series in the County.

Horizon	Depth, Inches	Description
Ap	0-10	Black (10YR 2/1) silty clay loam; moderate fine subangular blocky structure; firm; many roots; slightly acid (pH 6.4); abrupt smooth boundary.
A12	10-18	Black (10YR 2/1) silty clay loam; moderate fine subangular blocky structure; firm; abundant roots; slightly acid (pH 6.5); clear smooth boundary.
B1g	18-22	Very dark gray (10YR 3/1) heavy silty clay loam; common medium faint dark grayish-brown (2.5Y 4/2) and distinct olive-brown (2.5Y 4/4) mottles; moderate medium angular blocky structure; thin black (10YR 2/1) coatings on ped surfaces; neutral (pH 7.0); clear smooth boundary.
B21g	22-30	Gray (5Y 5/1) heavy silty clay loam; many medium faint grayish-brown (2.5Y 5/2) mottles and distinct dark yellowish-brown (10YR 4/4) mottles; moderate coarse prismatic breaking to moderate medium subangular blocky structure; very firm; many roots; thin dark gray (5Y 4/1) coatings; some sand grains and iron-manganese concretions present; clear, smooth boundary.
B22g	30-42	Gray (5Y 5/1) heavy silty clay loam; common medium distinct dark yellowish-brown to yellowish-brown (10YR 4/4, 5/6) mottles; moderate coarse prismatic breaking to moderate medium angular blocky structure; very firm; few roots; neutral (pH 7.2); clear, smooth boundary.
IIB3g	42-47	Dark gray (5Y 4/1) gravelly sandy loam; massive; sticky when wet; neutral (pH 7.3); abrupt irregular boundary.
IICg	47-60	Light gray to gray (5Y 6/1) sand and gravel; single grain; loose; calcareous glacial outwash.

Type location: Iroquois County, Illinois (NW¼, SW¼, Sec. 4, T26N, R14W).
Series established: Iroquois County, Illinois, 1939.
Source of name: Name of village in Iroquois County, Illinois.

MONTGOMERY SERIES (Soil Map Unit 21)

General description. The Montgomery series includes poorly drained clayey soils of lowlands on deep limy silts and clays.

Detailed description. This series includes poorly and very poorly drained soils developed in calcareous glacio-lacustrine silts and clays that may have loamy coverings up to 18 inches thick. The original vegetation was either deciduous forest (elm, ash, maple; *Ulmus, Fraxinus, Acer*) or wet prairie grasses (*Calamagrostis, Spartina, Andropogon*). The soils are classified as Wet Mollisols (Humic Gleys): Typic Haplaquolls; fine, mixed, noncalcareous, mesic family. The solum lacks evidence of differential clay accumulation and the subsoil (B) horizon is designated as a Cambic B. The upper 40 inches of the solum has more than 35% clay and less than 15% sand. The surface is dark colored to a depth of 12 inches or more and includes an Ap and/or one or more A1 subhorizon. Slope gradients are less than 2%. Types include loam, silt loam, silty clay loam, and silty clay. Associated soils are Del Rey, Tichigan, and Martinton series, and other members of their catenas. The following soil profile description is representative.

Horizon	Depth, Inches	Description
Ap	0-11	Black (10YR 2/1) to very dark gray 10YR 3/1) silty clay loam; weak, medium to coarse, subangular blocky structure; friable; slightly acid (pH 6.3); abrupt smooth boundary.

A12	11-15	Black to very dark gray (10YR 2/1 to 3/1) silty clay; moderate to strong, medium, angular blocky structure; firm; slightly acid becoming neutral (pH 7.0) in lower part; clear, wavy boundary.
B21g	15-24	Dark gray (10YR 4/1) silty clay with common, fine, distinct, brown (10YR 5/3) mottles; weak, coarse, prismatic, parting into moderate, coarse, angular blocky structure; firm, sticky; thin, dark gray (10YR 4/1) coatings or pressure faces on peds; common, soft, black manganese and iron concretions less than 1 mm.; diffused tubular tongues of dark gray (10YR 4/1) silty clay, 1 to 2" in diameter and 8 to 12" apart, extend vertically through horizon; neutral (pH 7.6) becoming mildly alkaline in lower part; gradual irregular boundary.
B22g	24-29	Grayish-brown (2.5Y 5/2) light silty clay with common, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, coarse, prismatic, parting to moderate, medium to coarse, angular blocky structure; firm; thin gray (10YR 5/1) coatings or pressure faces on peds; common soft, black manganese and iron concretions less than 1 mm in diameter; distinct tubular tongues of gray (10YR 51) silty clay, 1 to 2" in diameter and 8 to 12" apart, extend vertically through horizon; mildly alkaline (pH 7.8); gradual irregular boundary.
B3g	29-38	Gray (10YR 6/1) heavy silty clay loam with many, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, coarse, prismatic, parting to weak, coarse, angular blocky structure; firm; sticky; thin gray (10YR 5/1) coatings or pressure faces on peds; distinct tubular tongues of gray (10YR 5/1) silty clay, 1 to 2" in diameter and 8 to 12" apart, extend vertically through the horizon; mildly alkaline; calcareous; gradual smooth boundary.
C1g	38-48	Gray (10YR 6/1) heavy silty clay loam with many medium, distinct yellowish-brown (10YR 5/4) mottles; weak coarse angular blocky structure; firm; sticky; thin gray (10YR 5/1) clay films or pressure faces on peds; distinct tabular tongues of gray (10YR 5/1) silty clay, 1 to 2" in diameter and 8 to 12" apart, extend vertically through this horizon; mildly alkaline; calcareous.

Type location: Greene County, Indiana (SE¼, Sec. 26, T6N, R7W).
Series established: Monroe County, Indiana, 1922.
Source of name: Name of village in Daviess County, Indiana.

MOSEL SERIES (Soil Map Unit 17)

General description. The Mosel series includes somewhat poorly drained loams formed on level lowlands from 1 to 3 feet of loams over calcareous silts and clays. *Detailed description.* This series includes somewhat poorly drained soils formed in 18 to 36 inches of loamy material over calcareous glacio-lacustrine silts and clays. Carbonates have been leached to a depth of about 30 to 40 inches. The original vegetation was deciduous forest (elm, maple, basswood, ash; *Ulmus, Acer, Tilia, Fraxinus*). The soils are classified as Alfisols (Gray-Brown Podzolics): Aquollic Hapludalfs; fine-loamy, mixed, mesic. The textural subsoil (Bt) horizon begins at a depth of about 12 to 24 inches and continues downward extending into the underlying silt and clay. It has an average content of 18 to 35% clay and more than 15% sand. The surface horizons consist of a dark A1 or Ap, and a paler subsurface A2. Slope gradients range up to 6%. Associated soils are Aztalan and Kibbie series, and members of their catenas. Soil types include sandy loam, loam, and silt loam. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Very dark brown (10YR 2/2) sandy loam to loam; moderate medium granular structure; friable; neutral (pH 7.0); abrupt smooth boundary.
A2	8-15	Brown (10YR 5/3) sandy loam with a few fine distinct strong brown (7.5YR 5/6) mottles; numerous earthworm tubes filled with Ap colored material; weak fine subangular blocky structure; friable; neutral (pH 6.7); clear smooth boundary.
B1	15-20	Dark yellowish-brown (10YR 4/4) sandy loam; a few fine distinct brownish-yellow (10YR 6/6) and medium grayish-brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; neutral (pH 6.8); clear smooth boundary.
B21t	20-27	Brown to dark brown (7.5YR 4/4) sandy clay loam; many fine distinct strong brown (7.5YR 5/6) and a common medium distinct brown (7.5YR 5/2) mottles; moderate medium subangular blocky structure; clay films bridging sand grains; neutral (pH 6.8); clear smooth boundary.
IIB22t	27-33	Dark brown (7.5YR 4/2-4/4) silty clay loam; common fine distinct brown (7.5YR 5/2) and few medium distinct yellowish-red (5YR 4/6) mottles; moderate fine prismatic parting to strong fine and medium angular blocky structure; thin continuous dark brown (7.5YR 3/2) clay films on ped surfaces; numerous ¼-inch wide seams of sand in old cleavage planes; firm; neutral (pH 7.2); clear smooth boundary.
IIB3	33-37	Dark yellowish-brown (10YR 4/4) silty clay loam; common fine distinct grayish-brown (10YR 5/2) mottles; moderate medium prismatic parting to moderate medium angular blocky structure; thin patchy dark brown (7.5YR 3/2) clay films; firm; mildly alkaline (pH 7.5); abrupt irregular boundary.
IIC	37-50	Brown (10YR 5/3) silty clay loam; weak medium prismatic parting to moderate medium angular blocky structure; common fine distinct light brownish-gray (10YR 6/2) mottles; firm; laminated silts and clays; calcareous glacio-lacustrine materials.

Type location: Fond du Lac County, Wisconsin.
Series proposed: Sheboygan County, Wisconsin, 1950.
Source of name: Name of township in Sheboygan County, Wisconsin.

MUCK (Soil Map Units 24, 25)

General description. Muck is a soft, fluffy, or pasty organic soil of bogs, particularly of drained and cultivated ones.
Detailed description. Mucks (Bog soils; Saprists) are highly decomposed, finely divided organic soils that usually contain almost no mineral matter, but may consist of up to 60% by weight sand, silt, and/or clay. The organic deposits in which these soils have developed range in depth from about a foot to 20 feet, and are usually stratified. The original vegetation consisted of sedges (*Carex*), leatherleaf (*Chamaedaphne calyculata*), willows, and alder (*Salix, Alnus*). Associated soils are peats and Humic Gley soils (Kokomo, Montgomery, Pella, and others). The following soil profile description of a Houghton muck is representative.

Horizon	*Depth, Inches*	*Description*
1	0-10	Black (N 2/0) muck; amorphous; very friable when moist; less than 1/3 fibers by volume; medium acid (pH 6.0); clear smooth boundary.

2	10-30	Black (N 2/0) muck; moderate coarse angular blocky structure; friable when moist; less than 1/3 fibers by volume; slightly acid (pH 6.5); diffuse smooth boundary.
3	30-50	Dark reddish-gray to brown (5YR 4/2-3/2) mucky peat; matted; nonsticky when wet; more than 2/3 by volume of fibers more than a millimeter long; neutral (pH 7.0); clear smooth boundary.
4	50-60	Very dark gray (5Y 3/1), very marly sedimentary peat; massive; slightly sticky when wet; less than 1/3 fibers by volume; calcareous; abrupt smooth boundary.
IICg	60-70	Olive-gray (5Y 5/2) silty clay loam; massive; sticky when wet; neutral (pH 7.0).

Type location: Clinton County, Michigan.

Series established: Roscommon County, Michigan, 1924.

Source of name: Name of lake, Roscommon County, Michigan.

NAVAN SERIES (Soil Map Unit 20)

General description. The Navan series includes poorly drained loams and silt loams underlain at about 2 feet by very limy silts and clays.

Detailed description. This series includes poorly and very poorly drained soils developed in 18 to 36 inches of loamy material, glacial outwash, and beach deposits, over calcareous glacio-lacustrine silts and clays. The original vegetation was either lowland deciduous forest (elm, ash, maple; *Ulmus, Fraxinus, Acer*) or wet prairie species (*Calamagrostis, Spartina, Andropogon*). The soils are classified as wet Mollisols (Humic Gleys): Typic Argiaquolls; fine-loamy, mixed, noncalcareous, mesic family. The textural subsoil (Btg) begins at a depth of about 18 inches and continues downward 18 to 24 inches extending into the underlying silt and clay. This horizon has an average content of 18 to 35% clay and more than 15% sand. Overlying this horizon is a thick black surface (A1, Ap) horizon. Slope gradients are less than 2%. Associated soils are Montgomery, Colwood, and Keowns series. The following soil profile description was observed in the NW¼, SW¼, Sec. 35, T5N, R16E, Jefferson County, Wisconsin.

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Black (10YR 2/1) loam; moderate fine granular structure; friable; abundant plant roots; neutral (pH 7.2); abrupt smooth boundary.
A12	7-14	Black (10YR 2/1) loam with moderate fine to medium subangular blocky structure; abundant roots; friable; neutral (pH 7.3); clear wavy boundary.
B21tg	14-18	Grayish-brown (2.5Y 5/2) heavy loam with moderate fine subangular blocky structure; many medium distinct mottles (10YR 5/6 and 5/2); friable; streaks and tongues of dark surface soil extend through this horizon; mildly alkaline (pH 7.5); clear wavy boundary.
B22tg	18-24	Grayish-brown (2.5Y 5/2) heavy loam with moderate fine to medium subangular blocky structure; many medium distinct mottles (10YR 5/6, 5/2); friable; a few streaks of dark material extends into this horizon; mildly alkaline (pH 7.8); clear wavy boundary.
I&IIB23tg	24-30	Grayish-brown (2.5Y 5/2) sandy clay loam with moderate medium subangular blocky structure; mottled as in the above horizon; slightly plastic when wet; calcareous; clear wavy boundary.

IICg	30-40	Gray (5Y 6/1) silty clay loam above to silty clay below; slightly plastic when wet; moderate coarse angular blocky structure above to massive below; many old root channels; calcareous.

Type location: Racine County, Wisconsin (SW¼, SE¼, Sec. 24, T2N, R19E).
Series proposed: Jefferson County, Wisconsin, 1957.
Source of name: Name of village in Jefferson County, Wisconsin.

OAKVILLE SERIES (Soil Map Unit 11)

General description. The Oakville series includes deep sands which are weakly calcareous at a depth of 6 to 10 feet.
Detailed description. This series includes excessively drained sandy soils formed in deep deposits of slightly calcareous eolian sand. The original vegetation was scattered oaks (*Quercus*) with a sparse ground cover. The soils are classified as sandy Entisols (Regosols): Typic Udipsamments; sandy, mixed, nonacid, mesic family. The only visible evidence of horizonation is due to differences in organic matter content and in color. Slopes range from 0 to 25%. Associated soils include Spinks and Rodman series. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Very dark grayish-brown (10YR 3/2) fine sand; weak fine granular structure; very friable; many roots; neutral; abrupt smooth boundary (pH 7.0).
B21	7-13	Strong brown (7.5YR 5/6) fine sand; single grain; loose; few roots; very dark grayish-brown (10YR 3/2) sand in root channels; slightly acid; clear wavy boundary (pH 6.6).
B22	13-22	Yellowish-brown (10YR 5/6) fine sand; single grain; loose; few roots; slightly acid (pH 6.6); clear wavy boundary.
B3	22-34	Brown (10YR 5/3) fine sand; single grain; loose; few roots; neutral (pH 7.0); gradual wavy boundary.
C	34-66	Pale brown (10YR 6/3) fine sand; single grain; loose; calcareous.

Type location: Macomb County, Michigan (NE¼, SW¼, Sec. 9, T3N, R12E).
Series proposed: Ionia County, Michigan, 1959.
Source of name: Name of a village in Monroe County, Michigan.

OSHTEMO SERIES (Soil Map Unit 10)

General description. The Oshtemo series includes droughty deep sandy loams over limy sand and gravel.
Detailed description. This series includes well to excessively drained soils with 40- to 60-inch solums which have formed in calcareous sandy glacial outwash with some gravel. The original vegetation was deciduous forest (oak, hickory; *Quercus, Carya*). These soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalfs; coarse-loamy, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of 12 to 18 inches and continues downward to a depth of 40 to 60 inches or more with an average of less than 18% clay and 50 to 70-85% sand. Above this horizon is a sequence of a dark surface (A1, Ap) horizon and paler subsurface (A2) horizon. Slope gradients are from 0 to 12%.

Soil types are sandy loam and loamy sand. Associated soils are Boyer, Spinks, and Fox series. The following soil profile description is representative of the series in the County.

Horizon	Depth, Inches	Description
Ap	0-8	Dark grayish-brown (10YR 4/2) sandy loam; moderate medium granular structure; friable; neutral (pH 7.0); abrupt smooth boundary.
A2	8-14	Brown (10YR 5/3) loamy sand; weak medium subangular blocky structure; numerous earth worm tubes filled with Ap material; very friable; slightly acid (pH 6.5); clear smooth boundary.
B1	14-19	Brown to dark brown (10YR 4/3) sandy loam; weak medium subangular blocky structure; slightly acid (pH 6.1); clear smooth boundary.
B21t	19-30	Brown to dark brown (7.5YR 4/4) sandy loam to sandy clay loam; moderate medium and coarse subangular blocky structure; thin patchy very dark brown (7.5YR 4/2) clay films; firm; slightly sticky when wet; slightly acid (pH 6.2); gradual smooth boundary.
B22t	30-42	Reddish-brown (5YR 4/3-4/4) sandy loam; weak coarse subangular blocky structure; clay films bridging sand grains; friable; sticky when wet; slightly acid (pH 6.4); gradual smooth boundary.
B3	42-50	Reddish-brown (5YR 5/4) loamy sand; massive; very friable; neutral (pH 6.8); clear wavy boundary.
C	50-60	Yellowish-brown (10YR 5/4) sand with thin gravel layers; single grain; loose; stratified; calcareous outwash.

Type location: St. Joseph County, Michigan (SW¼, SW¼, Sec. 18, T6S, R10W).
Series established: Kalamazoo County, Michigan, 1922.
Source of name: Name of a village in Kalamazoo County, Michigan.

PEAT (Soil Map Units 25,25)

General description. Peat is a soft, fibrous to woody, organic soil of bogs.
Detailed description. Peat (Bog soils; Fibrists) are raw, relatively undecomposed (as compared to mucks), organic soils which may have almost no mineral matter, or may contain up to 70 or 80% by weight of mineral grains. The deposits of organic debris range in depth from about a foot to 20 feet and are usually layered. The original vegetation included sphagnum (*Sphagnum*), Laborador tea (*Ledum*), bog Rosemary (*Andromeda*), bog Laurel (*Kalmia*) Leatherleaf (*Chamaedaphne calyculata*), sedge (*Carex*). Tree species include tamarack (*Larix laricina*) and ash (*Fraxinus*). Poison sumac (*Rhus vernix*), alder (*Alnus*), and other woody shrubs may be present. Associated soils are mucks and Humic Gley soils (Kokomo, Montgmery, Pella and others). With drainage and cultivation, a surface peat layer can be expected to be converted into a muck by decomposition of the fibers.

Although the slope of the surface of a peat bog may average less than 2%, anyone who has walked across a bog knows that sphagnum and leatherleaf and other shrubby plants may grow in the form of large cushions, giving the bog a bumpy microtopography with a relief of about 2 feet which is increased by the weight of the human intruder or, for that matter, of deer and cattle on the more stable bogs. Ant mounds a foot or two high may be present. Occasional peat fires increase the relief by creating irregular depressions. Commonly there is a marshy moat several feet wide at the periphery of a peat bog in which sedges predominate. The moat may be a result of well aerated runoff from the surrounding uplands which promote decomposition and consolidation to lower the surface of the deposit adjacent to the hillslopes.

Where groundwater seepage or springs occur, either along foot slopes or in

sediments of lowlands, masses of peat may occur as mounds or terraces with slopes up to 12%. Figure 20 shows the distribution of peat mounds that rise above the level of surrounding Humic Gley soils or peats and mucks. The maximum height is about 20 feet and breadth, 300 feet. Drainage ditches through some of these mounds have encountered slowly bubbling springs. Analysis of wood in peat with abundant spruce pollen and sphagnum spores[8] at the base of one mound (SE¼, SE¼, Sec. 9, T5N, R15E) by C^{14} yielded the date 12,800±220 before present, indicating that some of the mounds began to form soon after the glacial ice present in the county during Woodfordian time had melted.

The following soil profile description is representative. It is classified as a sedge peat (Fibrist), of Greenwood series of open bogs supporting sedges, reeds, and grasses. The presence of tamarack and sphagnum vegetation is typical, but has not as yet influenced the soil profile, except in reaction.

Horizon	*Depth, Inches*	*Description*
1	0-2	Dark reddish-brown (5YR 2/2) fibrous mat of leatherleaf root stems and leaves with some sphagnum moss; very strongly acid (pH 4.5); abrupt smooth boundary.
2	2-6	Black (5YR 2/1), somewhat disintegrated sedge peat; numerous roots; more than 2/3 by volume fibers; very strongly acid (pH 4.5); clear smooth boundary.
3	6-30	Dark brown (7.5YR 3/2), somewhat disintegrated sedge peat; weakly matted with leaves and stems packed horizontally; more than 2/3 by volume of fibers; medium acid (pH 5.6); clear smooth boundary.
4	30-70	Similar to the above layer, but with some wood present; neutral (pH 6.9); clear smooth boundary.
5	70-80	Very dark gray (5Y 3/1) sedimentary peat; massive; less than 1/3 fibers by volume; calcareous; abrupt smooth boundary.
IICg	80-90	Olive-gray (5Y 5/2) clay loam; massive; sticky when wet; calcareous.

Type location: NE¼, SW¼, Sec. 5, T37N, R3W, Sheboygan County, Michigan.
Series established: Ogemaw County, Michigan, 1923.
Source of name: Name of a railroad siding in Ogemaw County, Michigan.

PELLA SERIES (Soil Map Unit 6)

General description. The Pella series includes deep, black silty soils over limy silts and loams.

Detailed description. This series includes poorly and very poorly drained soils formed in 30 to 50 inches of silty material over calcareous glacial drift, usually till, but may have some lenses of outwash and lacustrine material. The solum is usually leached of carbonates to a depth of around 36 inches. The original vegetation was either lowland deciduous forest (elm, maple, ash; *Ulmus, Acer, Fraxinus*) or wet prairie species (*Calamagrostis, Spartina* and *Andropogon*). The soils are classified as wet Mollisols (Humic Gleys): Typic Haplaquolls; fine-silty, mixed, non-calcareous, mesic family. The solum consists of a thick black surface (A1, Ap) horizon over a gleyed subsoil (cambic B) horizon. Several inches of peat may be present on the surface. The cambic B horizon has an average content of 18 to 35% clay and less than 15% sand. Slope gradients are less than 4%. Types include silt loam and silty clay loam. Associated soils are Kokomo, Brookston, and Harpster. The following soil profile was observed in the SW¼, SE¼, SW¼, Sec. 12, T8N, R15E. This soil had not been cultivated and lacks a sufficiently thick A1 horizon to meet the requirements for a Mollisol. This profile is an Inceptisol, but

[8] Pollen report from Thompson Webb, III, and Henry Cole, Research Assistants, Meteorology Department, The University of Wisconsin, Madison.

would probably be converted to a Mollisol by cultivation. Thus many of the Humic Gley soils presently classified as Mollisols, were probably Inceptisols prior to cultivation. Analytical data for this profile are given in Tables 9 and 10.

Horizon	*Depth, Inches*	*Description*
01 & 02	1-0	Maple and elm leaves and twigs over partly decomposed leaves and twigs.
A1[9]	0-7	Black (N 2/0) silty clay loam; moderate medium granular to moderate very fine subangular blocky.
A3g[9]	7-12	Dark gray to gray (5Y 4/1-5/1) silty clay; moderate very fine subangular blocky to angular blocky; firm; neutral (pH 6.9) gradual smooth boundary; small krotovina 5 to 15 mm diameter of A1 material.
B1g[9]	12-22	Gray to olive-gray (5Y 5/1-5/2) silty clay loam; very weak medium prismatic breaking to moderate fine to medium subangular blocky; firm; few fine distinct light olive-brown (2.5Y 5/6) mottles; few fine prominent black (N2/0) soft Mn concretions; neutral (pH 7.0), abrupt smooth boundary.
B2g[9]	22-32	Olive-gray (5Y 5/2) silty clay loam; weak medium prismatic breaking to moderate medium subangular blocky; firm; many fine to medium prominent reddish-brown (5YR 5/6) mottles; mottled zones up to 5mm, parallel new and old root channels; few fine black (N 2/0) soft Mn concretions; neutral (pH 7.1), weakly calcareous; clear smooth boundary.
I&II B31g	32-41	Olive (5Y 5/3) silt loam; very weak coarse prismatic breaking to weak coarse subangular blocky; firm; common fine to medium prominent reddish-brown (5YR 5/6) mottles; oxidized zone along roots and Mn concretions same as previous horizon; neutral (pH 7.3), weakly calcareous; abrupt wavy boundary.
IIB32g	41-46	Light olive-brown (2.5Y 5/4) sandy loam; massive; friable; common fine to medium distinct yellowish-brown (10YR 5/6) mottles; mildly alkaline; calcareous (pH 7.8); clear wavy boundary.
IIC	46-58	Brownish-yellow (10YR 6/6) sandy loam; massive; friable; common fine faint brownish-yellow to olive-yellow (10YR 6/8-2.5Y 6/8) mottles; calcareous glacial till.

Type location: Douglas County, Illinois (NW¼, Sec. 17, T16N, R7E).
Series established: Ford County, Illinois, 1929.
Source of name: Name of a township in Ford County, Illinois.

