SOIL SURVEY OF WILL COUNTY, ILLINOIS.

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DESCRIPTION OF THE AREA.

Will County is situated in the northeastern part of Illinois. It is bounded on the north by Dupage and Cook Counties, on the east by Cook County and the Indiana State line, on the south by Kankakee County, and on the west by Grundy and Kendall Counties. The county is irregular in outline. Its greatest length from east to west is about 37½ miles, through the center of the county, and its greatest width from north to south is 36 miles, along the western boundary line. It comprises 844 square miles, or 540,160 acres.

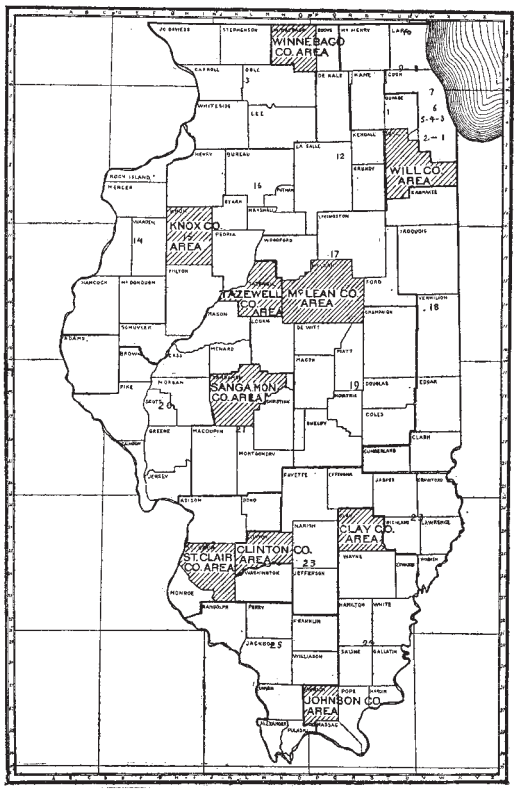

FIG. 40.—Sketch map showing areas surveyed in Illinois.

The county varies in topography from flat to gently rolling. It includes three distinct physiographic divisions—the stream flood plains, the terraces and outwash plains, and the upland.

The stream flood plains occur along the larger watercourses. Their surfaces are flat or very gently sloping toward the upland. The terraces and outwash plains are principally in the southwestern part of the county, comprising all of the territory south of the Kankakee River and also most of Channahon Township north of the river, with a rather wide development extending northward along the Dupage and Des Plaines Rivers beyond Joliet. The characteristically flat topography of this region is occasionally broken by gravelly hills, sandy hills, and dunes. Some of the gravel terraces

are almost as high as the main upland, their elevations ranging from 500 to 600 feet above sea level south of the Kankakee River and from 500 to 650 feet north of this river. The boundary between this region and that of the flood plains is usually marked by an escarpment varying in height from only a few feet to as much as 30 feet, though in places the two divisions are separated only by a gentle slope. The upland comprises the most extensive region. It includes nearly all of the county east of Wilmington and Joliet, the territory west of the Dupage River, and most of that between the Dupage and the Des Plaines Rivers. This region varies in topography from flat to gently rolling. Its boundary with the terrace region is usually marked by a blufflike escarpment 30 to 50 feet in height, although west of the Dupage River it is formed by a long, gentle slope. Over large areas the surface is generally flat, but along the breaks of the streams and on the main divides the topography is gently rolling. The territory north of a line between Joliet and Beecher has the greatest relief. This section has a rolling topography, particularly along the streams and on the higher divides. It is also characterized by marshy depressions, most of which are too small to be indicated on the soil map. The largest of these is Eagle Lake, near the Indiana State line, which is an old lake bed with well-defined banks. All of the depressions were undoubtedly occupied at one time by small lakes. The elevations in the main upland region range from about 500 feet to over 800 feet. The lowest point in the county is 485 feet and the highest 820 feet above sea level.[1]

In general the natural drainage of the county is good. The Kankakee, Des Plaines, and Dupage Rivers, with their tributaries, drain by far the greater part of the county, while the drainage of a comparatively small area in the northeastern part is into Lake Michigan. The divide between these two drainage systems is a part of the great continental divide between the Mississippi and the St. Lawrence Rivers. The region south of the Kankakee is the only part of the county which is poorly drained. While most of this region is wet during a large part of the year, good drainage outlets are available over practically all of it, and artificial drainage is established with little difficulty.

The streams of the county are not navigable, although small boats operate on the Illinois and Michigan Canal. The opportunities for power development on the Des Plaines River are excellent.

The first settlement in Will County was made in 1806 near the present town of Plainfield. Settlement was slow until about 1830, when a steady immigration, mainly of Scotch and German settlers from the Eastern States, began. The eastern part of the county was not settled until after 1849. The population is largely of German,

[1] Leverett, Monographs on Illinois Glacial Lakes.

Scotch, and Irish descent, but includes a few Swedes and some Italians, Poles, and negroes in the rural sections. In the upland region there is an average of about four houses to the square mile, but the poorly drained region south of the Kankakee River is much less thickly settled, there being only about two houses to the section in the rural districts.

The total population of the county, according to the United States census for 1910, is 84,371. It is about equally divided between the towns and the farming districts.

Joliet, with a population of about 35,000, is the metropolis and county seat. This is a modern city, through which most of the products of the western and central parts of the county are shipped. It is also an important manufacturing center.

The transportation facilities within the county are excellent. There are only two or three localities which are more than 5 miles from shipping points. There are 10 different steam railroads operating in the county over a total of about 257 miles of track, and 4 important electric lines. Chicago is the objective point of all these roads and is about 40 miles from the middle of the county on any of the lines. The county is in direct communication with the larger markets of the West and South, including St. Louis, Kansas City, and Denver. The eastern and northern points are reached through Chicago. Joliet and Steger are important manufacturing centers, and are good local markets.

The country roads are sufficiently numerous and are in fair condition as a rule, except during the fall and spring. There are several miles of graveled roads in the county. The opportunities for the construction of such roads are excellent, as large deposits of gravel and stone are conveniently available.

CLIMATE.

The climate of Will County is temperate. The temperatures are subject to sudden changes. Short periods of extreme heat are common in summer, as are those of extremely cold weather in the winter. The annual mean temperature is about 50° F. The mean of each of the winter months is below freezing. The summer mean temperature is 73°, and that of the spring and fall months is very close to the annual mean. The highest recorded temperature is 112°, and the lowest —26°. July is ordinarily the hottest month and February the coldest.

The average date of the first killing frost in the fall is October 7, although the earliest date recorded at Ottawa is September 19. The average date of the last killing frost in the spring is April 23. The latest date recorded is May 21. There is a normal growing season of about 168 days. This is ample for all of the farm crops grown within the county, but does not permit the growing of more than one crop.

The annual mean precipitation is about 37 inches. This is normally well distributed throughout the year, being least during the winter and greatest in the summer, when it is most needed. The lowest annual precipitation recorded is 26.9 inches, and the greatest amount for any one year is 55.7. Periods of two to four weeks of dry weather are not uncommon during the summer months. Where the soil is not properly handled, crops frequently suffer during such periods of drought. Over small areas within the county crops are likely to be damaged by storms, either in the form of occasional hailstorms or severe rainstorms, but tornadoes are extremely rare.

In general, the climate is favorable for all of the crops produced. Crop yields are seldom limited by high or low temperature or too little or too much precipitation. The small grains sometimes suffer from too much heat at blooming time, and it sometimes happens, as in the winter of 1911–12, that wheat is winterkilled. This loss of the wheat crop, however, is due largely to a heavy covering of ice rather than to low temperatures.

The data in the table below are compiled from the records of the Weather Bureau station at Ottawa, La Salle County. This station is about 50 miles west of the center of Will County, and the records are fairly representative of the climatic conditions in this county.

Normal monthly, seasonal, and annual temperature and precipitation at Ottawa, La Salle County.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December	28	64	−14	2.2	2.1	2.1	4.3
January	24	64	−26	2.2	1.8	5.8	8.0
February	23	65	−24	2.1	2.1	1.3	9.3
Winter	25	.....	.....	6.5	6.0	9.2	21.6
March	36	83	− 2	2.9	3.5	4.2	4.6
April	51	92	12	2.7	0.6	4.8	0.5
May	62	99	29	4.0	2.2	3.6	T.
Spring	50	.....	.....	9.6	6.3	12.6	5.1
June	71	103	37	3.6	2.7	5.6	0.0
July	76	112	42	4.0	5.5	8.9	0.0
August	73	103	42	3.1	0.8	6.8	0.0
Summer	73	.....	.....	10.7	9.0	21.3	0.0
September	65	102	26	3.6	3.2	7.6	0.0
October	53	90	13	3.8	0.9	2.5	T.
November	39	76	− 4	2.5	1.5	2.5	2.9
Fall	52	.....	.....	9.9	5.6	12.6	2.9
Year	50	112	−26	36.7	26.9	55.7	29.6

AGRICULTURE.