PLANO SERIES (Included in Soil Map Units 1, 8)

General description. The Plano series (Figure 6) includes well to moderately well drained deep (30 to 50 inches) silty soils with thick, dark surface soils. *Detailed description.* This series includes well to moderately well drained soils formed in 30 to 50 inches of silty material (loess) over calcareous sandy loam to loam glacial till. The original vegetation was prairie grasses (*Andropogon gerardi* and *A. scoparius*) and associated plants. The soils are classified as Mollisols (Brunizems): Typic Argiudolls; fine silty, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of about a foot and continues downward through the silt mantle and extends into the underlying till. The upper 20 inches of this horizon has an average content of 18 to 35% clay and less than 15% sand, coarser than very fine sand. Overlying horizons include a very dark

[9] Ciolkosz 1967) found iron concretions in the sand fractions of this horizon.

surface (A1, Ap) horizon and a transitional subsurface (A3) horizon. Slope gradients range from 0 to 12%. The silt loam is the only soil type. Associated soils include St. Charles and Dodge.

Horizon	*Depth, Inches*	*Description*
Ap	0-10	Black (10YR 2/1) silt loam; moderate, medium granular structure; friable; neutral (pH 6.8) abrupt smooth boundary.
A3	10-14	Very dark grayish-brown (10YR 3/2) silty clay loam; weak medium subangular blocky structure; firm; medium acid (pH 5.9); clear smooth boundary.
B1	14-17	Brown to dark brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; firm; medium acid (pH 5.7); clear smooth boundary.
B21t	17-26	Brown to dark brown (10YR 4/3) silty clay loam; moderate fine and medium subangular blocky structure; thin patchy dark brown (10YR 3/3) clay films on ped surfaces; firm; strongly acid (pH 5.4); gradual smooth boundary.
B22t	26-37	Brown to dark brown (10YR 4/3) silty clay loam; moderate coarse subangular blocky structure; thin continuous dark brown (10YR 3/3) clay films on ped surfaces and in fine channels; firm; strongly acid (pH 5.3); clear wavy boundary.
IIB23t	37-43	Dark brown (10YR 3/3) sandy clay loam; moderate coarse subangular blocky structure; thick patchy very dark grayish-brown (10YR 3/2) clay films on ped surfaces and in channels; firm; medium acid (pH 6.0); clear smooth boundary.
IIB3	43-46	Brown to dark brown (7.5YR 4/4) sticky sandy loam; weak coarse subangular blocky structure; friable; neutral (pH 7.0); abrupt wavy boundary.
IIC	46-50	Light yellowish-brown (10YR 6/4) sandy loam; massive; friable; calcareous glacial till.

Type location: LaSalle County, Illinois (NW¼, NW¼, Sec. 10, T34N, R3R).
Series established: Kendall County, Illinois, 1941.
Source of name: Name of a village in Kendall County, Illinois.

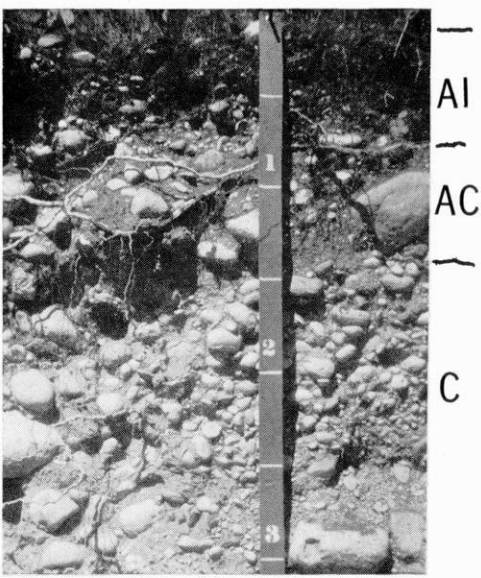


Figure 27. Rodman gravelly sandy loam — (above) View of an excavation in an esker on which Rodman gravelly sandy loam has formed. (left) This Rodman gravelly sandy loam developed in calcareous, coarse glacial outwash with some slight additions of wind-blown fines in the upper horizons. The stony, cobbly C horizon lies at a depth of about 16 inches.

RODMAN SERIES (Soil Map Unit 9)

General description. The Rodman series (Figure 27) includes stony sandy loams over deep deposits of limy sand and gravel.

Detailed description. This series includes coarse-textured excessively drained soils formed in deposits of calcareous glacial outwash. The original vegetation was scattered oaks (*Quercus*), prairie grasses (*Andropogon* sp.), and associated plants. The soils are classified as Mollisols with a minimum of profile development (Regosols): Typic Hapludolls; sandy skeletal, mixed, carbonatic, mesic family: grading to Rendollic Eutrochrepts; loamy skeletal, mixed, carbonatic mesic family. The solum consists of a dark A1 horizon over calcareous sand and gravel of kames and eskers. The maximum content of silt and clay may reach 10% at the surface and diminish to one to two percent at 15 inches. Gravel and stones may occupy half of the volume of the surface soil and 80% of the C horizon. Associated soils include Fox, Casco, and Spinks series. The following soil profile was observed (Gaikawad and Hole, 1965) in an esker-kame ridge (later excavated and removed) in Sec. 14, T5N, R16E, Jeffersos County, Wisconsin.

Horizon	*Depth, Inches*	*Description*
A11	0-2	Very dark brown (7.5YR 2/2) gravelly, cobbly, sandy loam; weak fine granular structure between single-grain coarse skeletal particles; few carbonate coatings present on the undersides of stones; very friable; some organic stains on stones; in this and lower horizons most stones are of local dolomites but erratics of metamorphic and igneous rocks are present; 58% coarser than 2 mm; pH 7.5; cec 38.4 in fine earth; gradual smooth boundary.
A12	2-5	Very dark brown (10YR 2/2) gravelly cobbly coarse sandy loam; single grain; loose; carbonate coatings present on undersides of stones; 85% coarser than 2 mm; pH 7.6; cec 19.2; clear smooth boundary.
A13	5-10	Dark brown (7.5YR 3/2) gravelly stony coarse sandy loam; single grain; loose; carbonate coatings with stalactite-like pendants present on lower surfaces of stones; 87% coarser than 2 mm; pH 7.7; cec 9.9; gradual, smooth boundary.
B	10-19	Dark yellowish-brown (10YR 4/4) gravelly cobbly loamy coarse sand; single grain; loose; carbonate coatings present on the under surfaces of stones; 79% coarser than 2 mm; pH 7.9; cec 2.1; gradual smooth boundary.
C1	19-132	Brown (10YR 5/3) gravelly cobbly loamy coarse sand with strata of coarse sand; single grain; loose; carbonate coatings present on the under surfaces of many stones; pH 8.2: 82% coarser than 2 mm.
C2	132-200	As above, but with few carbonate coatings.
Type location:		Sheboygan County, Wisconsin.
Series established:		Jefferson County, N.Y., 1911.
Source of name:		Probably for the name of a village in Jefferson County, N.Y.

ST. CHARLES SERIES (Soil Map Unit 1)

General description. The St. Charles series includes well-drained deep silty soils over limy sandy loam to loam glacial till.

Detailed description. This series includes well to moderately well drained soils formed in 30 to 50 inches of silty material (loess) overlying calcareous sandy loam or loam glacial till. The original vegetation was deciduous forest (oak, hickory, basswood, maple: *Quercus, Carya, Tilia, Acer*). The soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalfs; fine-silty, mixed, mesic

family. The textural subsoil (Bt) horizon starts at a depth of about 15 inches and continues downward through the silt mantle and extends into the underlying till. The upper 20 inches of this horizon has an average content of 18 to 35% clay and less than 15% sand. Above this horizon are a dark A1 and pale A2 horizons. Slope gradients range from 0 to 12%. The silt loam is the only soil type. Associated soils are Dodge, McHenry, and Theresa series. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
O1	1-2	Leaf and grass litter.
A1	0-5	Very dark grayish-brown (10YR 3/2) silt loam; weak fine granular structure; friable; slightly acid (pH 7.6); roots numerous; abrupt smooth boundary.
A2		Brown (10YR 5/3) silt loam; moderate medium platy structure; friable; medium acid (pH 5.8); many roots; abrupt smooth boundary.
B1	12-18	Dark brown (10YR 4/3) light silty clay loam; moderate fine subangular blocky structure with thin patchy very pale brown (10YR 8/3) silt coatings; firm; medium acid (pH 5.7); clear smooth boundary.
B21t	18-22	Dark yellowish-brown (10YR 4/4) silty clay loam; moderate fine and medium subangular blocky structure with thin continuous brown (7.5YR 4/4) clay films and some very pale brown (10YR 8/3) silt coatings; firm; medium acid (pH 5.6); clear smooth boundary.
B22t	22-35	Dark yellowish-brown (10YR 4/4) silty clay loam with common faint yellowish-brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure with thin continuous brown (7.5YR 4/4) clay films; medium acid (pH 5/6); gradual smooth boundary.
B31t	35-41	Yellowish-brown (10YR 5/4) light silty clay loam with few fine distinct pale brown (10YR 6/3) and common fine faint yellowish-brown (10YR 5/8) mottles; weak medium and coarse subangular and angular blocky structure; firm; medium acid (pH 5.7); gradual smooth boundary.
B32t	41-52	Yellowish-brown (10YR 5/4) heavy silt loam with many medium and coarse faint yellowish-brown (10YR 5/8) and brown (10YR 5/3) mottles; weak coarse angular blocky structure; friable; medium acid (pH 5/7); gradual wavy boundary.
IIBt	52-62	Dark brown (7.5YR 4/4) heavy sandy loam to sandy clay loam; weak coarse angular blocky structure; friable; slightly sticky when wet; neutral (pH 7.0); clear wavy boundary.
IIC	62-70	Light yellowish-brown (10YR 6/4) sandy loam; massive; friable; calcareous glacial till.

Type location: LaSalle County, Illinois (NE¼, NE¼, NW¼, Sec. 8, T36N, R3E).

Series established: Kendall County, Illinois, 1941.

Source of name: Name of a city in Kane County, Illinois.

SALTER SERIES (Soil Map Unit 16)

General description. The Salter series includes well-drained loams over stratified limy fine sands and silts.

Detailed description. This series includes well to moderately well-drained soils formed in stratified calcareous glacio-lacustrine fine sands and silts. Carbonates have been leached from the solum to a depth of 2 or 3 feet, usually less than 40 inches. The original vegetation was deciduous forest (oak, hickory, maple; *Quercus, Carya, Acer*). The soils are classified as Inceptisols (weakly developed Gray-Brown Podzolics): Typic Eutrochrepts; coarse-loamy, mixed, mesic family. There is little evidence of significant clay accumulation in the subsoil horizon, which has an average content of less than 18% clay and between 15 to 70-85% sand coarser than very fine sand. Above this horizon is a dark thin surface (A1) horizon and paler subsurface (A2) horizon. Slope gradient range from 0 to 12%. Soil types include sandy loam, loam, and silt loam. Associated soils are Sisson and Hebron series and other members of their catenas. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
O1	1-0	Litter of deciduous forest leaves and twigs.
A1	0-4	Very dark grayish-brown (10YR 3/2) silt loam; weak medium granular structure; friable; many roots; neutral (pH 6.8); clear wavy boundary.
A2	4-7	Brown (10YR 5/3) coarse silt; weak fine platy structure; very friable; many roots; neutral (pH 7.2); clear wavy boundary.
B2	7-12	Strong brown (7.5YR 4/6) coarse silt; weak very fine subangular blocky structure breaking to weak medium platy; very friable; many roots; moderately alkaline (pH 7.9); gradual irregular boundary.
B3	12-20	Brown (7.5YR 5/4) loamy very fine sand; weak medium subangular blocky structure; very friable; many roots; moderately alkaline (pH 8.2); gradual irregular boundary.
C	20-30	Brown 7/5YR 5/4) stratified loamy very fine sand and silt; single grain to very weak medium platy structure; very friable; few distinct fine mottles of yellowish-red (5YR 5/6); moderately calcareous; glacio-lacustrine silt and very fine sand.
Type location:		Outagamie County, Wisconsin (NE¼, Sec. 5, T23N, R15E).
Series proposed:		Washington County, Wisconsin, 1944.
Source of name:		Name of a small settlement in Washington County, Wisconsin.

SAYLESVILLE SERIES (Soil Map Unit 15)

General description. The Saylesville series includes moderately well drained soils formed in calcareous stratified silts and clays with local coverings of loam or silt loam.

Detailed description. This series includes well to moderately well drained soils formed in stratified calcareous glacio-lacustrine silts and clays of former lake basins. A thin surficial cover of loamy material up to 18 inches thick may be present on this series. The original vegetation was deciduous forest which included oak, hickory, and maple *(Quercus, Carya, Acer).* The soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalfs; fine, illitic, mesic family. The textural subsoil (Bt) horizon begins at a depth of about 12 to 18 inches and continues down another 12 to 18 inches, with an average content of more than 35% clay and a sufficient increase to qualify as an argillic horizon. Above this horizon is a sequence of dark surface (A1, Ap) soil, paler subsurface (A2) horizon, and transitional (A3, B1) horizons. Slope gradients range from 0 to 12%. Types include loam and silt loam. Associated soils are Camden, Hebron, Sisson, and

Salter series and members of their catenas. The following soil profile, for which analytical data are given in Tables 9 and 11, was observed in the SW¼, SW¼, Sec. 9, T5N, R16E, Jefferson County, Wisconsin.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Dark grayish-brown (10YR 4/2) loam which is light brownish-gray (10YR 6/2) when dry; moderate fine to medium subangular blocky structure; firm; abrupt smooth boundary neutral (pH 7.0).
A2	8-11	Brown (10YR 5/3) sandy loam which is light brownish-gray (10YR 6/2) when dry; moderate thick platy and fine subangular blocky structure; firm, somewhat fragic when dry; moderately alkaline (pH 8.0); clear wavy boundary.
B1	11-14	Brown to dark brown (10YR 4/3) loam; moderate medium subangular blocky structure with thin patchy coatings of silt and very fine sand which are brown (10YR 5/3) moist and light gray (10YR 7/2) dry; firm; moderately alkaline (pH 8.0); clear smooth boundary.
IIB21t	14-21	Brown to dark brown (7.5YR 4/2) clay; strong very fine to fine angular blocky structure with thin continuous brown to dark brown (7.5YR 4/2) clay coatings on ped surfaces; firm, moderately alkaline (pH 8.0); gradual smooth boundary.
IIB22t	21-26	Dark yellowish-brown (10YR 4/4) silty clay; strong fine angular blocky structure with thick continuous dark brown (7.5YR 3/2-4/2) coatings and some thick patchy very dark brown (10YR 2/2) coatings near the bottom of the horizon; firm; moderately alkaline (pH 8.0); abrupt wavy boundary.
IIB3t	26-29	Brown (10YR 5/3) silty clay; strong fine to medium angular blocky structure with thick patchy very dark grayish-brown (10YR 3/2) clay coatings on ped surfaces; firm; calcareous; clear wavy boundary.
IIC	29-45	Brown (10YR 5/3) silty clay loam; moderate medium platy and fine angular blocky structure with dark brown (7.5YR 4/2) clay coatings on surfaces of some cleavages, there were some thin very pale brown (10YR 7/3) to light greenish-gray (5GY 7/1) coatings of silt and very fine sand and a few fine distinct brownish-yellow (10YR 6/6) mottles; firm; calcareous; glacio-lacustrine silts and clays.
Type location:		Washington County, Wisconsin (SE¼, NW¼, Sec. 29, T9N, R20E).
Series proposed:		Jefferson County, Wisconsin.
Source of name:		Waukesha County, Wisconsin.

SEBEWA SERIES (Soil Map Unit 13h)

General description. The Sebewa series includes poorly drained moderately deep loams and silt loams underlain at 2 to 3 feet by calcareous sand and gravel.

Detailed Description. This series includes poorly and very poorly drained soils formed in 20 to 42 inches of loamy materials (the upper 20 inches may be silt loam) over calcareous glacial outwash sand and gravel. The original vegetation was deciduous forest (elm, ash, maple, oak, hickory; *Ulmus, Fraxinus, Acer, Quercus, Carya*). The soils are classified as wet Mollisols (Humic Gleys): Typic Argiaquolls; fine-loamy over sand or sandy skeletal, mixed, noncalcareous, mesic family. The textural subsoil (Btg) horizon begins at a depth of about a foot and continues down another 2 feet with an average content of 18 to 35% clay and more than 15% sand. Coarse textured outwash is within 42 inches of the soil surface. Above this horizon is a thick black surface (A1, Ap) horizon. Slope gradi-

ents are less than 4%. Associated soils are Gilford and Will series and members of their catenas. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-11	Black (10YR 2/1) loam; moderate fine granular structure; friable; many roots; slightly acid (pH 6.3); abrupt smooth boundary.
B21tg	11-14	Dark gray (10YR 4/1) light clay loam, few fine faint dark yellowish-brown (10YR 4/4) mottles; strong medium subangular blocky structure; firm; many roots; very dark brown (10YR 2/2) clay films on most peds; slightly acid (pH 6.5); clear wavy boundary.
B22tg	14-36	Grayish-brown (10YR 5/2) gravelly clay loam, common medium distinct yellowish-brown (10YR 5/8) mottles; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous clay films; neutral (pH 7.0); abrupt wavy boundary.
IIC	36-40	Grayish-brown (2.5Y 5/2) sand and gravel; single grain; loose; calcareous; stratified; glacial outwash.
Type location:		Lapeer County, Michigan (S.W.¼, S.W.¼, Sec. 26, T6N, R12E).
Series established:		Lenawee County, Michigan, 1957.
Source of name:		Name of village in Ionia County, Michigan.

SHIOCTON SERIES (Soil Map Unit 19)

General description. The Shiocton series includes somewhat poorly drained, deep fine sands and loams underlain by stratified limy silts and fine sands.

Detailed description. This series includes somewhat poorly drained soils formed in calcareous stratified silts and fine sands of glacio-lacustrine basins. Leaching of the solum is minimal and carbonates are usually encountered near the surface. The original vegetation was deciduous forest (elm, maple, basswood; *Ulmus, Acer, Tilia*). The soils are classified as Inceptisols (weakly developed Gray-Brown Podzolics): Aquollic Eutrochrepts; coarse-loamy, mixed, mesic. The subsoil (B) horizon lacks evidence of clay accumulation with an average content of less than 18% clay and between 15 to 70-85% sand coarser than very fine sand. Above this horizon is a dark thin surface (A1, Ap) horizon and paler subsurface (A2) horizon. Slope gradients are less than 5%. Soil types include fine sandy loam, loam, and silt loam. Associated soils are Kibbie, Mosel series, and other members of their catenas. The following soil profile description was observed in the SE¼, NW¼, Sec. 30, T5N, R16E.

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Black (10YR 2/1) silt loam; moderate fine granular structure; friable; many plant roots; moderately alkaline (pH 8.0); abrupt wavy boundary.
A2	7-12	Dark grayish-brown (10YR 4/2) silt loam; weak medium subangular blocky structure breaking to weak medium plates; friable; many roots; moderately alkaline (pH 8.0); clear wavy boundary.
B2	12-19	Brown to dark brown (10YR 4/3) silt loam; common medium distinct mottles of yellowish-brown (10YR 5/6); weak medium platy structure; friable; slightly calcareous; clear wavy boundary.
C1g	19-27	Olive-gray (5Y 5/2) very fine sandy loam; few medium distinct mottles of yellowish-brown (10YR 5/6); weak medium platy; moderately calcareous; abrupt smooth boundary.

C2g	27-40	Light olive-brown (2.5Y 5/4) coarse silt; few distinct medium mottles (10YR 5/6); weak medium platy structure; some small hard lime segregations present; laminated; calcareous; glacio-lacustrine silts and very fine sands.
Type location:		Jefferson County, Wisconsin (SE¼, NW¼, Sec. 30, T5N, R16E).
Series proposed:		Outagamie County, Wisconsin, 1948.
Source of name:		Name of village in Outagamie County, Wisconsin.

SISSON SERIES (Soil Map Unit 16)

General description. The Sisson series includes well-drained acid loamy soils with silty and clayey subsoils over limy silts and fine sands.

Detailed description. This series includes well to moderately well drained soils developed in calcareous glacio-lacustrine silty and fine sandy loam materials. The original vegetation was deciduous forest, mostly oak-hickory(*Quercus-Carya*). These soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalf; fine-loamy, mixed mesic. The textural B horizon (Bt) begins at a depth of about a foot and continues downward a foot or two with an average content of 18 to 35% clay and more than 15% sand coarser than very fine sand. Soil types include fine sandy loam and silt loam. Slope gradients are typically 2% to 6% but range up to 30%. Associated soils include Kibbie, and Saylesville. The following profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Dark grayish-brown (10YR 4/2) fine sandy loam; weak medium granular structure; friable; many roots; slightly acid (pH 6.4); abrupt smooth boundary.
A2	8-11	Brown (10YR 5/3) fine sandy loam; weak thin platy structure; friable; few dark grayish-brown (10YR 4/2) worm casts; many roots; slightly acid (pH 6.4); gradual wavy boundary.
B1	11-15	Yellowish-brown (10YR 5/4) silt loam; weak fine subangular blocky structure; slightly firm; many roots; slightly acid (pH 6.4) gradual wavy boundary.
B2t	15-27	Yellowish-brown (10YR 5/4) heavy silt loam; moderate medium subangular blocky structure; firm; thin clay films; many roots; thin lenses of fine sand; slightly acid (pH 6.5); abrupt wavy boundary.
B3	27-30	Yellowish-brown (10YR 5/4) very fine sandy loam; weak fine subangular blocky structure; friable; many fine roots; patchy thin clay films; neutral (pH 7.2); abrupt wavy boundary.
IIC	30-60	Pale brown (10YR 6/3) stratified silt and very fine sand with thin lenses of fine sand; massive; friable; few fine roots; calcareous glacio-lacustrine deposits.
Type location:		Ingham County, Michigan (NW¼, NW¼, Sec. 10, T4N, R1W).
Series established:		Lapeer County, Michigan, 1966.
Source of name:		Name of railroad station in Lenawee County, Michigan.

SPINKS SERIES (Soil Map Unit 11)

General description. The Spinks series includes deep fine sands with several thin brown loamy bands in the subsoil.

Detailed description. This series includes droughty, excessively drained soils formed in deposits of calcareous eolian sands or sandy outwash. The very permeable materials are usually leached of carbonates to a depth of 5 feet or more. The original vegetation was deciduous forest (oak, hickory; *Quercus, Carya*). The soils are classified as sandy Alfisols (Gray-Brown Podzolics): Psammentic

Hapludalfs; sandy, mixed, mesic family. The textural subsoil (Bt horizon) consists of a series of 1 to 3 inch thick strong brown loamy sand to sandy loam bands separated by paler thicker sand layers. Above this subsoil horizon is a dark surface (A1) horizon and paler subsurface (A2) horizon. Slope gradients are usually between 2 and 15% but may be as steep as 40%. The types are sand and loamy sand. Associated soils are Oakville and Rodman series. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Dark grayish-brown (10YR 4/1) loamy sand; very weak medium granular structure; very friable; many roots; slightly acid (pH 6.5); abrupt smooth boundary.
A2	7-30	Yellowish-brown (10YR 5/4) sand; single grain; loose; many roots; slightly acid (pH 6.1); abrupt wavy boundary.
A2 & Bt	30-70	Brown (7.5YR 4/4) heavy loamy fine sand; wavy discontinuous bands ¼ to 5 inches thick; massive to weak fine subangular blocky structure; medium acid (pH 5.8); separated by 4 to 10 inch-thick yellowish-brown (10YR 5/4) A'2 bands of sand, single grain, loose, and also medium acid; boundaries are abrupt and wavy.
C	70-80	Pale brown (10YR 6/3) fine sand; single grain; loose; neutral (pH 7.0) above to slightly calcareous at nine feet.

Type location: Ionia County, Michigan (NE¼, SE¼, Sec. 24, T6N, R7W).
Series proposed: Lapeer County, Michigan, 1954.
Source of name: Name of village in Berrien County, Michigan.

THERESA SERIES (Soil Map Unit 2)

General description. The Theresa series includes silt loams shallow over stony, very limy sandy loam to loam glacial till.

Detailed description. This series includes well to moderately well drained soils developed in 20 to 36 inches of silt covering over calcareous sandy loam to loam glacial till with a CaCO3 equivalent of 40 to 60%. These soils are often nearly neutral throughout the solum. The original vegetation was deciduous forest (maple, basswood, oak, hickory; *Acer, Tilia, Quercus, Carya*). The soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalfs; fine-loamy, mixed, mesic family. The textural subsoil (Bt) horizon starts at a depth of about a foot and continues down 18 to 24 inches with an average content of 18 to 35% clay and more than 15% sand. Above this horizon is a thin dark surface (A1) horizon, a paler subsurface (A2) horizon, and transitional (B1) horizon. Slope gradients are commonly between 2 and 12% but range up to 40%. The silt loam is the only type. Associated soils are of the Dodge and Lapeer series. The following soil profile for which analytical data are given in Tables 9 and 11, was observed in the NW¼, SE¼, Sec. 10, T8N, R15E in Jefferson County, Wisconsin.