Opportunities for the pursuit of agriculture were the only inducement for the settlement of this region. There was sufficient forest along the streams to furnish logs and rails for buildings and fences, while the surrounding prairies supported a magnificent growth of grasses for pasturage. Game and fish were abundant. As the forested areas were usually somewhat rolling and fairly well drained, the earlier settlements were made either on or near such land. After clearing, the forest lands, not having a heavy sod, were much more easily cultivated than the prairies, and this is the principal reason why the latter were settled less rapidly. Chicago was the principal market during the early history of the county and regular stage communication with that city was maintained. Before 1816 a canal to connect Lake Michigan with the Mississippi River was projected, but not until 1865 was it completed, although it was in operation prior to 1848 and gave great impetus to the settlement of the western part of the county. The period from 1850 to 1860 was one of great progress in this region. The Chicago, Rock Island & Pacific Railroad was opened from Joliet to Chicago in 1852 and to the Mississippi in 1854. The Chicago, Alton & St. Louis was completed in 1857 and the Michigan Central in 1855. During this period many plank roads were constructed in the county.

The crops first grown were practically the same as those grown to-day, consisting mainly of corn, wheat, oats, barley, rye, and buckwheat. Between 1865 and 1875 a large number of farmers attempted to make sorghum a leading money crop. The crop was expected to furnish sugar, sirup, a dye from the seed, a paper fiber from the stalks, and a spirit from the pomace. The quality of the sugar and sirup was unsatisfactory, however, and the industry was abandoned. While the wheat grown at first was of the spring varieties, the chinch bug worked such devastation that this crop was given up gradually after 1865 and was discontinued about 1880. Dairying became an important industry about 1870. A butter and cheese factory at Wilmington supplied the St. Louis market. The dairy industry has continued to grow, although cheese is no longer an important product. Arranged in order of their acreage the principal agricultural products of Will County are corn, oats, wild hay, wheat, potatoes, clover, and rye.

A production of 173,383 bushels of corn in Will County is reported in the census for 1840. According to the 1910 census 6,217,174 bushels were produced from 157,621 acres in 1909. Prior to 1885 deep cultivation of the corn crop was popular. The abandonment of this practice for shallow plowing resulted in increased yields. The careful selection of seed has also been instrumental in increasing the yields and improving the varieties of corn. The methods of cultiva-

tion now followed have developed through years of experience and in general are as good as in any section of the country.

Small-grain stubble is generally fall plowed for corn. The seed corn used is picked from the field and dried and is usually tested. A check-row planter is used, 2 or 3 grains being dropped in hills 3 feet 6 inches apart. The first cultivation is deep and is followed by frequent shallow plowing. The field is kept free of weeds, although pigeon grass is common. Both yellow and white corn are grown. The crop is usually husked in the field and the stalks pastured. Much of it, however, is harvested and shocked and either husked from the shock or fed to stock in the bundle. Probably most of the crop is fed to stock. Very little corn is shredded, although a large quantity is used for silage. There is need for a more thorough understanding and more careful practice of fertilization.

The production of oats in Will County has increased from 271,587 bushels, reported by the census in 1840, to 5,121,244 bushels, reported in 1910. This production was obtained from an acreage of 133,065 acres. During favorable seasons yields of 60 bushels per acre are not uncommon.

The oat crop nearly always follows corn. It is drilled during the early spring and is harvested during the latter part of July. Harvesting is done with the binder, and bundles are shocked and thrashed in the field.

The practice of fanning the seed and making germination tests is productive of good results. The yield may be increased by giving more attention to seed selection. The soils devoted to oats are usually in need of fertilization.

As early as 1840 a production of 110,464 bushels of wheat is reported for Will County. Prior to about 1870 spring wheat was grown almost exclusively. The census of that year reports 195,286 bushels of spring and 1,996 bushels of winter wheat. Owing to the ravages of the chinch bug, the growing of spring wheat was abandoned in favor of winter wheat. Although wheat has never been a very important crop, the acreage has fluctuated considerably. This is probably because of the winterkilling which sometimes occurs. But 172 acres, producing 3,280 bushels, are reported in 1900 and 3,616 acres, with a production of 80,279 bushels, in 1910. Wheat yields an average of 16 to 17 bushels per acre. Where the crop is destroyed, oats are usually substituted in the spring. The wheat is drilled in, and is harvested just before oats in July. Turkey Red is the most popular variety, and with carefully selected, vigorous seed good yields are obtained, particularly where the crop is planted during the latter part of September. With adequate fertilization the wheat yields may be materially increased.