Horizon	*Depth, Inches*	*Description*
Ap	0-9	Dark grayish-brown (10YR 4/2) silt loam which is light brownish-gray (10YR 6/2) when dry; moderate medium platy structure appears to have been compacted by machinery; friable; mildly alkaline (pH 7.5); abrupt smooth boundary.
B1	9-12	Dark yellowish-brown (10YR 3/4) heavy silt loam; moderate medium subangular blocky structure with light brownish-gray (10YR 6/2) coatings on the surfaces of peds; friable; many earthworm channels; neutral (pH 7.2); clear smooth boundary.
I&IIB21t	12-17	Dark brown (10YR 3/3) clay loam; very fine to fine subangular and angular blocky structure with thin patchy light brownish-gray (10YR 6/2) silt coatings and very dark grayish-

		brown (10YR 3/2) clay films on surfaces of peds; firm; neutral (pH 7.0); clear smooth boundary.
IIB22t	17-21	Very dark grayish-brown to dark brown (10YR 3/2-3/3) heavy clay loam; strong fine subangular and angular blocky structure with thin continuous very dark grayish-brown (10YR 3/2) clay films on ped surfaces; firm; neutral (pH 7.0); gradual smooth boundary.
IIB23t	21-27	Dark brown (7.5YR 3/4) clay loam; moderate coarse subangular blocky parting to moderate medium angular blocky structure with thin continuous very dark grayish-brown (10YR 3/2) clay films on peds and some thick patchy very dark brown (10YR 2/2) coatings near the base of the horizon; firm; neutral pH 7.0); gradual wavy boundary.
IIB3	27-38	Yellowish-brown to dark yellowish brown (10YR 5/4-4/4) sandy clay loam to sandy loam; weak coarse subangular blocky structure with thin patchy dark brown (10YR 4/3-3/3) clay films on ped surface and in channels; some earthworm burrows are filled with very dark grayish-brown (10YR 3/2) material; friable; calcareous; gradual wavy boundary.
IIC	38-45	Light yellowish-brown to yellowish-brown (10YR 6/4-5/4) sandy loam; weak thick platy structure with a few patchy very pale brown (10YR 7/4) coatings on some surfaces; friable; calcareous glacial till.
Type location:		Waukesha County, Wisconsin (NE¼, NE¼, Sec. 16, T8N, R19E).
Series proposed:		Dodge County, Wisconsin, 1955.
Source of name:		Name of village, Dodge County, Wisconsin.

TICHIGAN SERIES (Soil Map Unit 18)

General description. The Tichigan series includes somewhat poorly drained soils formed in lowlands from calcareous lake-laid silts and clays with loamy coverings locally.

Detailed description. The series includes somewhat poorly drained soils formed in highly calcareous glacio-lacustrine silts and clays with or without a loam or silt loam covering as much as 18 inches thick. These soils have not been strongly leached and carbonates are usually present within 1 to 2 feet of the surface. The original vegetation was a mixture of wet mesic prairie species (*Andropogon, Calamagrostis, Spartina,* and associated plants) and deciduous trees (oak, hickory, ash; *Quercus, Carya, Fraxinus*). These soils are classified as Alfisols intergrading to Mollisols and (Gray-Brown Podzolics and Brunizems): Aquollic Hapludalfs; fine, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of about a foot and continues downward another foot, with an average content of more than 35% clay. Above this horizon is a sequence of very dark surface (A1) horizon and thin less dark subsurface (A2) or (B1) horizon. Slope gradients are between 0 and 6%. Associated soils are Saylesville, Martinton, and Del Rey series. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Black (10YR 2/1) silt loam; moderate fine to medium granular structure; friable; plant roots abundant; mildly alkaline (pH 7.5); abrupt smooth boundary.
A2 or B1	8-11	Very dark gray (10YR 3/1 to 3/2) light silty clay loam; moderate very fine subangular blocky structure; friable; roots plentiful; mildly alkaline (pH 7.5); clear wavy boundary.

B21t	11-15	Olive-brown (2.5Y 4/4) light silty clay loam with moderate medium subangular blocky structure; firm; many fine distinct mottles of light brownish-gray and light olive-brown (2.5Y 6/2, 5/4); roots plentiful; mildly alkaline pH 7.5; clear smooth boundary.
B22t	15-24	Light yellowish-brown to light olive-brown (2.5Y 6/4 to 5/6) silty clay loam; weak medium subangular blocky structure; friable; many fine distinct mottles of light brownish-gray (2.5Y 6/2); roots plentiful; weakly stratified with some thin strata of very fine sands; moderately alkaline (pH 8.0); gradual smooth boundary.
B23t	24-30	Brown (7.5YR 5/2) heavy silty clay loam with light gray (10YR 7/2) coatings on surface of aggregates; moderate to strong fine to medium angular blocky structure; firm when dry, slightly plastic when wet; many medium distinct mottles of strong brown and reddish-yellow (7.5YR 6/6, 5/6); thick patchy clay skins on surface of aggregates; moderately calcareous; clear smooth boundary.
C1	30-40	Light brownish-gray and olive-brown (2.5Y 6/2 and 5/6) silty clay loam; weakly laminated; firm; moderately calcareous.
Type location:		Fond du Lac County, Wisconsin (NW¼, SE¼, Sec. 17, T14N, R16E).
Series proposed:		Fond du Lac County, Wisconsin, 1956.
Source of name:		Name of a lake in Racine County, Wisconsin.

WARSAW SERIES (Included in Soil Map Unit 9)

General description. The Warsaw series includes naturally well-drained loamy soils developed under prairie vegetation and moderately deep to limy sand and gravel (see Front Cover picture).

Detailed description. This series includes well-drained, somewhat droughty soils formed in 20 to 42 inches of loamy material, of which the upper 20 inches may be silt loam, over calcareous sand and gravel outwash. A textural B horizon (Bt) is present. Original vegetation included prairie species *(Andropogon, Stipa, Sparobolus).* These soils are classified as Mollisols (Brunizems): Typic Argiudolls; fine loamy over sandy or sandy skeletal, mixed, mesic. The textural subsoil (Bt) begins at a depth of about a foot and continues downward 24 to 30 inches with some tongues extending into the underlying glacial outwash. The Bt contains an average of 18% to 35% clay and more than 15% sand. Coarse textured outwash is within 40 inches of the surface. Dark organic stains and some clay films (cutans) are present on ped surfaces. Above the B horizon is a nearly black A1 horizon. Slope gradients range from 0 to 10%. Soil types include silt loam, loams, and sandy loams. Associated soils are the Lorenzo, Casco, Fabius, Rodman, Oshtemo, Boyer, and Oakville. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
01	½-0	Grass and leaf litter, discontinuous.
Ap	0-7	Black (10YR 2/1) loam; moderate fine granular structure; friable; slightly to medium acid (pH 6.1); gradual smooth boundary.
A12	7-12	Very dark grayish-brown (10YR 3/2) loam; moderate medium granular structure; friable; medium acid (pH 6.0); clear wavy boundary.
B1t	12-17	Dark grayish-brown (10YR 4/2) heavy loam to light sandy clay loam; some gravel present; moderate fine to medium subangular blocky structure; friable to firm; medium acid (pH 6.0); clear wavy boundary.

IIB2t	17-34	Dark brown (10YR 4/4) gravelly sandy clay loam; strong medium subangular blocky structure; firm; neutral (pH 7.0); abrupt irregular boundary tongues of this horizon extend 2 to 10 inches into the underlying sand and gravel.
IIB3t	34-40	Dark reddish-brown (5YR 3/4) gravelly clay loam; strong medium subangular blocky to massive; firm; neutral (pH 7.0); abrupt irregular boundary; this horizon extends in tongues 2 to 10 inches into the underlying sand and gravel.
IIC	40-50	Brown (10YR 4/3) sand and gravel; single grain; loose; stratified; calcareous glacial outwash.

Type location: Kosciusko County, Indiana.

Series established: Kosciusko County, 1922.

Source of name: County seat of Kosciusko County, Indiana.

WASEPI SERIES (Soil Map Unit 12h)

General description. The Wasepi series includes somewhat poorly drained sandy and loamy soils 2 to 3 feet deep over stratified limy sand and gravel.

Detailed description. This series includes somewhat poorly drained soils formed in 20 to 40 inches of loamy materials over stratified calcareous sandy glacial outwash with some gravel. The original vegetation was deciduous forest (oak, hickory, maple: *Quercus, Carya, Acer*). These soils are classified as Alfisols, with a dark surface horizon, (Gray-Brown Podzolics): Aquollic Hapludalfs; coarse-loamy, mixed, mesic family. The textural subsoil (Bt) horizon, which begins at a depth of about 15 inches and continues downward to 30 to 40 inches, has an average content of less than 18% clay and between 15 to 75-85% sand coarser than very fine sand. The most clayey part of the Bt is a heavy sandy loam. This horizon tongues down into the IIC horizon. Above the Bt horizon is a sequence of dark surface (A1, Ap) horizon, paler subsurface (A2) horizon, and transitional browner (B1) horizon. Slope gradients are 0 to 6%. Soil types include loamy sands and sandy loams. Associated soils are Matherton, Fabius, and Brady series and other members of their catenas. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-9	Very dark grayish-brown (10YR 3/2) sandy loam; weak medium granular structure; friable; neutral (pH 7.1); abrupt wavy boundary.
A2	9-16	Grayish-brown (10YR 5/3) sandy loam; weak medium granular structure; very friable; slightly acid (pH 6.2); clear wavy boundary.
B1	16-18	Yellowish-brown (10YR 5/4) loamy sand with a few medium distinct grayish-brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; slightly acid (pH 6.3); clear wavy boundary.
B21t	18-24	Yellowish-brown (10YR 5/4) sandy loam with common medium distinct grayish-brown (10YR 5/2) and brownish-yellow (10YR 6/6) mottles; weak medium subangular blocky structure; friable; a few thin clay films on ped surfaces; slightly acid (pH 6.4); gradual wavy boundary.
B22t	24-30	Brown (10YR 5/3) heavy sandy loam with common medium distinct light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; thick patchy clay films on peds and bridging sand grains; slightly acid (pH 6.5); abrupt wavy boundary.

IICg	30-48	Pale brown (10YR 6/3) stratified sand with some fine gravel; a few coarse faint yellowish-brown (10YR 5/8) mottles; single grain; loose; calcareous glacial outwash.

Type location: Genesee County, Michigan (SW¼, SE¼, Sec. 25, T6N, R8E).
Series established: Lapeer County, Michigan, 1966.
Source of name: Name of village in St. Joseph County, Michigan.

WATERLOO SERIES (Soil Map Unit 8)

General description. The Waterloo series includes deep well drained silty soils over limy sand and gravel.

Detailed description. This series includes well to moderately well drained soils developed in 30 to 50 inches of silty matrial (loess) over calcareous sand and gravel glacial outwash. The original vegetation was deciduous forest (oak, maple, basswood, hickory: *Quercus, Acer, Tilia, Carya*). These soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalfs; fine-silty over sandy or sandy-skeletal, mixed, mesic family. The textural subsoil (Bt) horizon begins at a depth of about 18 inches and continues downward 3 to 4 feet, extending into the underlying outwash. The argillic horizon has an average content of 18 to 35% clay and less than 15% sand coarser than very fine sand. Associated soils are Fox and St. Charles series and an unnamed Typic Argiudoll (described in detail below, p. 204). The following soil profiles are representative of the series in the County.

Horizon	*Depth, Inches*	*Description*
Ap	0-8	Very dark grayish-brown (10YR 3/2) silt loam which is a light brownish-gray (10YR 6/2) when dry; moderate medium granular structure; friable; slightly acid (pH 6.5); abrupt smooth boundary.
A2	8-13	Brown (10YR 5/3) silt loam; numerous earthworm burrows filled with casts; moderate thin and medium platy structure; very friable; slightly acid (pH 6.4); clear smooth boundary.
B1	13-17	Brown to dark brown (10YR 4/3) heavy silt loam; moderate very fine subangular blocky structure; friable to firm; strongly acid (pH 5.3) gradual smooth boundary.
B21t	17-25	Brown to dark brown (10YR 5/3) silty clay loam; moderate very fine and fine subangular blocky structure; thin patchy dark brown (10YR 3/3) clay films on ped surfaces; firm; very strongly acid (pH 5.0); gradual smooth boundary.
B22t	25-33	Brown to dark brown (10YR 4/3) silty clay loam; strong medium subangular blocky structure; thin continuous dark brown (10YR 3/3) clay films on peds and in fine pores; firm; very strongly acid (pH 4.9); clear smooth boundary.
IIB23t	33-41	Brown to dark brown (7.5YR 4/2-4/4) sandy clay loam with some gravels; moderate medium and coarse subangular blocky structure; thick patchy dark brown (7.5YR 4/2) clay films in channels and on ped surfaces; firm; medium acid (pH 5.8); clear smooth boundary.
IIB3t	41-45	Dark brown (10YR 3/2) sticky sandy loam; massive; sand and gravel which is impregnated by illuviated clay; clay films bridging sand grains; firm to friable; neutral (pH 7.2); abrupt irregular boundary.
IIC	45-60	Pale brown (10YR 6/3) sand and gravel; single grain; loose; stratified; calcareous glacial outwash.

Type location: Jefferson County, Wisconsin.
Series proposed: Jefferson County, Wisconsin, 1969.
Source of name: Name of a village in Jefferson County, Wisconsin.

The following Mollisol was observed in association with the Waterloo and is included in Soil Map Unit 8. Analytical data are given in Tables 8 and 10.

General description. This soil includes well-drained deep, silty soils over calcareous sand and gravel with a dark colored surface horizon.

Detailed description. This series includes dark, well to moderately well drained soils developed in 30 to 50 inches of silty material (loess) over calcareous sand and gravel glacial outwash. The original vegetation consisted of mesic prairie species: big-blue stem, needle grass, little-blue stem, drop seed grass *(Andropogon geradi, Stipa spartea, Andropogon scoparius, Sporobolus heterolepis)* and prairie forbs with scattered oak trees *(Quercus).* These soils are classified as Mollisols (Brunizems), Typic Argiudoll; fine silty over sandy or sandy skeletal, mixed, mesic family. The textural subsoil (Bt) horizon begins at around 12 to 18 inches and continues downward to the base of the silty mantle and extends into the underlying outwash. This horizon has an average content of 18-35% clay and less than 15% sand coarser than very fine sand. Associated soils include Warsaw and Plano series. The profile in the following description was observed in the SE¼, NW¼, Sec. 24, T5N, R12E., Dane County, Wisconsin, 30 yards west of the Jefferson County line. See Tables 9 and 10 for analytical data.

Horizon	*Depth, Inches*	*Description*
Ap	0-7	Very dark grayish-brown (10YR 3/2) heavy silt loam; weak fine granular structure; firm to friable; slightly acid (pH 6.5). Many earthworm casts and channels present; clear smooth boundary.
A3	7-12	Very dark grayish-brown to dark brown (10YR 3/2-3/3) silty clay loam. Moderate medium subangular to angular blocky structure; firm; medium acid (pH 6.0); many filled earthworm burrows and some casts present; clear smooth boundary.
B21t	12-22	Brown to dark brown (10YR 4/3) silty clay loam; moderate, medium subangular blocky structure with dark brown (10YR 3/3) clay films; firm; very strongly acid (pH 5.0); gradual smooth boundary.
B22t	22-32	Brown (10YR 5/3) silty clay loam; moderate medium subangular blocky structure with dark brown (10YR 3/3) clay films; firm; very strongly acid (pH 5.0); gradual smooth boundary.
I&II B23t	32-40	Dark grayish-brown to dark brown (10YR 4/2)-4/3) silty clay loam to clay loam; moderate, medium and coarse angular blocky structure with brown to dark brown (7.5YR 4/2) clay films; firm; medium acid (pH 6.0); numerous very fine pores present, abrupt wavy boundary.
IIB3t	40-46	Dark brown to dark reddish-brown (7.5YR to 5YR 3/2-3/3) gravelly sticky sandy loam; massive breaking to irregular fragments; firm; plastic when wet; medium acid (pH 6.0); contains discontinuous sand lenses in some portions; abrupt wavy boundary.
IIC	46-56	Brown (10YR 5/3) sand and gravel; stratified; loose; calcareous glacial outwash.

WHALAN SERIES (Soil Map Unit 7)

General description. The Whalan series includes well-drained loams, shallow (20 to 40 inches) to limestone bedrock.

Detailed description. This series includes well to moderately well drained soils formed in a loess mantle less than 20 inches thick over calcareous sandy loam or loam glacial till over limestone bedrock. Solum thickness ranges from 20 to 40 inches with development in both loess and till. The original vegetation was deciduous forest (oak, hickory, maple, basswood; *Quercus, Carya, Acer, Tilia*). The soils are classified as Alfisols (Gray-Brown Podzolics): Typic Hapludalfs; fine-loamy, mixed, mesic. The textural subsoil (Bt) horizon begins at a depth of 10 inches, continues to 30 to 42 inches, and may reach the bedrock surface where it is within 3 or 4 feet of the soil surface. This horizon contains an average content of 18 to 35% clay and more than 15% sand. Above the Bt horizon is a sequence of thin dark surface (A1, Ap) horizon and paler subsurface (A2) horizon. Slope gradients are usually 2 to 12%, but can range up to 40%. Soil types including sandy loam, loam, and silt loam with varying degrees of stoniness. Associated soils are Knowles, Lapeer, and Theresa series. The following soil profil description is representative.

Horizon	*Inches Depth,*	*Description*
01	1-0	Forest litter.
A1	0-6	Very dark grayish-brown (10YR 3/2) above, to dark grayish-brown (10YR 4/2) below, silt loam; weak fine granular structure; friable; slightly acid (pH 6.5); clear smooth boundary.
A2	6-10	Grayish-brown (10YR 5/2) silt loam; moderate medium platy structure; friable; slightly acid (pH 6.2); clear smooth boundary.
B21t	10-18	Brown (10YR 5/3) silty clay loam, strong medium subangular blocky structure; thin continuous clay films; firm; slightly acid (pH 6.5); clear smooth boundary.
IIB22t	18-30	Dark brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; thick, patchy dark brown (7.5YR 3/2) clay films; firm; neutral (pH 7.0); abrupt wavy boundary.
IIC	30-40	Light yellowish-brown (10YR 6/4) sandy loam massive; friable; calcareous glacial till.
IIIR	40+	Limestone bedrock.

Type location: Mower County, Minnesota.
Series proposed: Fillmore County, Minnesota, 1940.
Source of name: Name of village in Fillmore County, Minnesota.

WILL SERIES (Soil Map Unit 13h)

General description. The Will series includes poorly drained black loams 2 to 3 feet thick over sand and gravel glacial outwash.

Detailed description. This series includes poorly to very poorly drained soils developed in 20 to 42 inches of loamy materials over calcareous sand and gravel glacial outwash. This soil may have up to 20 inches of silt mantle on the surface and soil types include sandy loam, loam, and silt loam. The original vegetation was either deciduous forest (elm, ash, maple; *Ulmus, Fraxinus, Acer*) or wet prairie grasses *(Calamagrostis, Spartina, Andropogon).* The soils are classified as wet Mollisols (Humic Gleys): Typic Haplaquoll; fine-loamy over sandy or sandy skeletal, mixed, noncalcareous, mesic family. The subsoil (B) horizon lacks evidence of clay accumulation to qualify as argillic. It is a gleyed cambic horizon with 18 to 35% clay and more than 15% sand. Overlying this horizon is a thick black surface (A1, Ap) horizon. Slope gradients are less than 2%. Associated soils

are Sebewa and Milford series and other members of their catenas. The following soil profile description is representative.

Horizon	*Depth, Inches*	*Description*
Ap	0-12	Black (10YR 2/1) loam; moderate fine granular structure; friable; many roots; slightly acid (pH 6.4); abrupt smooth boundary.
B1g	12-18	Dark gray (10YR 4/1) loam; few faint dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; many roots; slightly acid (pH 6.3); gradual wavy boundary.
B2g	18-35	Grayish-brown (10YR 5/2) loam; few fine faint dark yellowish-brown 10YR 4/4) mottles; weak coarse subangular blocky structure; firm; some fine roots; neutral (pH 7.0); abrupt wavy boundary.
IIC	35-45	Grayish-brown (10YR 5/2) stratified sand and gravel; single grain; loose; calcareous glacial outwash.

Type location: NW¼, Sec. 23, T36N, R9E, Will County, Illinois.
Series established: Will County, Illinois, 1951.
Source of name: Name of Will County, Illinois.

VII. SOIL GEOGRAPHY

Introduction

The soil types described in Chapter VI occur in the landscapes of Jefferson County as three-dimensional soil bodies. Profile characteristics and a real distribution of the soils are closely related to the factors of soil formation discussed in Chapter V (also see Table 7). Soil bodies usually occur in repetitive patterns. For example, a particular combination of soil-forming factors, *i.e.*, organisms, topographic position, and parent material will lead to the development of a specific soil type at comparable sites throughout a given landscape (Figure 7). A soil scientist combines field examination of soil profiles with observations of vegetation, land form, and initial material to sketch boundaries which delimit these natural components of the landscape. Each delineated area may be composed entirely of an individual soil (Figure 25) or include a group of soils. Units consisting of two or more soils are called "soil associations" and are normally composed of soils that occur together on the landscape in a distinctive pattern.

Each of the 25 cartographic units (Table 8) shown on the colored soil map of Jefferson County has one or more dominant soil types, which are named in the legend. An observer on the land would be likely to discover other soils, not mentioned, and a more detailed soil pattern.

Grouping of the soils into cartographic units has been based on:

(1) Natural association of soils in the landscape, regardless of their similarities or dissimilarities. The Dodge, McHenry, St. Charles, and Theresa soils, for example, are quite different, yet they are found together on the upland and hence are grouped under map unit number 1.

(2) Similarities of soils. Pella, Harpster, Brookston, and Kokomo do not commonly occur together in the same wetlands, but because of their similarities, they are grouped under map unit number 6.

(3) Size of individual soil bodies in relation to the scale of the soil map. The smallest soil body shown on the map is about 10 acres in area. Hennepin soil bodies are typically smaller than that and so are included in map unit number 4 with more extensive associated soils.

(4) Total areal extent of a soil. Even if bodies of a soil are larger than 10 acres, total acreage for the county must exceed 500 acres before the soil can be considered for inclusion in the legend of the soil map. The area of Alluvial soils fell below that minimum, and so they are not mentioned in the legend.

TABLE 7. DISTRIBUTION OF MAJOR GROUPINGS OF SOIL ASSOCIATIONS, JEFFERSON COUNTY, WISCONSIN[1]

Major Soil Groupings	Included map legend symbols	Distribution[2]	
		Acres	% of area of county
SOILS OF THE GLACIAL TILL UPLANDS: Soils formed in silty to loamy material over-lying calcareous sandy loam glacial drift, largely till	1-6	121,500	32.5
Well to moderately well drained soils; 0-30% slopes	1-4	98,550	26.4
Somewhat poorly drained soils; 0-6% slopes	5	8,500	2.3
Poorly and very poorly drained soils[3]; 0-2% slopes	6	14,450	3.8
SOILS OF THIN GLACIAL DRIFT AND SILTY DEPOSITS OVER BEDROCK: well to moderately well drained; 0-30% slopes	7	3,300	0.9
SOILS OF THE GLACIO-FLUVIAL UPLANDS: Soils formed in silty to sandy deposits over-lying glacial outwash sand and/or gravel	8-13	88,150	23.5
Well to moderately well drained soils; 0-30% slopes	8-11	61,900	16.5
Somewhat poorly drained soils; 0-6% slopes	12	10,450	2.8
Poorly and very poorly drained soils[3]; 0-2% slopes	13	15,800	4.2
SOILS OF GLACIO-LACUSTRINE PLAINS	14-23	80,150	21.4
Well to moderately well drained soils; 0-6% slopes	14-16	10,450	2.8
Somewhat poorly drained soils; 0-6% slopes	17-19	11,800	3.1
Poorly and very poorly drained soils[3]; 0-2% slopes	20-23	57,800	15.5
SOILS OF ORGANIC DEPOSITS; poorly and very poorly drained soils[3]; 0-2% slopes	24-25	65,050	17.4

[1] Land area is estimated at 358,150 (95.7% of the county); water covers 16,250 acres according to the Blue Book (Wis. Leg. Bur., 1966), (4.3% of the area of the county). Together these make 374,400 acres for the entire county. Note that Poff *et al.*, (1968) show 17,059 acres of water (4.6%).

[2] Percentages and acreages are based on weights of various parts of the soil map as determined with an analytical balance.

[3] Note that bodies of poorly and very poorly drained soils that have been drained artificially are not identified in the legend nor delineated on the map, although patterns of drainage ditches indicate major areas of artificial drainage.

TABLE 8. DISTRIBUTION OF SOIL ASSOCIATIONS (SOIL MAP UNITS), JEFFERSON COUNTY, WISCONSIN[1]

Soil Map and Legend Symbols	Natural drainage conditions[2]	Soil Associations (Soil Map Units)	Description		Distribution			
			Parent Material[3]	Slope or other subdivision	Acres	% of area of county	Acres	% of area of county
1	Well to moderately well drained	Dodge, McHenry, St. Charles, and Theresa silt loam	Soils formed in more than 20 inches of silty deposits over the sandy loam glacial till	1a (0-6% slopes) 1b (6-12% slopes) 1c (12%+ slopes)	17,050 8,350 1,550	4.5 2.4 0.4	26,950	7.3
2		Lapeer loam and Theresa silt loam	Soils formed in less than 20 inches of silty deposits over the sandy loam glacial till	2a (0-6% slopes) 2b (6-12% slopes) 2c (12%+ slopes)	10,750 11,450 4,200	2.8 3.0 1.2	26,400	7.0
3		Lapeer sandy loam, Metea fine sandy loam	Soils formed in loamy deposits over the sandy glacial till	3a (0-6% slopes) 3b (6-12% slopes) 3c (12%+ slopes)	14,250 12,700 6,250	3.7 3.4 1.7	33,200	8.8
4		Hochheim silt loam and loam, thin solum Lapeer sandy loam, Hennepin sandy loam and loam	Soils formed in loamy deposits over sandy loam glacial till; sola are shallow (less than 24 inches thick)	4a (0-6% slopes) 4b (6-12% slopes) 4c (12%+ slopes)	3,850 5,100 3,050	1.1 1.4 0.8	12,000	3.3
5	Somewhat poorly drained	Lamartine, Lisbon, Kendall, and Elburn silt loam	Soils formed in more than 20 inches of silty deposits over sandy loam glacial till	(0-6% slopes)	8,500	2.3	8,500	2.3

TABLE 8. DISTRIBUTION OF SOIL ASSOCIATIONS (SOIL MAP UNITS), JEFFERSON COUNTY, WISCONSIN[1]

Soil Map and Legend	Natural drainage conditions[2]	Soil Associations (Soil Map Units)	Description		Distribution			
			Parent Material[3]	Slope or other subdivision	Acres	% of area of county	Acres	% of area of county
6	Poorly and very poorly drained	Pella, Harpster, Brookston, and Kokomo silt loam and silty clay loam	Soils formed in more than 20 inches of silty deposits over sandy loam glacial till	(0-2% slopes)	14,450	3.8	14,450	3.8
7	Well to moderately well drained	Knowles silt loam; Whalan loam and sandy loam	Soils formed in more than 20 inches of silty or loamy deposits over thin glacial drift over limestone, sandstone, or quartzite bedrock	(0-30% slopes)	3,300	0.9	3,300	0.9
8		Waterloo silt loam and associated soils	Soils formed in more than 20 inches of silty deposits over outwash sand and/or gravel	8a (0-6% slopes) 8b (6-12%+ slopes)	14,250 4,200	3.8 1.1	18,450	4.9
9		Fox silt loam and loams; Casco and Rodman sandy loams and loams	Soils formed in less than 20 inches of silty deposits over outwash sand or gravel or both	9a (0-6% slopes) 9b (6-12% slopes) 9c (12%+ slopes)	21,350 7,050 1,100	5.7 1.9 0.3	29,500	7.9

TABLE 8. DISTRIBUTION OF SOIL ASSOCIATIONS (SOIL MAP UNITS), JEFFERSON COUNTY, WISCONSIN[1]

Soil Map and Legend	Natural drainage conditions[2]	Soil Associations (Soil Map Units)	Description		Distribution			
			Parent Material[3]	Slope or other subdivision	Acres	% of area of county	Acres	% of area of county
10	Well to moderately well drained	Oshtemo and Boyer sandy loams and loamy sands	Soils formed in outwash deposits	10a (0-6% slopes) 10b (6-12%+ slopes)	8,150 2,850	2.2 0.7	11,000	2.9
11		Spinks and Oakville loamy sands and sands	Soils formed in sandy outwash and aeolian deposits	11a (0-6% slopes) 11b (6-12%+ slopes)	1,850 1,100	0.5 0.3	2,950	0.8
12	Somewhat poorly drained	Busseyville; Matherton silt loam and loam; Fabius, Brady, Wasepi loams and sandy loams	Soils formed in more than 20 inches (Busseyville, Matherton) or less than 20 inches of silty deposits or in loamy and sandy loamy deposits over sand and/or gravel	12g (>20" silt) 12h (<20" silt)	5,700 4,700	1.5 1.3	10,450	2.8
13	Poorly and very poorly drained	Milford silt loam; Sebewa and Will silt loam and loams; Gilford loam and sandy loam	Soils formed in more than 20 inches (Milford) or less than 20 inches of silty deposits or in loamy and sandy deposits over sand and/or gravel	13g (>20" silt) 13h (<20" silt)	7,700 8,100	2.0 2.2	15,800	4.2

TABLE 8. DISTRIBUTION OF SOIL ASSOCIATIONS (SOIL MAP UNITS), JEFFERSON COUNTY, WISCONSIN[1]

Soil Map and Legend	Natural drainage conditions[2]	Soil Associations (Soil Map Units)	Description		Distribution			
			Parent Material[3]	Slope or other subdivision	Acres	% of area of county	Acres	% of area of county
14	Well to moderately well drained	Hebron loam and sandy loam and associated soils	Soils former in 20-36 inches of sandy deposits over calcareous lacustrine silts and clays	(0-6% slopes)	3,500	0.9	3,500	0.9
15		Saylesville silt loam and loam and associated soils	Soils formed in less than 20 inches of sandy deposits over calcareous lacustrine silts and clays	(0-6% slopes)	3,600	1.0	3,600	1.0
16		Sisson and Salter silt loam, fine sandy loam and loams; Camden silt loam	Soils formed in silty or loamy deposits over calcareous lacustrine silts and/or very fine sands	(0-6% slopes)	3,350	0.9	3,350	0.9
17	Somewhat poorly drained	Mosel and Aztalan loams and sandy loams	Soils formed in 20-36 inches of sandy deposits over calcareous lacustrine silts and clays	(0-6% slopes)	3,050	0.8	3,050	0.8
18		Del Rey, Tichigan, and Martinton silt loam and loams	Soils formed in less than 20 inches or sandy deposits over calcareous lacustrine silts and clays	(0-6% slopes)	2,850	0.7	2,850	0.7

TABLE 8. DISTRIBUTION OF SOIL ASSOCIATIONS (SOIL MAP UNITS), JEFFERSON COUNTY, WISCONSIN[1]

Soil Map and Legend	Natural drainage conditions[2]	Soil Associations (Soil Map Units)	Description		Distribution			
			Parent Material[3]	Slope or other subdivision	Acres	% of area of county	Acres	% of area of county
19	Somewhat poorly drained	Kibbie and Shiocton fine sandy loams, silt loam and loams	Soils former in silty, fine sandy loam or loamy deposits over calcareous lacustrine silts and very fine sands	(0-6% slopes)	5,900	1.6	5,900	1.6
20	Poorly and very poorly drained[2]	Navan loam and sandy loam and associated soils	Soils formed in 20-36 inches of loamy or sandy loam deposits over calcareous lacustrine silts and clays	(0-2% slopes)	6,950	1.9	6,950	1.9
21		Montgomery silt loam and silty clay loam	Soils formed in less than 20 inches of sandy deposits over calcareous lacustrine silts and clays	(0-2% slopes)	28,500	7.6	28,500	7.6
22		Colwood fine sandy loam, silt loam and loam	Soils formed in silty, fine sandy loamy or loamy deposits over calcareous lacustrine silts and very fine sands	(0-2% slopes)	14,600	3.9	14,600	3.9

TABLE 8. DISTRIBUTION OF SOIL ASSOCIATIONS (SOIL MAP UNITS), JEFFERSON COUNTY, WISCONSIN[1]

Soil Map and Legend	Natural drainage conditions[2]	Soil Associations (Soil Map Units)	Description		Distribution			
			Parent Material[3]	Slope or other subdivision	Acres	% of area of county	Acres	% of area of county
23	Poorly and very poorly drained[2]	Keowns fine sandy loam and loamy fine sand	Soils formed in calcareous lacustrine very fine and fine sands	(0-2% slopes)	7,850	2.1	7,850	2.1
24		Deep peat and muck soils and associated soils	Soils formed in more than 42 inches of organic materials over sandy, loamy, or silty glacial drift	24v (with forest cover)	5,800	1.5	44,400	11.9
				24x (without forest cover)	38,600	10.4		
25		Shallow to moderately deep peat and muck soils and associated soils	Soils formed in less than 42 inches of organic materials over sandy, loamy, or silty glacial drift	25v (with forest cover)	1,100	0.3	20,650	5.5
				25x (without forest cover)	19,550	5.2		

[1] See footnote No. 1, Table 7, for areas of land and water, Jefferson County, Wisconsin.

[2] Note that bodies of poorly and very poorly drained soils that have been artificially drained are not identified in the legend nor delineated on the map, although patterns of drainage ditches indicate major areas of artificial drainage.

[3] All glacial till, outwash, and lacustrine deposits in the county were originally calcareous (dolomitic), and have been leached in various degrees during soil formation.

(5) Practical limitation on colors. The human eye can distinguish easily only about 25 colors on a printed map. The soils of the county were therefore grouped into 25 map units.

The geography of the soils of Jefferson County is reported in three ways: in the soil map, in the pictorial field keys (Figures 28-29, 31-32, and 33-34), and in the following discussion.

The Soil Map

The patterns depicted on the soil map are produced by the arrangement of wetland soils and upland soils; and of outwash, till- and loess-derived soils. Five major features of the overall soil pattern have been mentioned on page 53. Areas of artificial drainage of peats and mucks are indicated in a general way by drainage ditches shown in the large bodies of soil map unit 24. Locations of soil associations in the county are in some instances indicated by names of civil towns, an index map to which is reproduced in the lower left corner of the soil map sheet.

Field Keys

Field keys to the soils are presented in Figures 28, 31, and 33 and illustrated in accompanying diagrams. To use a key, the observer stands on a soil body and, with the aid of a spade and auger, observes the various soil layers to a depth of about 4 feet and determines whether he is over stony glacial till (Figures 12 and 29), lake-laid clays, silts and fine sands (Figure 34), or outwash sand and gravel (Figure 32). Having selected the appropriate part of the soil key, the reader notes the lay of the land (left hand column of the key), and soil profile characteristics (central part of the key). For example a person may be standing on a well-drained soil on a drumlin hill composed of glacial till and make the following observations in a logical order:

1. The soil I am standing on is well above streams and bogs and is not subject to flooding.
2. The silt cover (soft, flour-like soil, mostly stone-free) is between 20 and 36 inches thick.
3. The subsoil is not mottled (spotted with rusty-brown and gray splotches) above the 30-inch depth ($<30''$).[10]
4. The C horizon (yellowish-brown, calcareous glacial till) is a sandy loam to loam in texture. This horizon begins between the depths of 24 and 40 inches.
5. Therefore, the soil series name of this soil is Dodge (right-hand column of soil key, Figure 28; and see Figure 29), and the surface soil feels like a silt loam. It is a Dodge silt loam (see detailed description in Chapter VI).

[10]In the soil keys the symbols $>$ and $<$ mean "more than" and "less than", respectively. Thus $>20''$ signifies more than 20 inches; and $<20''$ means less than 20 inches.

Description of Cartographic Units

Soils of the Glacial Till Uplands and Associated Lowlands

The soils in this group are found on portions of the landscape chiefly underlain by glacial till. Where the till is overlaid by a covering of silty or loamy materials 1 to 3 feet thick, the soils have formed in both the covering and the till. The glacial till in Jefferson County is typically a light yellowish-brown (10YR 6/4, moist) dolomitic, sandy loam with a calcium carbonate ($CaCO_3$) equivalent content averaging 30 percent (see Table 13). Seven soil associations (Cartographic Units 1 through 7) are included in this grouping. Separation of units 1, 2, and 3 is based on thickness and texture of the material covering the till and on texture of the subsoil (B2 or Bt) horizon. Soils in the other four units include droughty, shallow soils (4), somewhat poorly drained soils (5), poorly to very poorly drained soils (6), and soils underlain by bedrock within 2 to 10 feet (7). These soil associations occupy a third of the land surface of Jefferson County.

The landscape in which these soils are found includes areas of elongated hills called drumlins and associated inter-drumlin lowlands[11] (Figures 7 and 29), and areas of rolling ground moraine.

An example of the soil-landscape relationships in this grouping can be observed along Interstate Highway 94 between Johnson Creek and Concord. Cut and fill for highway construction has produced a nearly level to undulating roadway across the rolling landscape of drumlins and lowlands. When the countryside is traversed on foot one encounters a repeating sequence of soils. Starting on the nearly level crest of a broad drumlin (Figure 29) with Dodge silt loam (Map Unit 1), one may move down to the shallower Theresa silt loam (Map Unit 2) on the steeper side slopes. The deeper, somewhat poorly drained Lamartine and Lisbon silt loams (Map Unit 5) are on the concave footslopes; and black, poorly drained Pella silty clay loam (Map Unit 6) lies on the level lowland. Depressed areas are occupied by peat and muck (Units 24 and 25).

If a traverse is initiated on the crest of a narrow steeply sloping drumlin, Hochheim and Hennepin sandy loams (Map Unit 4) are encountered on the convex crest and are suceeded down the steep slope by Lapeer sandy loam (Map Unit 5).

The complex patterns of deposition and erosion, and of local intergradation between soils even as diverse as Lapeer and Saylesville cannot be fully treated on the soil map and in this report, because of the limited scope of the study. The presence of thin solum variants in association with moderately and unusually deep soils suggests that erosion and transport of soil materials occurred at various places in the county both long before and since settlement by Europeans.

1. *Dodge, McHenry, Theresa, and St. Charles silt loams.* This unit includes light colored, well to moderately well drained silty soils with well developed textural subsoil (Bt, B2) horizons. These soils are most extensive in townships west of Wisconsin Highway 26 and south of U.S. Highway 18 and across the county north of Highway 18. The loess covering in Jefferson County is thickest — 20 to 42 inches — in the west and north and gradually thins to the southeast (Figure 14). This soil unit has been subdivided into three slope groups: 0-6 percent gradients (Map Unit 1a), 6-12 percent gradients Map Unit 1b) and 12-20 percent gradients (Map Unit 1c).

Dodge soils (p. 81; Figures 28, 29) are most common in the northeast and northcentral portions of the county. The till in this area has a high carbonate content (30 to 50 percent $CaCO_3$ equivalent) and a low content of coarse sand, and notable content of fine sand and silt. In Dodge soils, the portion of the Bt

[11] F. D. Hole has suggested that these lowlands be termed "nilmurds". A reverse spelling of drumlin is nilmurd, and represents the reversal of landscape position as one goes from elongated hill to elongated lowland in this landscape.

GENERALIZED SOIL KEY* FOR USE IN LANDSCAPES OF JEFFERSON COUNTY, WISCONSIN : PART I. SOILS ON GLACIAL TILL.
(Note: A soil key for your locality can be prepared with the assistance of a soil specialist.)

LAY OF THE LAND			SOIL PROFILE	DEPTH TO C HORIZON	SOIL SERIES NAME
Soils well above streams and bogs; not flooded	Silt cover 36-50"	Subsoil not mottled<30"	Thick (12") very dark (10YR 3/2) surface (A1, A3) horizon over Bt subsoil horizon	40"+	PLANO
			Thick (9") very dark surface (A1, Ap) horizon over paler (10YR 4/4) A2 horizon and Bt subsoil horiz.	40"+	BATAVIA
			Thin to thick (3-9") dark (10YR 4/2) surface (A1, Ap) horizon over paler A2 horiz. and Bt horizon	40"+	ST. CHARLES
		Subsoil is mottled>9"	Thick (12") very dark surface (A1, A3) horizon over dark mottled Bt subsoil horizon	40"+	ELBURN
			Thin (3-9") dark surface (A1, Ap) horizon over paler A2 horizon and mottled Bt subsoil horizon	40"+	KENDALL
	Silt cover 20-36" thick	Subsoil not mottled<30"	C horizon is a loam. Thin dark surface horizon over paler A2 horizon and Bt subsoil horizon	24-40"	DODGE
			C horizon is a sandy loam. Thin dark surface horizon over paler A2 horiz. and Bt subsoil horizon	24-40"	McHENRY
			C horizon is highly calcareous sandy loam to loam. Solum is neutral. Dark surface horizon/A2/ Bt	24-40"	THERESA
			Limestone bedrock lies at depths of 20-40". Very dark surface horizon over paler A2 over Bt horizon	20-40"	KNOWLES
		Subsoil is mottled>9"	Thick (9-12") very dark surface (A1, A3) horizon over dark mottled Bt subsoil horizon	24-40"	LISBON
			Thin (3-9") dark surface horizon over paler A2 horizon and Bt subsoil horizon	24-40"	LAMARTINE
	Silt cover <20"	Subsoil not mottled<30"	Thick (9-12") very dark surface (A1, A3) horizon over Bt subsoil horizon	20-40"	GRISWOLD
			Thin (3-9") dark surface horizon over paler A2 horizon and Bt subsoil horizon	20-40"	LAPEER
			Thin dark surface horizon over thin weakly developed subsoil (cambic B horizon) and/or C horizon	4-12"	HENNEPIN
			Thick (9") dark surface horizon over Bt subsoil horizon. Solum is neutral. C horiz. very calcareous	12-20"	HOCHHEIM
			Thin dark surface horizon over paler A2 horizon and Bt subsoil horiz. Limestone at 20-40" depth	20-40"	WHALAN
	Sandy cover on till	Sandy deposit 18-36" thick	Dark surface soil over paler A2 and Bt subsoil horizon	35-45"	METEA
Soils on low ground, flooded or ponded after heavy rains	Mineral soils	Silt cover, 36-50"	Very thick(12-15") black (10YR 2/1) surface (A1, A3) horizon over dark gray mottled and gleyed subsoil calcareous at 15 to 26 ins.	24-42"	PELLA
			Very thick calcareous black surface (Apca) soil, with many snail shells, over a dark mottled and gleyed subsoil	30-50"	HARPSTER
		Silt Cover <20"	Thick (12") black surface soil over dark mottled and gleyed subsoil	30-50"	BROOKSTON
		20-36"	Very thick (18") black surface soil, locally capped with thin muck, over gleyed subsoil	30-50"	KOKOMO
	Organic soils		Thick to very thick dark to black soft peat or muck over gleyed mineral substratum	12-50"	MUCK, PEAT

* See glossary for explanation of terms and symbols. Colors are of moist soil (designations according to the standard Soil Color Chart)

Figure 28. Key to soils on glacial till.

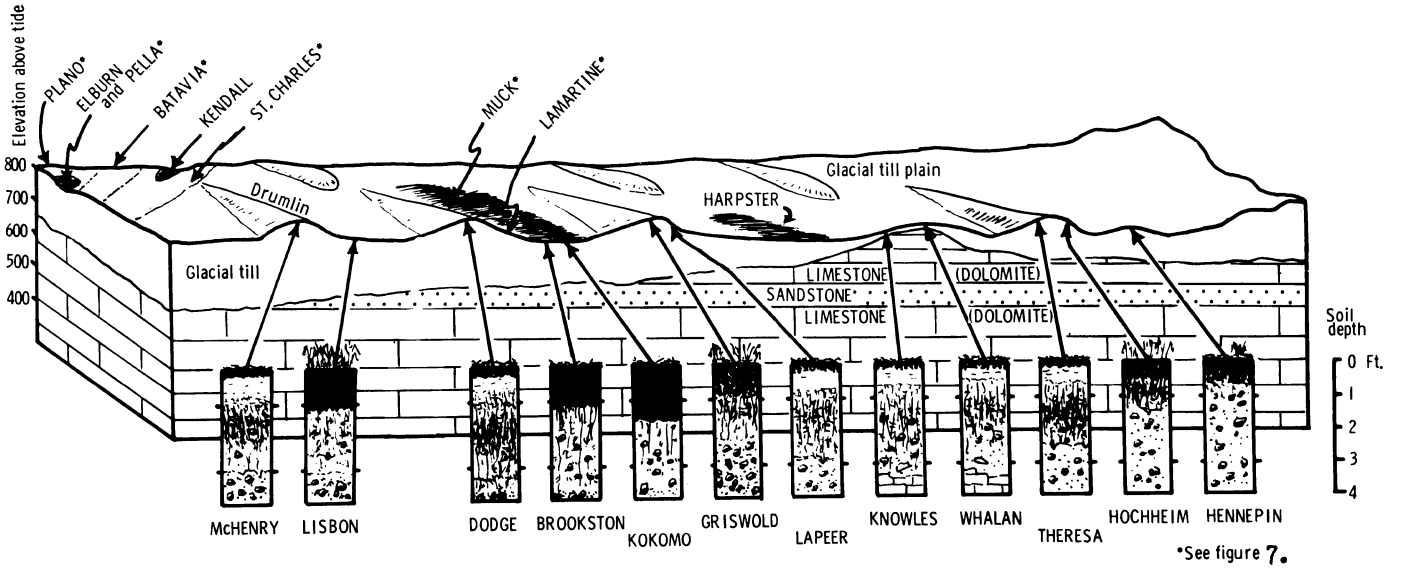


Figure 29. Landscape positions of soils on glacial till (see Figure 28).

developed in till has a clay loam texture. McHenry soils (p. 98; Figures 28, 29) have formed in about the same thickness of loess over till as the Dodge soils, but are found in the northwest area where the till has a lower carbonate content (less than 30 percent $CaCO_3$ equivalent), a higher content of coarse sand and less silt. The portion of the McHenry Bt developed in the till is usually a sandy clay loam texture. Dodge soils are common in Milford, Watertown, and Ixonia townships; McHenry soils are common in Waterloo and Lake Mills townships.

Theresa soils (p. 118; Figures 28, 29) are found associated with Dodge soils on those portions of the landscape where the loess is somewhat thinner. Most of the clay loam Bt horizon in the Theresa soils has developed in the till.

The deep silty (30-50" of silt) St. Charles soils (p. 112; Figures 6, 7, 28, 29) are found on nearly level till uplands in Waterloo and Lake Mills townships. The Bt horizons are silty clay loam in texture except for the lower few inches of sandy clay loam developed in till. Some soils with thick (50 to 70 inches) sola, formed half (30-36") in loess and half in till, are found in the southwest corner of Aztalan township along Wisconsin Highway 89. These soils have been included in the St. Charles series. Plano silt loam (p. 109; Figures 6, 7, 28, 29) is an inextensive inclusion along the western boundary of the county, near Lake Koshkonong.

2. *Lapeer loam and Theresa silt loam.* This association of light colored, well to moderately well drained soils has been subdivided according to slope: 0-6 percent gradients (Map Unit 2a), 6-12 percent gradients (Map Unit 2b) and 12-30 percent gradients (Map Unit 2c).

Lapeer loam soils (p. 95; Figures 2, 24, 28, 29) are the most extensive in the unit, particularly in the central townships of Oakland, Jefferson, Hebron, and Sullivan. They are common where the loess covering over the till is absent or no more than 10 inches thick. The surface soil texture is loam to silt loam and the Bt horizon is a sandy clay loam to a light clay loam.

Theresa soils occur in association with Lapeer soils where the loess mantle averages 10 to 20 inches thick and the carbonate content of the till is high, especially in Jefferson, Sullivan, Farmington, and Concord townships. In this region, the Lapeer loam soils occur on convex crests or flanks of drumlins where the slope gradients are more than 12 percent and the Theresa soils are found on the less steep slopes (2-12 percent gradients).

3. *Lapeer sandy loam and Metea fine sandy loam.* These light colored, well-drained sandy loams have formed in till, with and without fine sandy loam coverings. The soils are subdivided according to slope: 0-6 percent gradients (Map Unit 3a), 6-12 percent gradients (Map Unit 3b) and 12-30 percent gradients (Map Unit 3c).

The two soil series in this association are widely scattered over the county. Lapeer sandy loam, the more extensive, is common in the southeast (Koshkonong, Cold Spring, Hebron, Sullivan, and Plamyra townships) and Metea fine sandy loam (p. 100) is found in the north central region (Milford, and Watertown Townships). These two soil series may be found in close association only near the center of their geographic ranges. They have been listed together in an association because of similarity in surface textures and profile characteristics and in order to form a unit of reasonable size.

The 18 to 36-inch thick sandy covering of the Metea soil profile originated as eolian or glacial lake beach deposits. Metea profiles have a fine sandy loam surface horizon and a sandy clay loam to loam Bt horizon, developed in both the level portions of the landscape around the base of drumlins in Milford and Watertown townships where a loess mantle covers much of the upland. In this region bodies of soil units 3a and 3b consist of Metea soils; unit 3c includes steeper Lapeer sandy loams (3c).