Barley is a comparatively unimportant crop. The census of 1840 reports a yield of 5,729 bushels. The 1910 census reports a production of 9,406 bushels from 336 acres. This is the highest acreage and production reported. The average yield of barley is about 25 bushels per acre. It is a somewhat more remunerative crop than wheat. The area devoted to barley is increasing. The soils are generally well adapted to this crop.

The acreage devoted to rye, as in the case of wheat, fluctuates somewhat, largely because of winterkilling in some years. The crop is practically confined to the sandy soils along and south of the Kankakee River. The sandy lands of the county are well adapted to rye, but its production on the heavier soils is not satisfactory. The average yield per acre is about 19 bushels. According to the 1910 census 1,066 acres are devoted to rye, with a total production of 13,757 bushels.

Besides the cereals already mentioned, a little buckwheat is grown. It does not thrive as in more eastern areas, the yield averaging about 10 bushels per acre. According to the last census less than 200 acres were in this crop.

In 1910 there were 26,341 acres in timothy, with a production of 32,138 tons of hay. There is a timothy mowing on almost every farm in the county. The sods are commonly allowed to stand too long and become weedy and infested with various pests. Much of the timothy is thrashed for seed. Both the seed and the hay bring good prices. Medium red clover is grown extensively, with some alsike and mammoth. Red clover is an excellent legume, and is an important crop to include in rotations to improve the soil.

The acreage of alfalfa is increasing, although in 1909 it was relatively small; only 277 acres, producing 839 tons of hay, or an average yield of about 3 tons per acre, were reported by the census. Excepting the poorly drained region of the Kankakee River and the soils having limestone close to the surface, this crop can be grown on all the soils of the county. On many of them the application of lime or ground limestone is necessary to correct acidity. The well-drained, gravelly terrace soils are particularly adapted to this crop and are at present used for it extensively.

The last census report shows 9,522 acres of wild grasses, yielding about a ton of hay per acre. These grasses are practically confined to the large, undrained areas south of the Kankakee River. The quality of the hay is not very good, as it contains many plants besides grasses. Where drained this land is devoted to the cultivation of more remunerative crops, although the hay crop is generally profitable.

Besides the hay and forage plants already mentioned considerable millet is grown. The production in 1909 was 1,989 tons of hay, or a

little more than 1½ tons per acre. The crop does well, particularly during wet years. A part of the crop is saved for seed, but most of it is cut and cured for hay. Millet and buckwheat are used as catch crops.

While this is largely a grain-farming county, the live-stock industry is important. The value of live stock is given in the 1880 census as $2,412,253, and in that for 1910 as $4,789,993. Dairying is conducted in all parts of the county. There are a few creameries in the county, and a number of skimming stations. The market for dairy products is Chicago. A large number of farmers separate and ship their own cream or milk. The prices received by the farmers are low, compared with the prices paid in Chicago. This tends to discourage the practice of dairying, except where silage and alfalfa are available for feed. There are a large number of silos in the county, and the number is steadily increasing. There are a number of herds of excellent cattle in the county, Holstein and Jersey being the most popular breeds.

Many young cattle are shipped into the county for fattening. Corn is the principal feed, but hay and silage are also generally used. This industry is of course more important on the upland soils, where corn is grown. The proximity of markets and the abundance of corn produced make this an attractive occupation.

Some hogs are raised on practically every farm. The most popular breeds are the Poland China, Berkshire, and Duroc-Jersey. The production of hogs in connection with grain farming is a very profitable branch of the local agriculture.

There are a few flocks of sheep in Will County, and these, like the beef cattle, are shipped in for fattening purposes. Sheep raising is profitable in some of the more rolling sections of the county.

Work horses are usually of the heavy Percheron or Clyde type. A comparatively small number of mules are used as work stock. Some horses are shipped to outside markets. In general, the work animals are well bred.