4. *Hochheim loam and silt loam, thin-solum Lapeer sandy loam, and Hennepin sandy loam and loam.* This widely distributed association of light colored, well drained soils, formed in till and patches of thin loess covering, is subdivided into three slope groups: 0-6 percent gradients (Map Unit 4a), 6-12 percent gradients (Map Unit 4b) and 12-30 percent gradients (Map Unit 4c).

Hochheim soils (p. 88) are usually found on sharply convex drumlin crests and steep side slopes (12-40 percent). They are associated with Theresa and Dodge soils in Watertown and Ixonia townships.

Thin-solum (less than 24 inches thick) Lapeer and eroded Hennepin soils lie on sharply convex crests and flanks of drumlins in Jefferson, Sullivan, and Hebron townships. They occupy geologically eroded portoins of the landscape, in association with typical Lapeer soils.

5. *Lamartine, Lisbon, Kendall, and Elburn silt loams.* This association of somewhat poorly drained silty soils is in shallow depressions on uplands and on concave footslopes of drumlins.

The moderately deep Lamartine (p. 94) and Lisbon (p. 96) and deep silty Kendall (p. 89) and Elburn (p. 82) soils (Figures 7, 28, 29) usually occur in long, narrow bands at the base of drumlins and occupy a position on the landscape between the well-drained soils of the uplands and the poorly drained soils of the interdrumlin lowlands. They can be found throughout the county, but are most abundant in Watertown, Ixonia, Farmington, and Concord townships.

The soil bodies in this association receive runoff from the drumlins, and in many instances have a covering of 12 inches or more of silty alluvium. Areas of somewhat poorly drained alluvial soils are inclusions in this association.

6. *Pella, Harpster, Brookston, and Kokomo silt loams and silty clay loams.* These poorly and very poorly drained deep silty soils, with black surface horizons, are on the interdrumlin lowlands[11] where surface drainage is slow, the natural water table is near the surface, and run-off water from the surrounding uplands ponds during wet seasons. Lowering of the water table by artificial drainage has improved agricultural production in many areas. The soil map does not separate drained from undrained areas.

The non-calcareous Pella soils (p. 108; Figures 7, 28, 29) are usually found in the northeastern portion of the county in Watertown, Ixonia, Farmington, and Concord townships. The calcareous Harpster soils (p. 86; Figures 28, 29) are associated with areas of lacustrine deposits where surface drainage is slow or bicarbonate-charged water seeps to the surface. Snail shells are typically abundant in the surface soil. Both of the soils are common in Milford, Waterloo, and Aztalan townships.

The shallower Brookston and Kokomo soils (pp. 75, 93; Figures 28, 29) are present to a minor extent in Jefferson County because most of the interdrumlin lowlands have more than 36 inches of silty material over the till. Small areas of these soils can be found in Jefferson and Sullivan townships where the loess cover is thin on the uplands and where the lowlands lack lacustrine deposits.

7. *Knowles silt loam, Whalan loam and sandy loam, and associated soils.* These soils are shallow to bedrock, usually limestone, and are scattered throughout the western and central portions of the county. This unit also includes small bodies of unnamed soils shallow over sandstone and quartzite bedrock. The presence of bedrock is usually not considered in the classification of a soil unless it lies within 4 to 5 feet of the surface. However, this mapping unit does include some areas in which the bedrock may be as much as 10 to 15 feet below the soil

[11] F. D. Hole has suggested that these lowlands be termed "nilmurds". A reverse spelling of drumlin is nilmurd, and represents the reversal of landscape position as one goes from elongated hill to elongated lowland in this landscape.

surface. The soil unit is subdivided according to slope: 0-6 percent gradients (Map Unit 7a), and 6-30 percent gradients (Map Unit 7b).

Knowles soils, which are chiefly confined to the western half of the county in areas of moderately thick loess, are probably the least extensive. Bodies of Whalan loamy soils can be observed where loess coverings are thin or absent, such as around the edges of the limestone quarries southeast of Fort Atkinson.

The three kinds of bedrock that outcrop in Jefferson County — limestone, sandstone, and quartzite — have been discussed in the section on geology. Of the three, limestone is the most abundant. Outcrops of bedrock with associated bodies of Whalan and Knowles soils are found in areas north of Whitewater, southeast and north of Fort Atkinson, north of Lake Koshkonong, south of Lake Ripley, east of Lake Mills near the Rock River, and northwest of Rock Lake. The soft sandstone outcrops in only a few places in the county, such as in the southwest quarter of Section 28 and the southwest quarter of Section 33 in Waterloo township. The very resistant quartzite comes to the surface only in the northwest corner of the county. Outcrops can be found in the eastern half of Section 24 and 25 in Waterloo Township. A larger exposure of this rock can be seen in a quarry in Dodge County along State Highway 19, about three miles northwest of Waterloo.

Small areas of somewhat poorly and poorly drained soils over bedrock, as in Section 22 of Aztalan township, have been included in this unit.

Soils of the Glacio-Fluvial Uplands and Associated Wetlands

These soils are formed in a silty to loamy mantle, 1 to 3 feet thick, over calcareous stratified glacial outwash sand or gravel, or both.

There are four characteristic landscapes: (1) level outwash plains, (2) pitted outwash plains, (3) rolling and hummocky kame-kettle complexes, and (4) level wetlands with restricted drainage. Examples of the level and pitted outwash plains (Figure 32) can be observed between Cambridge and Jefferson and Fort Atkinson along U.S. Highways 12 and 18. Outstanding examples of the kame-kettle landscape (Figure 27) are in the Kettle Moraine State Park south of Palmyra. Less striking examples of hummocky outwash can be observed along State Highway 89 north of Lake Mills, and in the northeast along County Trunk S north of Highway 16. Level wetlands on outwash are scattered throughout the county in association with the other landscapes.

Six soil associations (Cartographic Units 8 through 13) are included in this grouping. Units 8 and 9 consist of well to moderately well drained soils that have developed in 1 to 3 feet of silty or loamy material over sand and gravel. These units are usually found on the level to pitted outwash landscapes and are separated from each other on the basis of texture and thickness of the silty to loamy covering. Units 10 and 11 include well to excessively drained soils formed in sandy outwash deposits. Unit 10 consists of sandy soils with well developed Bt horizons, and Unit 11 consists of sandy soils with a banded Bt or which lack a definite Bt horizon. The somewhat poorly drained soils (Unit 12) and the poorly to very poorly drained soils (Unit 13) have formed in silty to loamy deposits over outwash sand and/or gravel at sites with restricted drainage or a high water-table.

8. *Waterloo*[6] *silt loam.* This is a light colored, well to moderately well drained soil (p. 122; Figures 31, 32) formed in 20 to 36 inches of loess over outwash sand and gravel. This unit has been subdivided by slope as follows: slopes of 0-6 percent slope gradients (Map Unit 8a), and slope gradients of 6-20 percent (Map Unit 8b).

Waterloo soils have a silt loam surface texture and a Bt horizon which is silty clay loam in the loess derived part and sandy clay loam in the outwash. They are found in the western half of the county where the loess mantle is thickest, especially in Lake Mills, Oakland, and Sumner townships. Included in this unit

[6] A few tentative series names are proposed in this publication: Busseyville, Milford, Waterloo.

is an area of Mollisols found in the southwest corner of Sumner Township. The profile described on page 123 is an example of this soil type.

9. *Fox silt loam and loam; Casco and Rodman loams and sandy loams.* Most of these soils have formed in more than 20 inches of loamy materials but with less than 20 inches of silt, over outwash sand and gravel, and have profile characteristics associated with development under forest vegetation. The Rodman soils have developed under prairie in oak openings on gravelly outwash. This unit has three divisions on the basis of slope: Subunit 9a includes slopes of 0-6 percent gradients; gradients of 6-12 percent are in Subunit 9b; slope gradients of 12-50 percent, Subunit 9c.

These soils are scattered throughout the county and it is difficult to describe a general pattern of occurrence. Fox silt loam profiles (p. 84; Figures 31, 32) are usually found in the western half of the county where the regional silt mantle is thickest. Fox and Casco (pp. 84, 78) loams and sandy loams occur together on areas of level to pitted outwash in the central and southern portions of the county where the silt mantle is thin or absent. In places the soil distribution is related to the braided pattern inherited from the outwash deposits (Figure 30).

Rodman (p. 112) soils are typically found in areas of hummocky outwash deposits, such as in the Kettle Moraine region (Figures 7, 32). Rodman and Casco soils occur together as a complex unit on this landscape. Rodman is commonly on the steep convex slopes and Casco is found on gentler slopes and in sags where a mantle of loamy deposits overlies the sand and gravel. The deeper Fox soils may also be present in this landscape. Patches of an unnamed, deep, dark silty soil occupy the floors of some deep kettles.

10. *Oshtemo and Boyer sandy loams and loamy sands.* These are light colored, well-drained soils formed in sandy outwash deposits with little gravel. The two subdivisions within the unit are based on slope gradients: 0-6 percent (Subunit 10a); and 6-30 percent (Subunit 10b).

Oshtemo soils (p. 106; Figures 31, 32) have a thicker solum and Bt horizon and are less droughty than Boyer soils (p. 72; Figures 26, 32). These soils are scattered throughout the county but are most abundant in the southeast in Palmyra and Sullivan townships where sandy outwash is extensive and the loess mantle is thin or absent.

11. *Spinks and Oakville loamy sands and sands.* These are light colored, well to excessively drained soils formed in deep sandy outwash. The unit has two subdivisions based on slope gradient: 0-6 percent (Subunit 11a); and 6-30 percent (Subunit 11b). The Spinks soils (p. 117; Figures 31, 32) have a banded Bt horizon that is lacking in the more droughty Oakville soils (p. 106; Figure 7). These

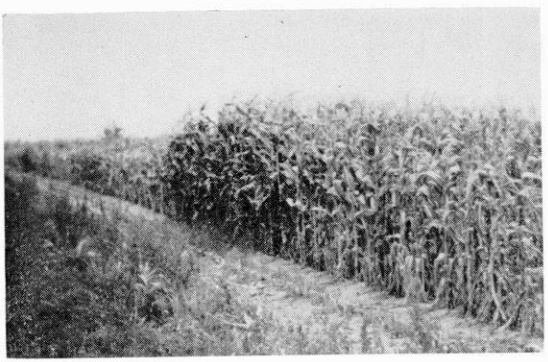
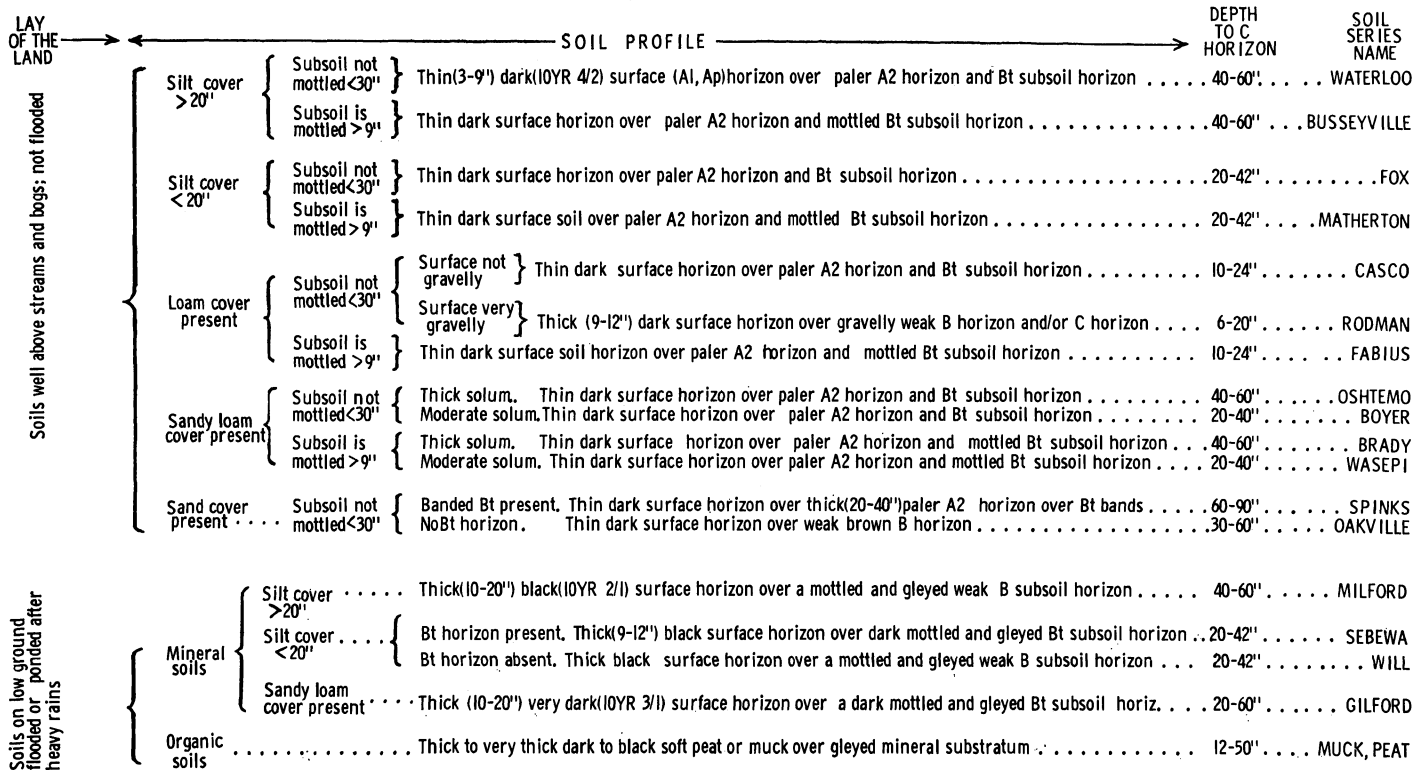


Figure 30. Effect of abrupt changes in soil on crop is shown by the uneven height and color of the corn. The stunted crop in the distance is on shallow Casco soil. The tall crop in the foreground is on Fox soil, which is deepest (5 feet of loamy material), center, where the corn is darkest in color.

GENERALIZED SOIL KEY* FOR USE IN LANDSCAPES OF JEFFERSON COUNTY, WISCONSIN: PART 2. SOILS ON GLACIO-FLUVIAL DEPOSITS.
(Note: A soil key for your locality can be prepared with the assistance of a soil specialist)



* See glossary for explanation of terms and symbols. Colors are of moist soil (designations according to the standard Soil Color Chart)

Figure 31. Key to soils on glacial outwash.

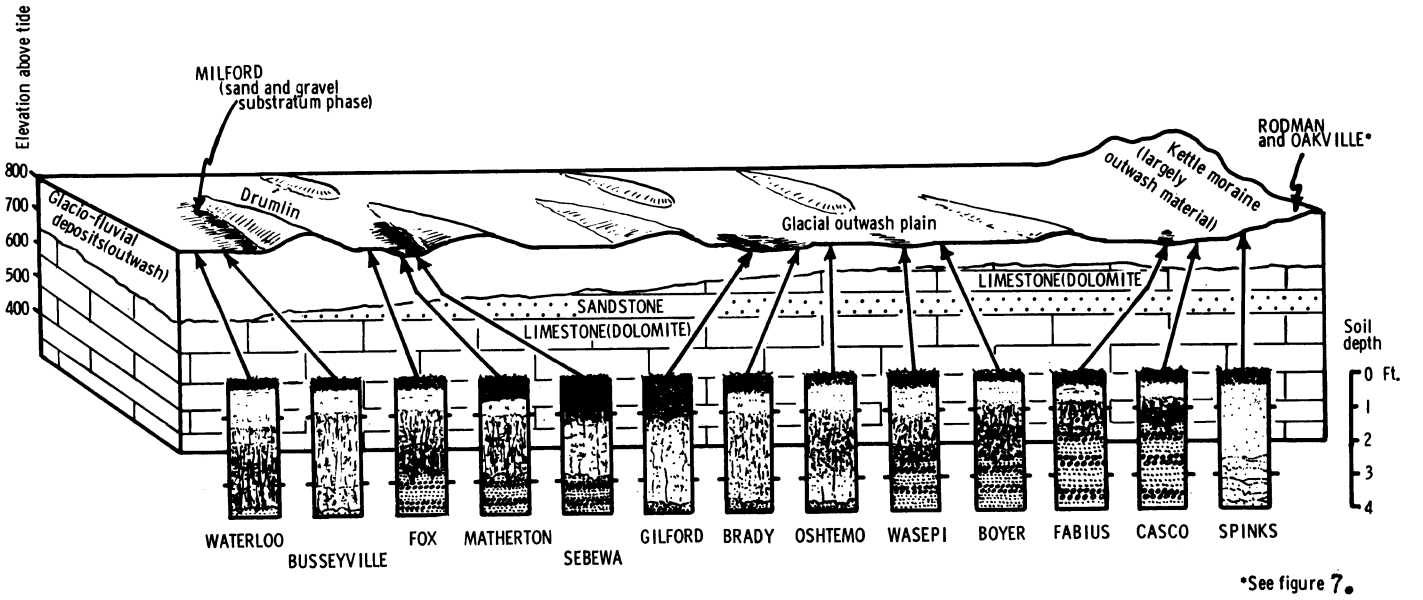


Figure 32. Landscape positions of soils on glacio-fluvial (outwash) deposits (see Figure 30).

soils are formed in deposits of windblown sand associated with the Kettle Moraine in Palmyra and Sullivan townships.

12. *Busseyville*[6] *silt loam; Matherton silt loam and loam; Fabius,, Brady, and Wasepi loams and sandy loams.* These are nearly level somewhat poorly drained soils (Figures 31, 32) with dark surface horizons of intermediate thickness formed in more than 20 inches of silty to loamy materials over calcareous sand and gravel. Subdivisions within this unit are based on texture of the covering material over outwash as follows: 1) more than 20 inches of silty material (Subunit 12g; Busseyville and Matherton silt loams); 2) less than 20 inches of silty material (Subunit 12h; Matherton, Fabius, Brady, and Wasepi loams and sandy loams).

The five soils in this association (pp. 76, 100, 83, 73) are distributed throughout the county on nearly level portions of the landscape between the well drained upland soils and the poorly to very poorly drained wetlands. The distribution of these soils is not related to the distribution of the loess mantle in the county as has been the case with the upland soils.

13. *Milford*[6] *silt loam; Sebewa and Will silt loams and loams; Gilford sandy loam and loam.* These are level, poorly and very poorly drained soils (Figures 31, 32) with thick, dark colored surface horizons formed in silty to loamy materials overlying outwash sand or gravel or both. The unit has been subdivided according to texture of the covering material as follows: 1) more than 20 inches of silty materials (Subunit 13g; Milford, Sebewa and Will silt loams); and 2) loamy materials with less than 20 inches of silt mantle (Subunit 13h; Sebewa and Will loams, and Gilford sandy loam and loam).

These soils (pp. 101, 115, 124) are distributed throughout the county on portions of the landscape where surface runoff is slow and often ponded for a time, with restricted internal drainage and a high water table. Associated soils include peats and mucks (Units 24 and 25).

Soils of the Glacio-Lacustrine Plains and Associated Wetlands

These soils have formed in glacio-lacustrine deposits of laminated, calcareous very fine sands, silts, and clays, on low-lying, nearly level portions of the landscape once covered by glacial lakes. The 10 soil associations (Cartographic Units 14 through 23) of this group occupy a fifth of the area of the county.

The soils formed in lacustrine materials are divided into three broad groups as follows: (1) soils formed in 20 to 36 inches of sandy deposits over calcareous lacustrine silts and clays; (2) soils formed in calcareous lacustrine silts and clays over which may lie a thin mantle (less than 20 inches) of sandy outwash material on the surface; and (3) soils formed in calcareous, lacustrine very fine sands with fine sands or silts. There are three drainage divisions in each of these broad parent material groupings.

Low landscape position and relief, and fine texture are conducive to restricted soil drainage. As a result, of the total area occupied by these associations, 10 percent is well to moderately well drained, 15 percent somewhat poorly drained, and 75 percent poorly to very poorly drained. Therefore, drainage problems have to be considered on 90 percent of the area of these soils.

There is much less regularity in the geographic sequence of soils in this landscape as compared with soils on till and outwash as previously described. Soils and land use of this group can be observed along State Highway 59 between Palmyra and Whitewater.

The 10 soil associations are grouped into three broad categories based on parent materials, as discussed previously. Variations in thickness of coverings,

[6] A few tentative series names are proposed in this publication: Busseyville, Milford, Waterloo.

drainage conditions, and presence or absence of Bt horizons are used in the soil classification which is outlined simply in Figure 33, and represented in sketches in Figure 34. Figure 3 illustrates the Keowns soil.

1. *Soils formed in 20 to 36 inches of sandy material over lacustrine silts and clays* include the Hebron-Mosel (Aztalan)-Navan soil sequence (Soil Map Units 14, 17, 20), from well to poorly drained, in the order named. They are found wherever lacustrine silts and clays are covered by coarse to medium sandy deposits at sites of old beaches, bars, or colluvial overwash deposits. Bodies of these soils (see pp. 87, 103, 70, 105) are scattered throughout the county, but are common in lacustrine basins in Palmyra, Cold Spring, and Hebron townships. The presence of a sandy loam covering over the clayey substratum is an advantage with respect to tilth, trafficability, and responsiveness of the soil to spring warming. The finer textured subsoil provides reserves of moisture and plant nutrients. However, variations in thickness of the sandy cover can lead to abrupt changes within a field that are apparent in crop conditions and in management problems.

2. *Soils formed in lacustrine silts and clays which may have sandy coverings as much as 20 inches thick* include the Saylesville-Del Rey (Tichigan, Martinton)-Montgomery soil sequence (Soil Map Units 15, 18, 21), named in order of increasing wetness. Bodies of these soils (see pp. 114, 80, 119, 99, 102) are widely scattered over the county, but are relatively extensive along the Crawfish River in the north, along the Rock River in central sections, and in the broad basin of the Bark River and Scuppernong Creek in the southeast.

The mineralogical similarity of clay of the Saylesville soil to that in the Lapeer sandy loam (in glacial till) has been reported by Borchardt and others (1968). Another evidence of the genetic relationship between fines in till and lacustrine sediments are field observations near Hebron of a gradual, rather than abrupt, transition uphill between the highly clayey Bt horizon of the Saylesville soil and the less clayey Bt horizon of the Lapeer soil.

3. *Soils formed in lacustrine very fine sands and silts* include two catenas: the Sisson-Kibbie-Colwood (Soil Map Units 16, 19, and 22; see pp. 117, 91, 79) and the Salter-Shiocton-Keowns (Soil Map Units 16, 19, and 23; pp. 114, 116, 90). Soils in the second catenal sequence do not have a Bt horizon. The absence of a Bt horizon and the slight depth of leaching of carbonates (as little as 1 foot in the second sequence) differentiate it from the first. The Sisson-Colwood sequence of soils is most common in northern townships and the Salter-Keowns soils in southern townships.

Soils Formed from Organic Materials

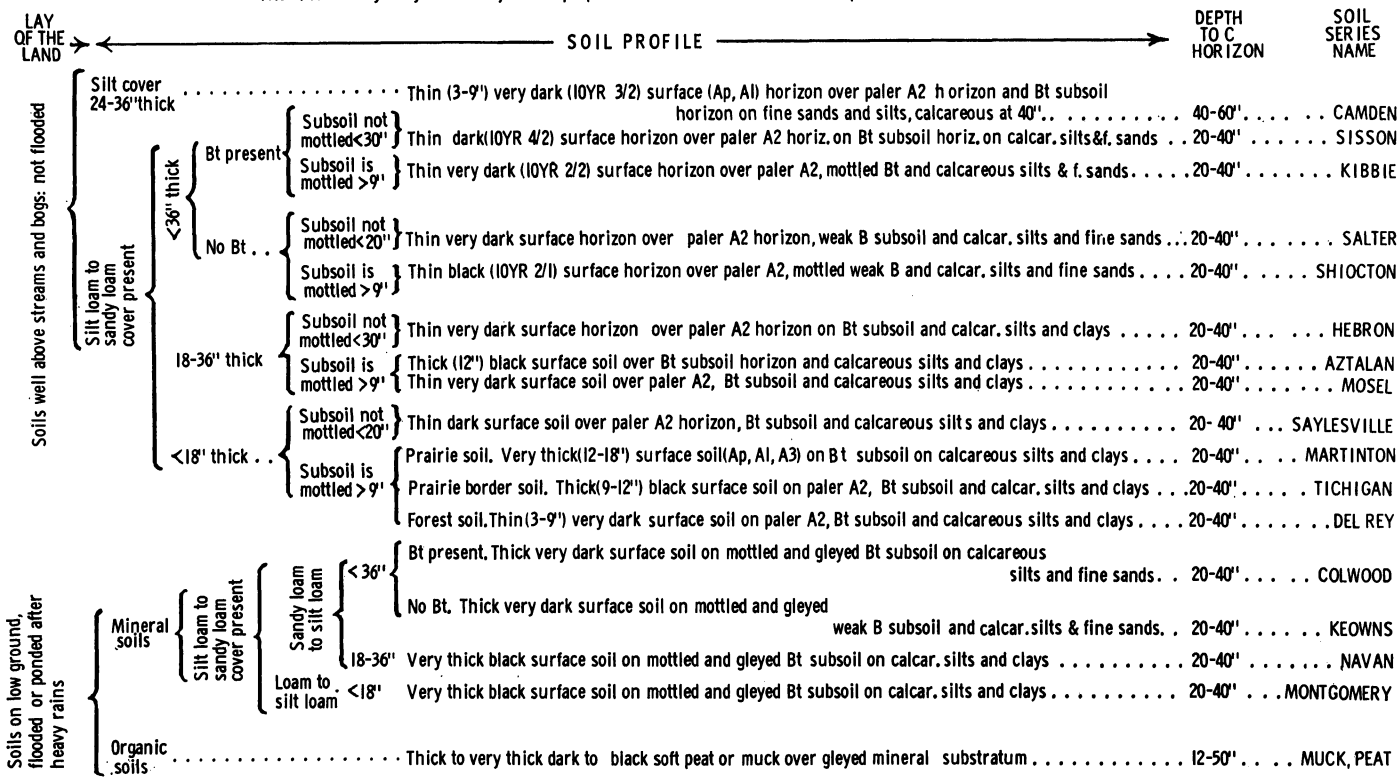
Deposits of organic materials, in which organic soils (Histosols) have formed, are common in low-lying portions of the landscape in association with the previously described mineral soils. Organic materials have accumulated in areas where a high water table has created saturated and anaerobic conditions in depressions or over artesian springs (Figure 20). These conditions retard the decomposition of plant remains and they accumulate as a deposit almost entirely composed of organic debris. Organic materials that are physically broken up but little decomposed and consist of recognizable plant parts are called peat. Organic materials decomposed to the point that plant remains are no longer recognizable to the unaided eye are called muck.

Histosols occur both as small bodies associated with wet depressions in pitted outwash and as large bodies in former glacial lake basins. Many of the larger areas have been cleared and drained and are used for agricultural production. A fine example of Histosols and associated mineral soils can be observed along State Highway 135 where it crosses the Scuppernong River basin just north of the city of Palmyra. A similar basin is crossed by U.S. Highway 18 about 3 miles west of the city of Jefferson.

The organic soils occupy nearly one fifth of the area of the county. Two soil associations are distinguished by thickness of the organic material in which the Histosols have formed: 1) soils more than 42 inches thick (Unit 24); and 2) soils less than 42 inches thick (Unit 25). Further subdivision has been made according to the type of current vegetative cover 1) with a forest cover (v) and 2) without forest cover (x).

GENERALIZED SOIL KEY* FOR USE IN LANDSCAPES OF JEFFERSON COUNTY, WISCONSIN: PART 3. SOILS ON GLACIO-LACUSTRINE DEPOSITS

(Note: A soil key for your locality can be prepared with the assistance of a soil specialist)



* See glossary for explanation of terms and symbols. Colors are of moist soil (designations according to the standard Soil Color Chart)

Figure 33. Key to soils on glacial lake deposits.

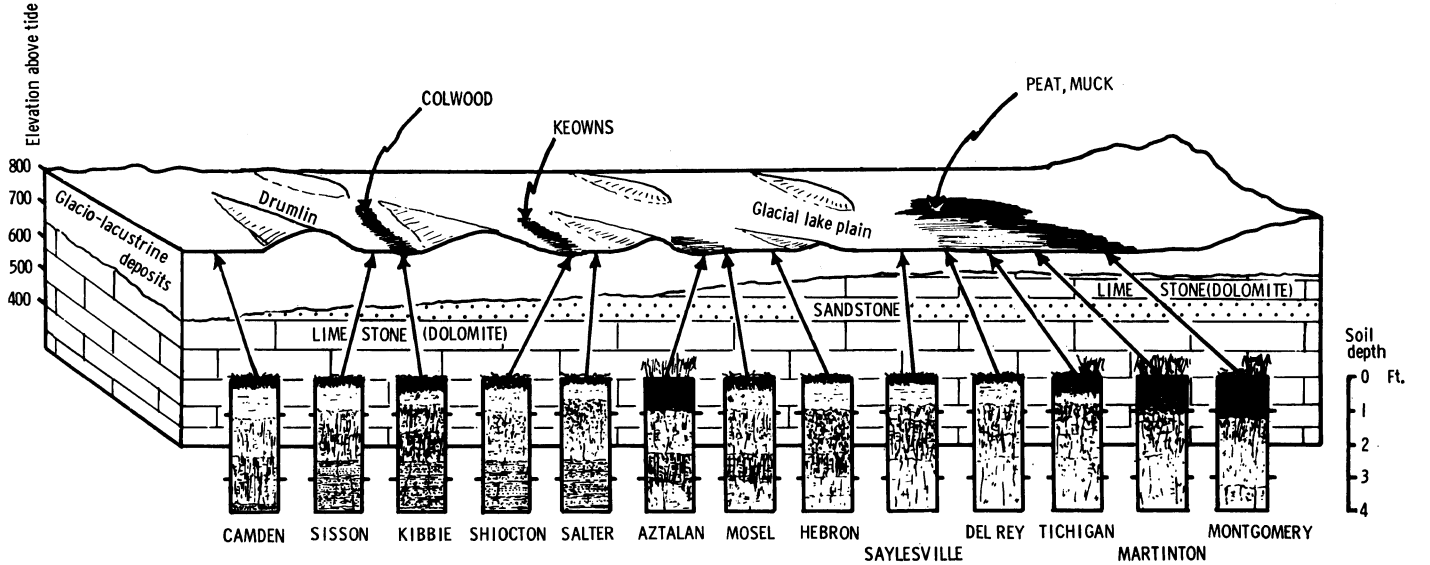


Figure 34. Landscape positions of soils on glacio-lacustrine deposits (see Figure 33).

APPENDIX A. ANALYTICAL DATA FOR REPRESENTATIVE SOILS

TABLE 9. PARTICLE SIZE ANALYSIS OF SOME SOILS OF JEFFERSON COUNTY.

Horizon	Depth (inches)	Size Class and Particle Diameter (mm) of Fine Earth [1]											
		Total (%)			Silt (%)		Sand (%)					Total (%)[3]	
		clay <.002	silt .05-.002	sand 2.0-.05	fsi .002-.02	csi .02-.05	vfs .05-.1	fs .1-.25	ms .25-.5	cs .5-1.0	vcs 1.0-2.0	silt + vfs .002-.1	sand-vfs 0.1-2.0
Casco Loam, T 7 N, R 14 E, Sec. 5, NW 160, NE 40													
Ap	0-6	23.3	44.5	32.2	28.7	15.8	4.1	7.4	16.1	4.0	0.6	48.6	28.1
Blt	6-11	28.8	29.4	41.8	21.2	8.2	2.9	10.2	22.2	6.0	0.5	32.3	38.9
B21t	11-15	26.5	18.0	55.5	12.5	5.5	2.3	11.0	29.2	11.2	1.8	20.3	53.2
B22t	15-20	33.8	14.0	52.2	9.4	4.6	3.7	10.5	24.2	11.8	2.0	17.7	48.5
C	20-25	8.8	11.9	79.3	4.8	7.1	11.5	11.8	40.3	13.5	2.2	23.4	67.8
Dodge Silt Loam, T 8 N, R 15 E, Sec. 12, SW 160, SE 40, SW 10 [2]													
A1	0-3.5	17.6	70.9	11.5	35.8	35.1	3.6	3.6	3.1	1.1	0.1	74.5	7.9
A2	3.5-8	16.7	71.3	12.0	26.4	44.9	3.9	3.8	3.1	1.1	0.1	75.2	8.1
A3	8-13	22.0	67.7	10.3	25.2	42.5	3.5	3.1	2.5	0.9	0.3	71.2	6.8
B1	13-17	26.4	61.8	11.8	29.9	31.9	3.8	3.6	2.9	1.2	0.3	65.6	8.0
B21t	17-24	28.1	60.5	11.4	28.2	32.3	3.8	3.5	2.8	1.0	0.3	64.3	7.6
I&II B22t	24-30	27.8	54.0	18.2	22.8	31.2	4.6	6.5	4.9	2.0	0.2	58.6	13.6
II B23t	30-35	27.4	36.6	36.0	16.3	20.3	7.7	14.7	11.5	1.5	0.6	44.3	28.3
II B24t	35-40	31.8	22.0	46.2	11.6	10.4	9.7	18.2	14.1	3.3	0.9	31.7	36.5
		(31.0)	(20.2)	(48.8)	(8.7)	(11.5)	(10.6)	(18.6)	(14.8)	(3.5)	(1.3)	(30.8)	(38.2)
II B31	40-45	16.4	22.2	61.4	8.3	13.9	18.6	21.0	15.8	4.5	1.5	40.8	42.8
		(22.3)	(20.6)	(57.1)	(12.0)	(8.6)	(10.2)	(20.5)	(19.6)	(4.9)	(1.9)	(30.8)	(46.9)
II B32	45-49	11.7	28.8	59.5	10.4	18.4	17.3	19.5	16.1	4.9	1.7	46.1	42.2
		(17.7)	(24.1)	(58.2)	(13.6)	(10.5)	(11.0)	(21.5)	(20.8)	(3.9)	(1.0)	(35.1)	(47.2)
II C1	49-64	8.9	36.8	54.3	14.2	22.6	16.3	16.7	13.9	5.0	2.4	53.1	38.0
		(16.3)	(27.7)	(56.0)	(15.5)	(12.2)	(11.3)	(20.8)	(19.0)	(3.9)	(1.0)	(39.0)	(44.7)
II C2	64-74	11.0	35.2	53.8	13.4	21.8	16.9	15.4	13.7	4.5	3.3	52.1	36.9
		(17.1)	(29.2)	(53.5)	(16.6)	(12.6)	(10.8)	(19.5)	(18.5)	(3.5)	(1.2)	(40.0)	(42.7)
Fox Silt Loam, T 8 N, R 13 E, Sec. 27, SE 160, NW 40													
Ap	0-8	21.6	56.9	21.5	34.6	22.3	1.4	5.6	12.6	1.9	0.0	58.3	20.1
Blt	8-14	30.0	48.7	21.3	31.5	17.2	5.1	4.8	10.2	1.0	0.2	53.8	16.2
II B21t	14-21	26.2	28.9	44.9	19.3	9.6	3.5	6.5	31.5	3.2	0.2	32.4	41.4
II B22t	21-25	27.5	13.7	58.8	9.3	4.4	2.5	9.2	40.0	6.2	0.9	16.2	56.3
II B23t	25-31	35.0	12.4	52.6	8.2	4.2	3.6	6.5	28.2	12.2	2.1	16.0	49.0
III B3t	31-39	17.5	14.0	68.5	7.5	6.5	19.0	22.5	18.5	8.0	0.5	33.0	49.5
III C	39-60	5.0	6.3	88.7	3.0	3.3	8.5	19.8	42.2	14.5	3.7	14.8	80.2
Hennepin Sandy Loam, T 5 N, R 14 E, Sec. 31, SE 160, NW 40													
A1	0-9	13.9	16.1	70.0	11.3	4.8	7.1	7.9	46.5	7.6	0.9	23.2	62.9
AB	9-12	8.9	18.3	72.8	8.6	9.7	9.0	15.1	39.2	8.3	1.2	27.3	63.8
C	12	12.5	15.5	72.0	10.8	4.7	8.4	18.8	34.0	9.8	1.0	23.9	63.6

TABLE 9. PARTICLE SIZE ANALYSIS OF SOME SOILS OF JEFFERSON COUNTY.

Horizon	Depth (inches)	Size Class and Particle Diameter (mm) of Fine Earth [1]										
		Total (%)			Silt (%)		Sand (%)					Total (%)[3]
		clay <.002	silt .05-.002	sand 2.0-.05	fsi .002-.02	csi .02-.05	vfs .05-.1	fs .1-.25	ms .25-.5	cs .5-1.0	vcs 1.0-2.0	silt + vfs .002-.1	sand-vfs 0.1-2.0
Kibbie Fine Sandy Loam, T 8 N, R 16 E, Sec. 1, NW 160, SE 40, NW 10												
Ap	0-7	13.3	24.2	62.5	15.0	9.2	15.3	27.7	17.5	1.8	0.2	39.5	47.2
A2	7-10	12.9	20.3	66.8	12.9	7.4	16.7	31.5	16.5	1.9	0.2	37.0	50.1
B1	10-13	12.5	19.0	68.5	13.0	6.0	17.4	33.2	16.2	1.5	0.2	36.4	51.1
B21t	13-17	17.5	13.5	69.0	9.0	4.5	18.8	33.3	15.2	1.5	0.2	32.3	50.2
B22t	17-22	21.2	10.8	68.0	6.3	4.5	18.4	35.8	12.8	1.0	0.0	29.2	49.6
B23	22-25	12.5	11.0	76.5	4.0	7.0	25.0	36.5	14.2	0.8	0.0	36.0	51.5
C	25	7.5	12.7	79.8	4.5	8.2	28.7	35.5	14.8	0.8	0.0	41.4	51.1
Lamartine Silt Loam, T 8 N, R 15 E, Sec. 12, SW 160, SE 40, SW 10 [2]												
A1	0-7	21.9	70.6	7.5	39.3	31.3	2.7	2.0	1.9	0.8	0.1	73.3	4.8
A2	7-11	21.4	70.8	7.8	36.5	34.3	2.9	1.9	1.8	0.9	0.3	73.7	4.9
B1t	11-13	34.7	60.2	5.1	32.4	27.8	2.5	1.1	1.0	0.4	0.1	62.7	2.6
B21t	13-21	40.8	56.0	3.2	30.8	25.2	2.2	0.4	0.4	0.2	0.0	58.2	1.0
B22t	21-30	32.1	64.0	3.9	33.6	30.4	2.4	0.6	0.5	0.3	0.1	66.4	1.5
		(32.2)	(63.7)	(4.1)	(34.2)	(29.5)	(2.3)	(0.7)	(0.5)	(0.3)	(0.3)	(66.0)	(1.8)
I&II B23t	30-33	18.0	35.4	46.6	16.3	19.1	8.0	15.5	18.4	3.5	1.2	43.4	38.6
		(21.1)	(36.1)	(42.8)	(18.0)	(18.1)	(5.2)	(13.4)	(19.5)	(3.3)	(1.4)	(41.3)	(37.6)
II B3	33-39	9.9	27.8	62.5	8.5	19.3	9.2	22.3	22.8	6.4	1.8	37.0	53.3
		(12.1)	(17.0)	(70.9)	(9.6)	(7.4)	(6.1)	(22.6)	(35.1)	(5.4)	(1.7)	(23.1)	(64.8)
II C1	39-52	9.1	38.5	52.4	16.9	21.6	23.9	9.4	13.5	3.7	1.9	62.4	28.5
		(16.0)	(29.6)	(54.4)	(17.3)	(12.3)	(10.6)	(20.8)	(18.8)	(3.4)	(0.8)	(40.2)	(43.8)
II C2	52-66	10.5	34.4	55.1	23.0	11.4	17.5	16.8	13.9	4.5	2.4	51.9	37.6
		(16.5)	(29.9)	(53.6)	(19.3)	(10.6)	(10.3)	(21.0)	(18.3)	(3.1)	(0.9)	(40.2)	(43.3)
Lapeer Sandy Loam, T 6 N, R 15 E, Sec. 16, NW 160, NE 40 [4]												
A1	0-3	10.3	34.1	53.7	19.7	14.4	10.8	17.0	22.3	3.8	0.6	44.9	42.9
A2	3-10	8.8	33.4	55.8	21.8	11.6	10.4	19.3	21.9	3.3	0.9	43.8	45.4
B1	10-12	14.5	25.0	60.5	15.0	10.0	10.8	17.5	27.1	4.4	0.7	35.8	49.7
B21t	12-17	22.8	18.2	59.2	8.4	9.8	7.6	22.4	24.6	3.6	1.0	25.8	51.6
B22t	17-28	23.5	7.5	69.0	2.9	4.6	8.9	20.4	32.8	5.5	1.4	16.4	60.1
B3	28-35	13.0	6.6	79.4	4.0	2.6	7.2	22.6	40.3	7.7	1.6	13.8	72.2
C	35-42	9.7	6.3	84.0	2.7	3.6	8.7	30.4	38.0	5.5	1.4	15.0	75.3
Lisbon Silt Loam, T 8 N, R 15 E, Sec. 1, SW 160, NW 40, SW 10, SW 2½												
Ap+	0-8	27.7	69.1	3.2	49.8	19.3	0.7	1.3	1.0	0.1	0.1	69.8	2.5
A12	8-16 }	33.5	61.2	5.3	43.7	17.5	2.7	0.8	1.2	0.4	0.2	63.9	2.6
A13	16-20 }												
A3	20-23	33.8	59.4	6.8	42.0	17.4	3.0	1.3	1.7	0.6	0.2	62.4	3.8
B21	23-30	30.0	59.5	10.5	42.0	17.5	2.0	3.8	3.8	0.8	0.1	61.5	8.5
B22	30-37	25.0	57.5	17.5	39.5	18.0	5.4	5.5	5.5	1.0	0.1	62.9	12.1
II B3	37-44	15.0	29.5	55.5	16.2	13.3	14.5	15.5	19.0	6.0	0.5	44.0	41.0
II C	44-50	13.8	35.4	50.8	23.0	12.4	12.8	12.8	14.2	9.5	1.5	48.2	38.0

TABLE 9. PARTICLE SIZE ANALYSIS OF SOME SOILS OF JEFFERSON COUNTY.

Horizon	Depth (inches)	Size Class and Particle Diameter (mm) of Fine Earth [1]											
		Total (%)			Silt (%)		Sand (%)					Total (%) [3]	
		clay <.002	silt .05-.002	sand 2.0-.05	fsi .002-.02	csi .02-.05	vfs .05-.1	fs .1-.25	ms .25-.5	cs .5-1.0	vcs 1.0-2.0	silt + vfs .002-.1	sand-vfs 0.1-2.0
Pella Silty Clay Loam, T 8 N, R 15 E, Sec. 12, SW, 160, SE 40, SW 10 [2]													
A1	0-7	31.4	66.4	2.2	37.9	28.5	1.1	0.3	0.4	0.2	0.2	67.5	1.1
A3g	7-12	34.8	63.8	1.4	36.2	27.6	0.9	0.2	0.1	0.1	0.1	64.7	0.5
B1g	12-22	31.6	65.6	2.8	36.4	29.2	1.9	0.3	0.4	0.2	—	67.5	0.9
B2g	22-32	30.1	66.8	3.1	36.1	30.7	1.9	0.5	0.6	0.1	—	68.7	1.2
		(31.6)	(65.3)	(3.1)	(34.1)	(31.2)	(1.6)	(0.9)	(0.5)	(0.1)	(—)	(66.9)	(1.5)
B31g	32-41	25.0	68.0	7.0	32.2	35.8	2.0	2.1	2.4	0.4	0.1	70.0	5.0
		(25.4)	(68.1)	(6.5)	(29.3)	(38.8)	(2.1)	(1.6)	(2.6)	(0.2)	(—)	(70.2)	(4.4)
II B32g	41-46	10.6	36.9	52.5	20.8	16.1	9.3	15.0	16.4	8.0	3.8	46.2	43.2
		(15.4)	(31.0)	(53.6)	(18.9)	(12.1)	(7.2)	(16.2)	(18.9)	(7.7)	(3.6)	(38.2)	(46.4)
II C1	46-58	7.9	37.4	54.7	17.9	19.5	11.6	15.5	15.2	7.6	4.8	49.0	43.1
		(13.5)	(29.3)	(47.5)	(17.5)	(11.8)	(9.7)	(16.7)	(20.4)	(7.5)	(2.9)	(39.0)	(37.8)
Rodman Gravelly Cobbly Sandy Loam, T 5 N, R 16 E, Sec. 14, NW 160, SE 40 [5]													
AII	0-2	14.1	25.4	60.5	—	—	21.0	12.3	13.6	7.5	6.1	46.4	40.4
		(19.8)	(13.1)	(67.1)	—	—							
A12	2-5	12.1	24.0	63.9	—	—	25.6	12.2	11.1	7.4	7.6	49.6	38.3
		(15.0)	(28.5)	(56.5)	—	—							
A13	5-10	9.0	20.8	70.2	—	—	20.0	12.0	16.2	11.0	11.0	40.8	50.2
		(9.1)	(11.8)	(79.1)	—	—							
B	10-19	6.0	6.2	87.8	—	—	4.2	5.3	21.1	28.0	29.2	10.4	83.6
		(8.2)	(6.2)	(85.6)	—	—							
C	19-1000	1.2	4.0	94.8	—	—	5.7	10.3	50.3	22.8	5.7	9.7	89.1
		(0.8)	(3.4)	(95.8)	—	—							
Saylesville Loam, T 5 N, R 16 E, Sec. 9, SW 160, SE 40													
Ap	0-8	21.8	36.2	42.0	26.4	9.8	5.0	16.1	17.9	2.8	0.2	41.2	37.0
A2	8-11	12.5	22.5	65.0	18.5	4.0	6.2	25.0	28.8	4.5	0.5	28.7	58.8
II B21t	14-21	55.0	30.2	14.8	26.5	3.7	2.8	3.5	3.2	1.5	3.8	33.0	12.0
II C	29-45	32.5	65.0	2.5	52.7	12.3	1.3	0.5	0.5	0.1	0.1	66.3	1.2
Theresa Silt Loam, T 8 N, R 15 E, Sec. 10, SE 160, NW 40													
Ap	0-9	14.1	59.7	26.2	36.9	22.8	6.8	7.0	10.8	1.6	0.0	66.5	19.4
B1	9-12	23.8	56.2	20.0	38.5	17.7	4.6	6.0	8.0	1.2	0.2	60.8	15.4
I&II B21t	12-17	32.5	31.7	35.8	22.7	9.0	5.8	11.5	15.0	3.0	0.5	37.5	30.0
II B22t	17-21	37.5	23.0	39.5	17.7	5.3	5.5	14.0	16.8	3.0	0.2	28.5	34.0
II B23t	21-27	35.0	22.2	42.8	17.0	5.2	5.8	14.8	18.5	3.5	0.2	28.0	37.0
II B3	27-38	20.0	24.5	55.5	15.9	8.6	15.4	18.2	18.0	3.8	0.1	39.9	40.1
II C	38-48	12.5	31.7	55.8	20.5	11.2	15.3	16.0	18.0	6.0	0.5	47.0	40.5

TABLE 9. PARTICLE SIZE ANALYSIS OF SOME SOILS OF JEFFERSON COUNTY.

Horizon	Depth (inches)	Size Class and Particle Diameter (mm) of Fine Earth [1]											
		Total (%)			Silt (%)		Sand (%)					Total (%)[3]	
		clay <.002	silt .05-.002	sand 2.0-.05	fsi .002-.02	csi .02-.05	vfs .05-.1	fs .1-.25	ms .25-.5	cs .5-1.0	vcs 1.0-2.0	silt + vfs .002-.1	sand-vfs 0.1-2.0
Waterloo-Like Silt Loam: Mollisol Associate, T 5 N, R 13 E, Sec. 19, NW 160, SW 40													
Ap	0-7	26.9	64.1	9.0	44.4	19.7	3.2	2.2	2.9	0.7	0.0	67.3	5.8
A3	7-10	35.2	60.3	4.5	43.1	17.2	2.7	0.9	0.7	0.2	0.0	63.0	1.8
B21t	10-22	38.8	56.1	5.1	35.7	20.4	3.1	1.0	0.8	0.2	0.0	59.2	2.0
B22t	22-32	35.0	57.8	7.2	36.2	21.6	3.7	1.8	1.5	0.2	0.0	61.5	3.5
I&II B23t	32-40	33.8	46.5	19.7	28.4	18.1	6.5	6.2	6.2	0.8	0.0	53.0	13.2
II B3t	40-46	15.0	2.9	82.1	2.0	0.9	3.1	14.0	42.0	19.5	3.5	6.0	79.0
II C	46-50	6.2	3.8	90.0	1.7	2.1	5.8	16.0	46.0	19.2	3.0	9.6	84.2

Footnotes to Table 9

[1] Fine earth is mineral material of the soil less than 2 mm in diameter.

[2] Data are from E. J. Ciolkosz (1967). Carbonates were removed by digestion with pH4.5 NaOAc buffer. Data for particle size distribution analysis after carbonate removal are given in parentheses.

[3] These data are useful in making family textural groupings in the new classification of the USDA (1960, 1967).

[4] Data from G. A. Borchardt (1966).

[5] Data from Gaikawad (1964). Data for particle size distribution analysis after carbonate removal are given in parentheses. These data are for the fine earth. See footnote 2, Table 11, for proportion of fine earth in the horizons of this soil.

TABLE 10. CHARACTERIZATION ANALYSIS OF FOUR SOILS OF JEFFERSON COUNTY, WISCONSIN

Horizon	pH	Percent by weight			m.e./100g					Base saturation %
		Organic matter	Free iron oxides	CaCO3 equiv.	Exchangeable cations				CEC[1]	
					K	Na	Ca	Mg		
Dodge Silt Loam[2] (S.W.¼, S.E.¼, S.W.¼, Sec. 12, T.8N., R.15 E.)										
A1	6.6	9.1	1.0	0.0	0.67	0.05	17.58	6.46	38.1	64.9
A2	5.1	1.4	1.0	0.0	0.17	0.14	6.79	2.55	18.8	51.3
A3	4.9	0.7	1.1	0.0	0.19	0.12	9.22	2.32	18.2	65.1
B1	4.7	0.5	1.4	0.0	0.23	0.13	11.98	2.46	21.3	69.4
B21	5.0	0.5	1.4	0.0	0.28	0.14	14.48	3.25	24.1	75.3
I&II B22	5.0	0.5	1.5	0.0	0.28	0.10	13.94	4.01	23.2	79.0
IIB31	5.3	0.3	1.6	0.0	0.28	0.12	11.09	5.02	22.1	74.7
IIB32	7.1	0.5	2.0	5.2	0.33	0.11	13.59	7.68	24.5	88.6
IIB33	7.9	0.4	1.0	30.8	0.12	0.09	6.77	4.13	12.0	92.5
IIB34	8.2	0.2	0.8	38.3	0.09	0.09	5.46	3.48	7.6	120.0
IIC1	8.4	0.2	0.6	44.1	0.08	0.03	6.96	3.73	4.8	225.0
IIC2	8.3	0.2	0.6	43.8	0.08	0.01	7.39	4.42	4.9	242.8
Lamartine Silt Loam[2] (S.W.¼, S.E.¼, S.W.¼, Sec. 12, T.8N., R.15 E.)										
A1	6.5	6.9	0.8	0.0	0.15	0.08	12.69	9.17	34.2	66.9
A2	6.8	1.6	0.7	0.0	0.16	0.10	9.18	8.64	21.7	83.3
B1	6.9	1.0	0.8	0.0	0.37	0.13	13.40	12.99	32.0	84.0
B21	7.1	0.6	0.8	1.6	0.53	0.16	16.35	13.14	39.4	94.3
B22	7.3	1.2	0.5	2.5	0.53	0.14	13.14	12.61	31.2	84.6
I&II B23	8.0	0.2	0.7	16.8	0.27	0.07	8.50	6.99	16.8	94.2
IIB3	8.0	0.1	0.5	21.5	0.13	0.06	4.90	4.03	8.1	112.5
IIC1	8.3	0.1	0.6	39.7	0.10	0.05	9.07	4.44	5.7	239.6
IIC2	8.3	0.1	0.5	43.8	0.09	0.02	10.49	3.17	4.4	301.8

TABLE 10. CHARACTERIZATION ANALYSIS OF FOUR SOILS OF JEFFERSON COUNTY, WISCONSIN

Horizon	pH	Percent by weight			m.e./100g				CEC[1]	Base saturation %
		Organic matter	Free iron oxides	$CaCO_3$ equiv.	Exchangeable cations					
					K	Na	Ca	Mg		
Lapeer Loam[3] (N.W.¼, N.E.¼, S.E.¼, Sec. 16, T.6N., R.15 E.)										
A1	5.1	3.8	—	0.0	0.09	0.03	5.7	2.5	9.4	88
A2	4.6	1.5	0.6	0.0	0.04	0.04	2.3	0.7	5.1	61
B1	4.1	1.0	0.8	0.0	0.10	0.05	3.0	0.9	6.2	66
B21	4.6	0.6	—	0.0	0.14	0.07	5.2	2.0	10.2	73
B22	4.1	0.5	1.2	0.0	0.22	0.09	5.0	3.3	10.8	80
B3	7.0	0.4	—	15.9	0.08	0.05	3.7	1.4	4.2	100+
C	7.6	0.2	0.3	26.7	0.06	0.03	3.3	0.7	2.0	100+
Pella Silty Clay Loam[2] (S.W.¼, S.E.¼, S.W.¼, Sec. 12, T.8N., R.15 E.)										
A1	6.8	19.0	0.5	0.0	0.44	0.15	39.73	16.90	76.6	75.1
A3g	6.9	2.3	0.2	0.0	0.42	0.14	17.43	14.42	38.9	83.3
B1g	7.0	0.5	0.6	0.0	0.49	0.11	14.74	12.98	30.7	92.2
B2g	7.1	0.3	1.1	2.5	0.49	0.12	12.79	12.17	27.8	91.9
B31g	7.3	0.3	0.6	4.4	0.42	0.11	10.43	9.63	22.3	92.3
II B32g	7.8	0.3	0.6	25.6	0.18	0.08	6.41	5.40	10.4	116.0
IIC1	8.1	0.3	0.5	31.7	0.12	0.07	9.79	4.30	7.5	190.4

TABLE 11. ANALYTICAL DATA[1] FOR REPRESENTATIVE SOILS OF JEFFERSON COUNTY, WISCONSIN

Horizon	Depth (inches)	pH	Available Nutrients (pounds per acre; pp 2m) P	K	Ca	Mg	Total Organic Matter %
			Casco Silt Loam (N.E.¼, N.W.¼, Sec. 5, T.7N., R.14 E.)				
Ap	0-8	7.0	122	280	2300	1450	4.5
B1	8-11	7.0	49	215	2910	1600	1.5
B21	11-15	7.2	65	225	3360	1730	1.2
B22	15-20	7.3	51	250	3130	1700	1.7
C	20-25	7.9	32	85	600	1400	0.7
			Fox Silt Loam (N.W.¼, S.E.¼, Sec. 27, T.8N., R.13 E.)				
Ap	0-8	7.5	18	125	1000	800	2.0
B1	8-14	6.7	42	190	1950	1000	0.9
IIB21	14-21	6.2	86	250	2300	1100	0.8
IIB22	21-25	6.3	60	250	1500	1000	0.7
IIB23	25-31	6.6	43	265	2420	1400	0.8
IIIB3	31-39	7.3	12	185	1500	1100	0.8
IIIC	39-60	8.5	12	60	1500	420	0.3
			Hennepin Loam (N.W.¼, S.E.¼, Sec. 31, T.5N., R.14 E.)				
A1	0-9	7.6	170	265	2300	750	5.5
AB	9-12	7.8	132	145	800	310	3.2
C	12-18	8.1	19	110	500	180	2.0

TABLE 11. ANALYTICAL DATA[1] FOR REPRESENTATIVE SOILS OF JEFFERSON COUNTY, WISCONSIN

Horizon	Depth (inches)	pH	Available Nutrients (pounds per acre; pp 2m) P	K	Ca	Mg	Total Organic Matter %
			Kibbie Sandy Loam (N.W.¼, S.E.¼, N.W.¼, Sec. 1, T.8N., R.16 E)				
Ap	0-7	7.1	39	75	980	530	3.5
A2	7-10	7.0	43	75	700	400	1.2
B1	10-13	7.1	24	125	800	500	0.7
B21	13-17	7.0	24	175	1280	700	0.8
B22	17-22	7.1	24	200	1390	1800	0.7
B23	22-25	7.5	14	145	750	700	0.4
C	25-30	8.0	6	80	650	650	0.3
			Lisbon Silt Loam (S.W.¼, S.W.¼, N.W.¼, Sec. 1, T.8N., R.15 E)				
Ap+	0-8	6.7	35	160	4030	1200	10.0
A1	8-20	6.8	17	225	3130	1900	6.0
A3	20-23	7.0	5	275	3100	1880	1.7
B21	23-30	7.4	4	285	3110	1890	1.0
B22	30-37	7.4	2	285	3130	1900	0.6
IIB3	37-44	7.9	7	215	1280	1100	0.5
IIC	44-50	8.4	7	100	590	590	0.5
			Rodman Gravelly Cobbly Sandy Loam[2] (S.E.¼, N.W.¼, Sec. 14, T.5N., R.16 E)				
A11	0-2	7.6	59	320	—	—	14.3
A12	2-5	7.6	57	130	—	—	7.8
A13	5-10	7.7	62	80	—	—	4.9
B	10-19	7.8	20	40	—	—	1.8
C	19-370	8.2	7	40	—	—	1.4

TABLE 11. ANALYTICAL DATA[1] FOR REPRESENTATIVE SOILS OF JEFFERSON COUNTY, WISCONSIN

Horizon	Depth (inches)	pH	Available Nutrients (pounds per acre; pp 2m) P	K	Ca	Mg	Total Organic Matter %
			Saylesville Silt Loam (S.E.¼, S.W.¼, Sec. 9, T.5N., R.16 E.)				
Ap		7.1	50	165	950	660	2.9
A2		7.4	68	85	900	1190	0.5
IIB21t		7.4	24	280	1500	1050	0.8
IIC		8.1	7	160	950	1000	0.4
			Theresa Silt Loam (N.W.¼, S.E.¼, Sec. 10, T.8N., R.15 E.)				
Ap	0-9	7.4	38	135	450	200	1.9
B1	9-12	7.2	46	195	550	210	0.8
I&IIB21	12-17	7.1	60	250	500	400	0.8
IIB22	17-21	6.9	76	285	1280	1200	0.8
IIB23	21-27	7.0	62	270	650	610	1.0
IIB3	27-38	7.8	29	195	650	490	0.7
IIC	38-48	8.2	2	115	500	300	0.2
			Waterloo-Like Silt Loam: Mollisol Associate (S.W.¼, N.W.¼, Sec. 19, T.5N., R.13 E.)				
Ap	0-7	8.8	83	210	1500	1000	3.1
AB	7-10	6.4	29	240	1500	1180	2.8
B21t	10-22	5.4	54	325	2180	1310	1.8
B22t	22-32	5.3	89	350	2180	1400	1.3
B23t	32-40	5.6	101	335	2070	1400	0.8
B24t	40-46	6.7	34	185	750	750	1.0
C	46-50	7.6	20	85	800	400	0.2

[1] Analyses by the State Soil Testing Laboratory, Department of Soil Science, College of Agriculture, The University of Wisconsin, Madison, Wisconsin.

[2] Data are for <2 mm material, from Gaikawad (1964). This fine earth fraction constitutes the following proportions of the whole soil by horizons: A11, 42.3%; A12, 15.1%; A13, 13.2%; B, 21.2%; C, 15.2%.

B. Glossary

A horizon — The surface horizon of an undisturbed mineral soil. It is usually subdivided into several subhorizons. The A1 is dark colored and high in content of organic matter; the A2 is usually light colored and leached; the A3 is transitional to the B horizon; the Ap is the plow layer (0″-7″ depth) of surface soil in a field that has been cultivated. If this layer contains a notable accumulation of lime it is termed the Apca horizon. Some soils have all of these subdivisions; others do not.

Aggregate, soil — A cluster of soil particles. Synonym for ped.

Alfisol — See Appendix C.

Alluvium — Soil material deposited by streams.

Association, soil — A group of soils that may or may not resemble each other, but that are geographically associated together in a particular pattern.

B horizon — A master horizon or layer in a soil profile usually found below the A horizon. It is usually characterized by stronger colors (usually brown) than those in horizons above or below, by an accumulation of iron, clay, or organic matter, and by a blocky structure. It is usually subdivided into several subhorizons.

B1 — A horizon that is transitional from A3 to B2.

B2 — The part of the B horizon in which diagnostic properties dominate. If clay accumulation is diagnostic the horizon may be labeled Bt or B2t (B21t and B22t are subdivisions thereof). If accumulation of organic matter and iron oxide are diagnostic, the horizon is designated Bhir.

B3 — A horizon that is transitional from B2 to C.

Bog (soil) — An organic soil.

Bog (peat) — A peat deposit, usually consisting of moss peat, upon which plants are growing. Bogs are generally found in enclosed depressions.

Brunizem — The kind of soil which usually developed under prairie vegetation in southern and western Wisconsin. These soils have thick, dark surface horizon over C or B and C horizons.

C horizon — A layer of relatively unweathered material similar to the material from which at least a part of the soil above it was formed. Soil parent material.

Calcareous (soil) — Soil containing free lime which effervesces when diluted (1:10) HCl is applied.

Catena — A group of soils developed from similar parent material but differing in morphology because of differences in natural drainage conditions.

Clay — The smallest mineral grains, less than 0.002 mm in diameter.

Clay (texture) — Soil that contains 40% or more clay, less than 45% sand, and less than 40% silt.

Clay loam — Soil consisting of 27 to 40% clay and 20 to 45% sand.

Colluvium — Deposit of soil accumulated at the base of a slope under the influence of gravity. Slope wash.

Color of soil — Soil color designations given in parentheses in this bulletin are from the scientific Munsell Color Chart (Pendleton and Nickerson, Munsel Co., Baltimore, Md., 1951) in terms of (1) hue, such as 10YR; (2) value (white or black); and (3) chroma (intensity of color). 10YR 4/4 is a designation for dark yellowish-brown (Soil Survey Staff, 1951).

Complex, soil — Several soils, so closely intermingled that they cannot be shown separately on a map at the scale being used.

Consistence, soil — The resistance of soil to separation or deformation. Soil consistence varies with moisture content. It is described in terms such as loose, friable, firm, hard, sticky.

Cradle-knoll — A shallow pit, 6 to 30 inches deep and several feet across, and adjacent mound, 12 to 36 inches high and several feet across, created by tipping of a tree in a wind-storm. The root mass of the falling tree pulled soil up from the pit site (cradle) and dumped it in the form of the mound (knoll).

Cycle — A regularly recurring series of events or phenomena.

Dolomite — Magnesian limestone. A limestone consisting mostly of the mineral dolomite: $CaMg(CO_3)_2$.

Drainage, soil — Natural soil drainage refers to the speed with which water is removed from the soil surface and through the soil itself. Seven classes have been recognized: excessive, somewhat excessive, well, moderately well, imperfect, poor, and very poor. Artificial drainage refers to removal of water by ditching, tiling, and construction of surface water ways and terraces.

Drift — Glacial deposits, both ice-laid and water-laid.

Drumlin — An oval or cigar-shaped hill of glacial drift (usually till), ordinarily with its long axis parallel to the movement of ice that formed it.

Eluvial (horizon) — A horizon that has lost bases, iron, clay, *etc.* by processes of soil formation. A2 horizons are eluvial.

Entisol — See Appendix C.

Esker — Serpentine ridge of rudely stratified glacial outwash sand and gravel deposited in tunnels under stagnant glacial ice.

Exchangeable cations — Available plant nutrients in the form of cations (such as ions of calcium, magnesium, potassium) in soils, determined in me/100 gm with a flame photometer on leachate.

Field grading of soil texture — For more than 50 years soil surveyors have routinely done field grading of soil texture by rubbing soil between the fingers. With experience, a person can judge by the feel of the soil how much sand, silt, and clay are present. According to the proportions of material of these 3 sizes, textural class names are given to soil from different horizons and different profiles. These textural terms and their definitions are best summarized in a chart known as the textural triangle (Soil Survey Staff, 1951). Some people find it helpful to have a copy of this triangle with them in the field. However, an attempt is made here to describe briefly how the different textural classes of soil feel. These classes are defined elsewhere in the glossary. Some phrases are taken from C. F. Shaw (Soil Survey Staff, 1951). It is a good idea to accompany a professional soil surveyor from time to time in order to compare field grading judgements. Textures intermediate between those listed below can be recognized by relative amounts of gritty, soft, and sticky material in them.

1. *Stones, cobbles,* and *gravel.* These coarse fragments, all with diameters greater than 2 mm, 1/12th inch), can be recognized by eye and measured with a rule and are not rubbed between the fingers as is finer soil. Fragments of gravel size are less than 3 inches in diameter, cobbles are between 3 and 10 inches in diameter, and stones (or boulders) are larger than that.

2. *Sand.* Sand feels gritty and harsh. Individual grains can be seen and felt. Squeezed when moist, the soil forms a fragile cast.

3. *Sandy loam.* This class feels quite gritty but also somewhat loamy. Individual sand grains can be seen and felt. There is enough silt and clay to soften the feel of this soil. Squeezed when dry, the soil forms a somewhat stable cast.

4. *Loam.* This feels somewhat gritty, somewhat smooth, and possibly a little sticky and plastic. Sometimes the observer decides to call the soil a loam chiefly because it is not sandy enough to be a sandy loam, silty enough to be a silt loam, nor clayey enough to be a clay loam. Squeezed dry, it forms a fragile cast. Squeezed moist, it forms a stable cast.

5. *Silt loam.* In a dry state, lumps and clods prove to be very fragile. When rubbed, this soil feels soft like flour and forms a fairly stable cast when squeezed. In a moist state this soil feels

smooth and mellow. The moist cast is stable. Moist soil will not form a polished ribbon when rubbed between the thumb and finger, but will appear as a somewhat rough and noncoherent coating on the thumb.

6. *Clay loam.* The dry soil is hard and lumpy. Moist soil is plastic; forms a very stable cast when squeezed; and, when rubbed between the thumb and finger, forms a thin, somewhat fragile ribbon, with a somewhat polished surface. The moist soil can be kneaded in the hand into a compact mass which does not readily crumble.

7. *Clay.* The soil is very hard and lumpy, when dry. Moist soil is very plastic and sticky; it forms a cast which is stable; elongated casts may sag under their own weight; when rubbed between the thumb and finger, the soil forms a long flexible ribbon which has a good polish on the surface.

g — A soil horizon that is gleyed.

Glacial drift — See Drift

Glacial till — Unsorted glacial drift transported and deposited by ice.

Glacio-fluvial deposits — Sediments deposited by glacial streams. These deposits are usually sandy or gravelly and are typically stratified.

Glacio-lacustrine deposits — Sediments deposited in glacial lakes. These include fine sands, silts, and clays. They may be stratified or varved.

Gleyed (soil) — Soil material which is olive-gray or bluish-gray in color. Gleyed horizons are usually found below a dark-colored surface layer in poorly drained soils.

Gray-Brown Podzolic — The kind of soil that usually developed under forest vegetation in southern Wisconsin. These soils have light-colored subsurface horizons, brown illuvial (clayey) subsoils, and are generally acid.

Histosol — See Appendix C.

Horizon, soil — A layer of soil more or less parallel to the land surface and having characteristics produced by processes of soil formation.

Humic gley — A naturally poorly drained soil having a thick, dark-colored surface horizon and a gray (gleyed) subsoil.

Humus — The organic layer of a forest soil consisting of well-decomposed organic matter, the origin of which cannot be determined by observation of the material with the naked eye.

Illuvial horizon — Horizon that has received material (bases, clay, etc.) from an eluvial horizon. B horizons of Gray-Brown Podzolic and Podzol soils are illuvial.

Inceptisol — See Appendix C.

Intergrade — A soil that does not clearly belong to any great soil group but has some characteristics of several groups.

Kame — A roughly conical hill of rudely stratified glacial outwash sand and gravel deposited in a cavern under a glacier.

Leaching — Removal of material from soil in solution by percolating water. For example, the removal of lime from the upper part of a soil is a leaching process.

Lithosol — A shallow soil consisting of a dark-colored surface soil underlain by bedrock.

Litter layer — The mat of dead decomposing organic material above the mineral soil.

Loam (texture) — Soil that contains 7 to 27% clay, 28 to 59% silt, and less than 52% sand.

Loamy sand — Soil that contains at the upper limit 85 to 90% sand, and the percentage of silt plus 1½ times the percentage of clay is less than 15. At the lower limit it contains not less than 70 to 85% sand, and the percentage of silt plus twice the percentage of clay does not exceed 30.

Loess — A wind-blown deposit of silt size particles of a wide variety of minerals including quartz, feldspar, and carbonates. Loess and loess-derived soils are generally fertile.

Marl — An earthy deposit consisting of calcium carbonate (lime), silt, and clay. It is found in lake bottoms or below peat.

Marsh — A wet area supporting sedge, grass, and reed vegetation.

Mollisol — See Appendix C.

Morphology, soil — This refers to the physical constitution of the soil, including such characteristics as the color, texture, structure, and consistency of the various horizons, their thickness, and arrangement in the soil profile.

Mottled — Somewhat spotted appearance, as in the case of soil that shows splotches of rust and gray colors. Mottling in most of the soils in Wisconsin indicates that natural drainage is restricted, or that the water table rises to or near the surface periodically.

Muck — Organic soil material that is partially decomposed. Muck is usually dark in color.

Mull — A mixture of humus and mineral soil that is intimate. The A1 soil horizon.

O horizon — An organic soil horizon, that is a soil horizon containing more than about 25% by weight of organic matter, ovendry. Sandy soil horizons are termed organic if the organic matter content exceeds 20%; clayey horizons, if it exceeds 30%.

Organic soil — Soil formed from organic materials. Peat and muck are organic soils and are classified in the Bog great soil group.

Outwash — Sorted sand and gravel deposited by glacial melt waters flowing out from the glacier.

Parent material — The material from which a soil formed, such as sandy loam glacial till, deep sand, or woody peat.

Particle size distribution (of soil) — This is a synonym for texture and refers to the per cent by weight of clay and silt (determined by hydrometer method of Day, 1957, in this study), and sands (determined with sieves) in dry material.

Peat — Organic soil material that is relatively undecomposed. This material may be broken (disintegrated), but plant parts can still be recognized. When peat undergoes decomposition it becomes muck.

Ped (soil) — A soil aggregate. A ped may be blocky, platy, prismatic, or granular in shape.

pH — A notation used to designate the acidity or alkalinity of a soil. A pH of 7.0 indicates neutrality. Lower values indicate acidity and higher values, alkalinity.

Phase, soil — A subdivision of a soil unit based on features significant to man's use of a soil. For example: sloping phase, stony phase.

Profile, soil — A vertical section through a soil, exposing all of its horizons, including the parent material.

Quartzite — A metamorphic rock consisting mostly of silica; a former sandstone cemented with quartz.

Reductant-soluble Fe — This refers to free iron in soil. Free iron is determined by reducing and complexing the iron in a neutral system.

Regosol — A shallow soil consisting of an A horizon over unweathered, unconsolidated parent material.

Sand — Mineral grains having diameters ranging between 2 and 0.05 mm.

Sand (texture) — Soil consisting of 85% or more of sand. The percentage of silt plus 1½ times the percentage of clay shall not exceed 15. Coarse sand, sand, fine sand, and very fine sandy subclasses are recognized.

Sandy clay loam — Soil that consists of 20 to 35% clay, less than 28% silt, and 45% or more of sand.

Sandy loam — Soil consisting of either 20% clay or less; and the percentage of silt plus twice the percentage of clay exceeds 30; and 52% or more of sand; or less than 7% clay, less than 50% silt, and between 43 and 52% of sand.

Sequum — A sequence of an eluvial horizon and its related illuvial horizon.

Silt — Mineral grains ranging in size from 0.05 to 0.002 mm in diameter. Soil material containing more than 80% silt and less than 12% clay is included in the silt class.

Silty clay — Soil that contains 40% or more of clay and 40% or more of silt.

Silty clay loam — Soil consisting of 27 to 40% of clay and less than 20% sand.

Silt loam — Soil consisting of 50% or more of silt and 12 to 27% of clay; or 50 to 80% of silt and less than 12% of clay.

Solum, soil — The soil solum is the A and B horizons taken together. The C horizon is not included.

Structure, soil — This refers to the aggregation of primary soil particles into compound particles such as granules, blocks, prisms, or plates.

Swamp — A wet area supporting woody vegetation, usually tamarack.

Texture, soil — This refers to the relative proportions of the various size groups of individual soil grains. See *field grading of soil texture.*

Till — See Glacial till.

Variant, soil — A soil of limited or unknown extent but having characteristics unique enough to set it apart from related series. The term variant is usually used temporarily until the soil can be studied further. Phase is sometimes used in the same sense.

C. Classification of Soils

The classifications used in this bulletin are those described by the Soil Survey Staff (1960, 1967) and by Baldwin, Kellogg, and Thorp (1939) and Thorp and Smith (1949). Terms from the Soil Survey Staff classification are given in the text and other (older) terms are given in parentheses. This section of the appendix is devoted to an explanation of the newer terms because this information is not at present as accessible to the public as the older soil classification terms.

The new soil classification system, long known as the "7th Approximation", was developed over about a decade, beginning around 1955, has been in wide use in the United States since January, 1965, and somewhat earlier than that in some parts of the world.

Categories in the new system consist of orders (the highest category), suborders, great groups, subgroups, families, and series. The first four categories are illustrated in Table 12, using a representative soil series from each subgroup. The Wisconsin soil key contains only subgroups, families, and series. Order, suborder, and great group names can be determined from the name of the subgroup.

The nomenclature of the new system above the level of the soil

TABLE 12. NAMES OF ORDERS, SUBORDERS, GREAT GROUPS AND SUBGROUPS OF REPRESENTATIVE SOILS, JEFFERSON, COUNTY, WISCONSIN

Order	Suborder	Group	Subgroup	Representative series
Entisols	Orthents	Udorthents	Anthropic Udorthents	"Made land"
	Psamments	Udipsamments	Typic Udipsamments	Oakville
Inceptisols	Aquepts	Haplaquept	Mollic Haplaquepts	Keowns
	Ochrepts	Eutrochrepts	Aquollic Eutrochrepts	Shiocton
			Typic Eutrochrepts	Salter
Mollisols	Aquolls	Argiaquolls	Typic Argiaquolls	Brookston
		Haplaquolls	Typic Haplaquolls	Pella
		Calciaquolls	Typic Calciaquolls	Harpster
	Udolls	Argiudolls	Aquic Argiudolls	Lisbon
			Typic Argiudolls	Warsaw
	Rendolls	Rendolls	Eutrochreptic Rendolls	Rodman
Alfisols	Aqualfs	Ochraqualfs	Udollic Ochraqualfs	Matherton
			Aeric Ochraqualfs	Del Rey
	Udalfs	Hapludalfs	Aquollic Hapludalfs	Mosel
			Arenic Hapludalfs	Metea
			Psammentic Hapludalfs	Spinks
			Mollic Hapludalfs	Batavia
			Typic Hapludalfs	Lapeer
Histosols	Fibrists	Medofibrist	Typic Medofibrist	Greenwood
	Saprists	Medosaprist	Typic Medosaprist	Houghton

family consists of names coined from Latin, Greek and, occasionally, German roots. Nonsense syllables are also used. The order names have a common ending, sol, with the connecting vowel *o* for Greek roots and *i* for other roots. In Wisconsin, only six of the 10 orders are recognized. They are:

1. Entisol — *Ent* is a nonsense syllable derived from the word "recent".
2. Inceptisol — *Incept* is taken from the Latin word "inceptum" meaning "beginning".
3. Mollisol — *Moll* is taken from the Latin word "mollis" meaning "soft".
4. Spodosol — *Spod* comes from the Greek word "Spodos" meaning "wood ash".
5. Alfisol — *Alf* is a nonsense syllable taken from the word "Pedalfer", which refers to soils having an accumulation of aluminum and iron sesquioxides in their subsoil horizons.
6. Histosol — *Hist* comes from the Greek word "histos" meaning "tissue".

Suborder names can be recognized by their having two syllables (See Table 12). This characteristic is unique to the suborders. The first formative element suggests a diagnostic property common to the suborder and the second is suggestive of the name of the order. For example, the formative element *aqu* (from Latin aqua, water) is combined with "*ent*" to designate Aquents, the wet soils of the Entisol order. The first formative elements used in suborder names in Wisconsin are:

Aqu — Latin *aqua,* water. Characteristics associated with wetness.
Bor — Greek *boreas,* boreal. Cool.
Fluv — Latin fluvius, river. Flood plains.
Ochr — Greek *ochros,* pale. A light-colored surface.
Orth — Greek *orthos,* true. The common ones.
Psamm — Greek *psammos,* sand. Sand textures.
Ud — Latin *udus,* humid. Of humid climates.

Great group names are coined by prefixing one or more additional formative elements to the appropriate suborder name. Each great group name therefore has a suborder name as its final two syllables. If a great group is distinguished from others within the same suborder by a named diagnostic horizon or property, the name of that property is used as the root of a prefix to form the great group name.

Among the Psamments (sandy Entisols), the great group made up of soils having a high quartz content and a low content of weatherable minerals, is named Quartzipsamment. The formative element *Quartz* is derived from the German word *quarz,* quartz. Names of great

groups can be recognized by the presence of three or more syllables and the absence of the ending *sol.* The appropriate suborder is indicated, since its name is the ending of the great group name, and the appropriate order is suggested by the final syllable.

The formative elements added to suborder names to obtain names of great groups in Wisconsin are:

Arg — Latin *argilla,* clay. An argillic (clayey) horizon.
Dystr — Greek *dystrophic,* infertile. Low base saturation.
Eutr — Greek, *eutrophic,* fertile. High base saturation.
Frag — Latin *fragilis,* brittle. Presence of a fragipan.
Gloss — Greek *glossa,* tongue. Tongued.
Hapl — Greek *haplous,* simple. Minimum horizon.
Hum — Latin *humus,* earth. Presence of humus.
Psamm — Greek *psammos,* sand. Sand textures.
Ochr — Greek *ochros,* pale. A light colored surface layer.
Quartz — German *quarz,* quartz. High quartz content.
Ud — Latin *udus,* humid. Of humid climates.

Subgroup names consist of the name of the appropriate great group modified by one or more adjectives. The adjective *typic* is used for the subgroup that is thought to typify the central concept of the great group.

Intergrade subgroups that have, in addition to the properties of their great group, some properties of another class, carry the name of the other class in an adjective form. For example, in Wisconsin, the properties of Ap horizons in some Hapludalfs are nearly those of Ap horizons in Mollisols. These soils are too dark colored to be classified as Typic Hapludalfs, but if a dark surface horizon is their only aberrant property, they are classified as intergrades to Mollisols and are called Mollic Hapludalfs. In this case the subgroup name has been formed by modifying the great group name Hapludalf with the adjective form of the order Mollisol.

The names of orders, suborders, or great groups, or any of the prior formative elements of these names, are used in adjectival form for subgroup names. A few soils have aberrant properties of two great groups belonging in different orders or suborders. With these, it is necessary to use two adjectival forms of class names in the subgroup name.

Other soils have aberrant properties that are not characteristic of a class in any order, suborder, or great group. They may be truncated by rock or have an over-thickened A horizon resulting from slope wash. Descriptive adjectives, along with great group names, are used to form subgroup names for extragrades of this sort. The following

adjectives are recognized in Wisconsin:

Arenic — Latin *arena,* sand. Sandy texture.

Cumulic — Latin *cumulus,* heap. Thickened epipedon (surface horizon).

Glossic — Greek, *glossa,* tongue. Tongued soils.

Lithic — Greek *lithos,* stone. Presence of a lithic contact (bedrock).

If the subgroup is one with a buried soil that is an important part of the present soil, the name includes *Thapto* (Greek, *thapto,* buried) as a modifier of the name of the buried soil.

Soil families are subdivisions of the subgroups. The principal differentiae used for soil families in Wisconsin are texture, mineralogy, and soil temperature. Other differentiae are reaction, permeability, depth, slope, and consistence. Seven textural classes are used for defining soil families (see page 40 of Supplement). These differ from those given in the Soil Survey Manual. Temperature ranges in soils are expressed, in Wisconsin, as mesic (mean annual temperature 47° — 59°F), or frigid (mean annual temperature less than 47°). Texture, mineralogy, temperature, reaction, and other classes are discussed in detail in the March 1967 Supplement to the New Soil Classification System (7th Approximation).

The soil series is a subdivision of the soil family. It is the lowest category in the new system. A soil series includes all soil individuals essentially uniform in differentiating characteristics and in arrangement of horizons; or, if genetic horizons are thin or absent, a collection of soil individuals that, within defined depth limits, resemble each other enough to be thought of as one kind. Each series is given a geographic place name from the area where it was first described. The Aztalan soil, for example, was first described near Aztalan, Wisconsin.

TABLE 13. CHARACTERISTICS OF GLACIAL TILL IN JEFFERSON, WISCONSIN

Location	Sand	Silt	Clay	CaCO eq. (%[3])	Textural Class
SW¼, Sec 31, T8N, R13E	74.1	10.9	15.0	18.7	sl
SE¼, NE¼, Sec 17, T8N, R13E	72.3	13.9	13.8	22.6	sl
SE¼, NE¼, Sec 6, T8N, R15E	58.6	27.6	13.8	56.6	sl
NW¼, SE¼, Sec 11, T8N, R13E	71.1	16.4	12.5	35.2	sl
NE¼, SW¼, Sec 6, T8N, R14E	60.4	24.6	15.0	—	sl
SE¼, SE¼, Sec 15, T8N, R14E	70.2	18.5	11.3	32.7	sl
SE¼, NW¼, Sec 33, T8N, R14E	75.9	19.1	5.0	29.7	ls
SW¼, SW¼, Sec 34, T8N, R14E	71.3	18.7	10.0	34.7	sl
SE¼, SE¼, Sec 3, T7N, R14E	69.6	16.6	13.8	31.9	sl
SW¼, SW¼, Sec 4, T8N, R15E	74.5	13.0	12.5	41.3	sl
SW¼, NW¼, Sec 4, T7N, R15E	72.1	14.6	13.8	36.7	sl
SE¼, NW¼, Sec 2, T7N, R15E	56.9	29.3	13.8	43.4	sl
NE¼, NE¼, Sec 36, T8N, R15E	59.9	32.6	7.5	57.9	sl
SE¼, NE¼, Sec 20, T8N, R16E	86.8	5.7	7.5	39.9	ls
SW¼, NE¼, Sec 22, T5N, R15E	75.3	14.7	10.0	42.5	sl
NE¼, NW¼, Sec 11, T5N, R15E	68.5	17.7	13.8	34.5	sl
SE¼, SW¼, Sec 32, T5N, R15E	67.9	24.6	7.5	36.6	sl
SE¼, SW¼, Sec 30, T5N, R15E	57.9	29.6	12.5	33.8	sl
SW¼, SE¼, Sec 21, T5N, R15E	47.0	30.5	22.5	27.7	l
SW¼, SE¼, Sec 3, T5N, R15E	78.0	14.5	7.5	39.0	ls
SE¼, SW¼, Sec 2, T5N, R15E	61.6	28.4	10.0	44.3	sl
SE¼, SE¼, Sec 35, T5N, R14E	72.4	16.3	11.3	61.8	sl
SE¼, NE¼, Sec 25, T6N, R16E	74.3	18.2	7.5	28.9	sl
NE¼, Sec 10, T5N, R16E	69.6	24.9	5.5	31.0	sl
SW¼, NW¼, Sec 27, T8N, R15E	69.3	18.7	12.0	34.5	sl
SW¼, NW¼, Sec 27, T8N, R15E	65.5	24.5	10.0	44.3	sl
NW¼, SW¼, Sec 4, T7N, R15E	70.9	17.1	12.0	38.2	sl
NW¼, SW¼, Sec 15, T7N, R15E	73.8	15.2	11.0	29.3	sl
NW¼, NW¼, Sec 33, T6N, R16E	65.0	25.0	10.0	33.1	sl
SW¼, Sec 14, T6N, R15E	71.8	23.2	5.0	38.8	sl
SW¼, SW¼, Sec 15, T6N, R15E	72.3	17.7	10.0	31.9	sl
NW¼, NW¼, Sec 10, T6N, R15E	64.2	21.8	14.0	40.3	sl
SW¼, SW¼, Sec 6, T5N, R15E	68.1	23.9	8.0	40.5	sl
SE¼, NW¼, Sec 15, T8N, R16E	63.1	22.9	14.0	39.6	sl
SE¼, NW¼, Sec 23, T5N, R15E	42.1	35.9	22.0	13.2	l
NE¼, SW¼, Sec 12, T7N, R15E	59.4	27.6	13.0	45.5	sl
SW¼, NW¼, Sec 20, T6N, R16E	61.3	17.7	11.0	35.1	sl
SE¼, NW¼, Sec 28, T6N, R16E	35.6	48.4	16.0	31.3	l
NW¼, NW¼, Sec 1, T6N, R16E	75.1	16.1	8.8	—	sl
NW¼, NW¼, Sec 15, T7N, R16E	69.0	21.0	10.0	—	sl
NE¼, SW¼, Sec 1, T7N, R16E	58.9	27.3	13.8	—	sl
SE¼, NW¼, Sec 9, T7N, R16E	65.6	24.4	10.0	—	sl
NW¼, NW¼, Sec 6, T7N, R13E*	75.0	10.4	14.4	21.0	sl
SW¼, SE¼, Sec 32, T8N, R13E*	69.0	17.6	13.3	33.0	sl
NE¼, NE¼, Sec 21, T7N, R13E*	70.8	17.0	12.0	34.0	sl
SE¼, SW¼, Sec 35, T7N, R13E*	69.4	18.8	11.6	28.0	sl
SW¼, SW¼, Sec 28, T6N, R14E*	72.4	16.8	10.7	35.0	sl
SE¼, NE¼, Sec 26, T6N, R13E*	69.9	16.7	13.2	28.5	sl
SE¼, NE¼, Sec 26, T6N, R13E*	65.2	20.9	13.8	29.5	sl
NE¼, NW¼, Sec 12, T8N, R16E*	65.4	22.1	12.3	36.0	sl
SW¼, NE¼, Sec 2, T5N, R13E*	73.7	12.9	13.2	29.5	sl
SE¼, SW¼, Sec 9, T5N, R14E*	76.4	12.8	10.7	31.5	sl
NW¼, SW¼, Sec 31, T5N, R14E*	70.8	16.0	13.0	37.5	sl
SE¼, SE¼, Sec 16, T5N, R15E*	73.0	14.7	12.1	38.5	sl
NW¼, NE¼, Sec 10, T5N, R16E*	77.7	13.0	9.1	28.5	sl
NW¼, SE¼, Sec 10, T8N, R15E*	53.1	32.0	14.7	46.5	sl
NW¼, NW¼, Sec 1, T8N, R14E*	76.6	12.6	10.6	40.0	sl
NW¼, SE¼, Sec 12, T8N, R13E*	59.6	28.2	12.1	38.5	sl
SW¼, SE¼, Sec 14, T8N, R14E*	77.9	14.2	7.6	28.5	ls-sl

TABLE 13. CHARACTERISTICS OF GLACIAL TILL IN JEFFERSON, WISCONSIN

Location	Sand	Silt	Clay	$CaCO_3$ eq. (%)	Textural Class
SE¼, SE¼, Sec 3, T7N, R14E*	73.7	14.9	11.3	33.0	sl
SW¼, SE¼, Sec 3, T7N, R15E*	73.3	19.1	7.5	38.0	sl
SW¼, SW¼, Sec 3, T7N, R16E*	70.4	21.3	8.1	35.5	sl
SE¼, SW¼, Sec 3, T6N, R16E*	75.4	15.0	9.4	35.0	sl
NE¼, SE¼, Sec 16, T6N, R15E*	80.2	10.4	9.2	36.0	ls
NE¼, NW¼, Sec 18, T6N, R15E*	74.8	11.9	13.1	34.0	sl

*Data from R. J. Allan, 1967.

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SOIL MAP OF JEFFERSON COUNTY, WISCONSIN

UNIVERSITY EXTENSION, THE UNIVERSITY OF WISCONSIN, Geological and Natural History Survey, George F. Hanson, Director, Soil Survey Division, F.D. Hole, Chairman; Cartographic Division, R.D. Sale, in charge.

SOILS LEGEND

SOILS OF THE GLACIAL TILL UPLANDS

A. Well to Moderately Well Drained Soils; 0 to 30 percent slopes.
Soil Units 1 through 4 are subdivided according to slope by letters as follows: a equals 0 to 6 percent; b equals 6 to 12 percent; c equals 12 percent plus.

1. Dodge, McHenry, St. Charles and Theresa silt loams. (formed in more than 20 inches of silts over sandy loam till)
2. Lapeer loam and Theresa silt loam. (formed in less than 20 inches of silty deposits over sandy loam till)
3. Lapeer sandy loam, Metea fine sandy loam. (formed in loamy deposits over sandy loam till)
4. Hochheim silt loam and loam, thin solum Lapeer sandy loam, Hennepin sandy loam and loam. (formed in loamy deposits over sandy loam till, sola are less than 24 inches thick)

B. Somewhat Poorly Drained Soils; 0 to 6 percent slopes.

5. Lamartine, Lisbon, Kendall and Elburn silt loams. (formed in more than 20 inches of silty deposits over sandy loam till).

C. Poorly and Very Poorly Drained Soils; 0 to 2 percent slopes.

6. Pella, Harpster, Brookston and Kokomo silt loams and silty clay loams. (formed in more than 20 inches of silty deposits over sandy loam till)

SOILS OF THIN GLACIAL DRIFT OVER BEDROCK UPLANDS

A. Well to Moderately Well Drained Soils; 0 to 30 percent slopes.
Soil unit 7 is subdivided according to slope by letters as follows: a equals 0 to 6 percent, b equals 6 to 30 percent.

7. Knowles silt loam, Whalan loam and sandy loam. (formed in more than 20 inches of silty or loamy deposits over thin deposits of glacial drift over limestone)

SOILS OF THE GLACIO-FLUVIAL UPLANDS

A. Well to Moderately Well Drained Soils; 0 to 30 percent slopes.
Soil unit 9 is subdivided according to slope by letter as follows: a equals 0 to 6 percent, b equals 6 to 12 percent, c equals 12 percent plus. Soil units 8, 10, and 11 are subdivided according to slope by letter as follows: a equals 0 to 6 percent, b equals 6 to 12 percent plus.

8. Waterloo silt loam (formed in more than 20 inches of silty deposits over outwash sand or gravel or both)
9. Fox silt loam and loam, Casco and Rodman sandy loams and loams. (formed in less than 20 inches of silty deposits over outwash or gravel or both)
10. Oshtemo and Boyer sandy loams and loamy sands. (formed in sandy outwash deposits)
11. Spinks and Oakville loamy sands and sands. (formed in sandy outwash or aeolian deposits)

B. Somewhat Poorly Drained Soils; 0 to 6 percent slopes.
Soil units 12 and 13 are subdivided according to thickness of silty deposits as follows: g equals more than 20 inches of silty deposits; h equals less than 20 inches of silty deposits.

12. Busseyville silt loam, Matherton silt loam and loam, Fabius, Brady, Wasepi loams and sandy loams. (formed in silty or loamy deposits over outwash sand or gravel or both)

C. Poorly and Very Poorly Drained Soils; 0 to 2 percent slopes. See B above.

13. Milford silt loam, Sebewa and Will silt loams and loams, Gilford loam and sandy loam. (formed in silty or loamy deposits over outwash sand or gravel or both)

SOILS OF GLACIO-LACUSTRINE PLAINS

A. Well to Moderately Well Drained Soils; 0 to 6 percent slopes.

14. Hebron loam and sandy loam. (formed in 20 to 36 inches of sandy deposits over calcareous lacustrine silts and clays)
15. Saylesville silt loam and loam. (formed in less than 20 inches of sandy deposits over calcareous lacustrine silts and clays)
16. Sisson and Salter fine sandy loams, silt loams and loams; Camden silt loam. (formed in silty or loamy deposits over calcareous lacustrine silts or very fine sands or both)

B. Somewhat Poorly Drained Soils; 0 to 6 percent slopes.

17. Mosel and Aztalan loams and sandy loams. (formed in 20 to 36 inches of sandy deposits over calcareous lacustrine silts and clays)
18. Del Ray, Tichigan and Martinton silt loams and loams. (formed in less than 20 inches of sandy deposits over calcareous lacustrine silts and clays)
19. Kibbie and Shiocton fine sandy loams, silt loams and loams. (formed in silty, fine sandy or loamy deposits over calcareous lacustrine silts and very fine sands)

C. Poorly and Very Poorly Drained Soils; 0 to 2 percent slopes.

20. Navan loam, sandy loam. (formed in 20 to 36 inches sandy deposits over calcareous lacustrine silts and clays)
21. Montgomery silt loam and silty clay loam. (formed in less than 20 inches sandy deposits over calcareous lacustrine silts and clays)
22. Colwood fine sandy loam, silt loam and loam. (formed in silty, fine sandy or loamy deposits over calcareous lacustrine silts and very fine sands)
23. Keowns fine sandy loam and loamy fine sand. (formed in calcareous lacustrine very fine and fine sands)

SOILS OF ORGANIC DEPOSITS

A. Poorly and Very Poorly Drained Soils; 0 to 2 percent slopes.
Soil units 24 and 25 are subdivided according to whether the area is forested or non-forested as follows: v equals forested; x equals non-forested.

24. Peats and mucks (formed in more than 42 inches of organic materials over sandy, loamy or silty glacial drift)
25. Peats and mucks (formed in less than 42 inches of organic materials over sandy, loamy or silty glacial drift)

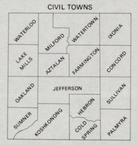
1 0 1 2 3 4
SCALE IN MILES

MAP SIGNS

County boundary
Township line
Section line
Stream
Lake
Soil boundary
Drainage ditch
Gravel pit or quarry
Interstate highway
U.S. highway
State highway
County highway
Railroad
Urbanized area
Village

Soil Survey, 1963 to 1966, was by the Soil Survey Division, Wisconsin Geological and Natural History Survey, University Extension, The University of Wisconsin, Madison, in cooperation with the Department of Soil Science, College of Agricultural and Life Sciences, The University of Wisconsin, and the Soil Conservation Service, United States Department of Agriculture. Soil survey was by Clarence J. Milfred, field party chief R. J. Allan, G. A. Borchardt, E. J. Cialkosz, F. D. Hole, J. E. Langton, A. Q. Lind, G. W. Peterson, R. O. Radke, and W. Wells. A. J. Klingelhoets and P. H. Carroll of the Soil Conservation Service, and F. D. Hole and G. B. Lee of the University of Wisconsin served as Correlators. Reference was made by permission to some detailed soil maps by J. Steingraeber of the Soil Conservation Service. The manuscript map was compiled by C. J. Milfred from field sheets consisting of aerial photographs and U.S.G.S. topographic map quadrangles. Cartography by R. D. Sale, J. T. Liu, D. M. Brophy and M. L. Czechanski.

CIVIL TOWNS



LAMBERT CONFORMAL PROJECTION 4000 FOOT GRID BASED ON WISCONSIN COORDINATE SYSTEM, SOUTHERN ZONE

SOIL MAPS AND REPORTS PUBLISHED

County	Publisher (date)*
Adams	GNHS (1924)
Barron	USDA (1958); GNHS (1948)
Bayfield	USDA (1961); GNHS (1929)
Brown	GNHS (1929-OP)
Buffalo	USDA (1962); GNHS (1917)
Calumet	GNHS (1925)
Columbia	GNHS (1916-RD)
Crawford	USDA (1961); GNHS (1930)
Dane	GNHS (1917)
Dodge	GNHS (Part, 1953')
Door	GNHS (1919)
Florence	GNHS (1962)
Fond du Lac	GNHS (1914-OP)
Grant	USDA (1961); GNHS (1952'; 1956)
Green	GNHS (1930)
[illegible]on Lake	GNHS (1919)
	USDA (1962); GNHS (1914-OP)
	GNHS (1923)
	[illegible]HS (1970; 1916-OP)
	[illegible]914-RD)
	[illegible]65); GNHS (1923)

State Soil Maps (In color)

Leaflet map GNHS (1968)
Wall map GNHS (1968)
Overlay map (to be used on USGS 1:250,000 quadrangles) GNHS (1968)

Miscellaneous Publications

What's on that soil map? GNHS (1953)

Introduction to Soils of Wisconsin GNHS (1955)

Development of a field procedure for predicting movement of liquid wastes in soils. Report No. 1. GNHS (1970-RD)

*Publishing agencies are:
GNHS = Geological and Natural History Survey, University Extension, The [illegible]niversity of Wisconsin, [illegible]on, Wisconsin 53706
[illegible] = S. E. Wisconsin [illegible]ning
[illegible]ment of

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Green	GNHS (1930)
Green Lake	GNHS (1919)
Iowa	USDA (1962); GNHS (1914-OP)
Jackson	GNHS (1923)
Jefferson	GNHS (1970; 1916-OP)
Juneau	GNHS (1914-RD)
Kenosha	SEWPRC (1965); GNHS (1923)
Kewaunee	GNHS (1914-OP)
La Crosse	USDA (1966)
Langlade	GNHS (1947)
Manitowoc	GNHS (1926)
Marquette	GNHS (1961)
Menominee	GNHS (1967)
Milwaukee	SEWRPC (1965); GNHS (1919-OP)
Monroe	GNHS (1931)
Oneida	GNHS (1959)
Outagamie	GNHS (1922-OP)
Ozaukee	SEWRPC (1965); GNHS (1926)
Pepin	USDA (1964)
Pierce	USDA (1968); GNHS (1930)
Portage	GNHS (1918)
Racine	SEWRPC (1965); GNHS (1923)
Richland	USDA (1959); GNHS (1950)
Rock	GNHS (1922)
Sauk	GNHS (1925)
Sheboygan	GNHS (1929)
Trempealeau	GNHS (1927)
Vernon	USDA (1969); GNHS (1928)
Vilas	GNHS (1915)
Walworth	SEWRPC (1965); GNHS (1924-OP)
Washington	GNHS (1926)
Waukesha	SEWRPC (1965); GNHS (1965; 1914-OP)
Waupaca	GNHS (1921)
Waushara	GNHS (1913-OP
Winnebago	GNHS (1927)
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SEWRPC = S. E. Wisconsin Regional Planning Commission
USDA = U.S. Department of Agriculture, Soil Conservation Service

The abbreviations "OP" and "RD," respectively, signify "out of print" and "restricted distribution"

'Folder detailed soil maps are available for several towns in this county.