While there are no large truck farms in the county, the aggregate acreage devoted to the various garden crops, including potatoes, is large. The soils of the southwestern part of the county, particularly in the vicinity of Braidwood, are used extensively for market gardening. Potatoes are largely confined to the northwestern part of the county, particularly near Plainfield. The sandy land of the Kankakee River district when well drained is an excellent truck soil. With Chicago as a ready market, the opportunities in utilizing this sandy land exclusively for trucking are excellent. Almost all of the potatoes grown are of the later varieties. Fair yields are obtained.

Apples, pears, peaches, plums, and cherries are grown to some extent for home consumption. Fruit is not produced commercially,

although there are a number of excellent orchard sites in the county, particularly along the bluffs of the Des Plaines River, where the air drainage is excellent. The high sandy soil is best adapted to peaches. Some of the soils, particularly the Fox silt loam and the Fox very fine sandy loam, are adapted to the production of small fruits. The well-drained sandy lands are also adapted to strawberries. There is a ready market for all such crops.

The greatest general need in the agriculture of Will County is for the systematic rotation of crops. The most common system of rotation practiced is to alternate corn and oats until the yields become somewhat low, when the field is seeded to timothy, sometimes with clover, and allowed to stay in mowing or pasture land until it becomes rather weedy. The period of such use ranges from two to seven years. The better farms do not keep their fields in grass for more than three years. It is then plowed up and oats and corn are again alternated. The principal objection to this rotation is that it often does not include a legume crop.

The 1910 census reports an expenditure of $6,556 for fertilizer in Will County. Most of this is used in the Kankakee River region of sandy soils. The fertilizer used is generally a low-grade mixture, analyzing about 2–8–2.[1] It is used mainly for corn, being applied in the hill at the rate of 50 to 100 pounds per acre. Rock phosphate is used on a number of farms. On the upland prairie soils it has proved profitable, but on the Waukesha loam results have not been satisfactory. Barnyard manure is used throughout the county. On most of the farms the manure is saved and distributed with spreaders.

According to the 1910 census, the average farm in Will County comprises 139 acres, with an average of almost 124 acres improved. A total of 3,588 farms is reported, 2,102 of which are operated by the owners, and practically all of the remainder by tenants. By far the greater number of tenants rent on the cash basis. Where the share system of renting is followed the tenant gives two-fifths of all the products. In certain other cases two-fifths of the crops and $1 an acre in addition is paid. The highest cash rent reported is $9 an acre and the highest share rent three-fifths of the products.

There is a general scarcity of efficient farm labor. For one man to farm 140 or even 200 acres is not uncommon. This is possible of course only with improved labor-saving machinery, and even then the land is seldom properly cultivated.

SOILS.

No type of soil in Will County has been wholly derived from the underlying rocks through the ordinary agencies of weathering, but

[1] The formula 2–8–2 as here used means that the fertilizer mixture contains 2 per cent nitrogen, 8 per cent phosphoric acid, and 2 per cent potash. In many sections of the country this is known as an 8–2–2 mixture.

several types derived from unconsolidated materials have undergone modification through weathering. The basic soil-forming material is glacial drift. This material was deposited in its present position as moraines or till sheets by the ice itself, or as outwash redeposited and more or less assorted by water, or as finely divided silts and fine sands transported and distributed by wind action.

After this deposition, drainage, through its influence upon weathering and upon the growth of plants and the retention of organic matter, has been an important factor in determining the present physical properties of the various soils. Where grass grew abundantly, and particularly where drainage was rather slow, a large amount of organic matter from decayed vegetation was incorporated in the soil to a considerable depth and material of a very dark gray to black color is found. Where there was a forest growth and drainage was well established there was less accumulation of organic matter, the soil remaining light grayish or yellowish in color. The light and dark colored soils are separated into different series, even where the materials are similar in formation. Thus in the soil material deposited by the ice itself the dark-colored soils are grouped in the Carrington series, represented by the silt loam type in this county. This is an extensive type over the glaciated region of the United States and forms 67.5 per cent of the area of Will County. The light-colored, ice-deposited material is included with the Miami series, represented in Will County by the silt loam. A few areas of the loam also occur.

Gravel terraces are found in many parts of the county, and these give rise to the Fox silt loam and clay loam. These are usually classed as dark soils, although they are not nearly so dark as the Carrington. The clay loam has a reddish-brown surface soil.

In places the rapidly running water removed nearly all of the material which had been deposited over the limestone and left a layer of black soil material resting on the bedrock. This material is mapped as the Millsdale silt loam, and the areas where rock occurs within 12 inches of the surface are indicated on the map by symbols. The light-colored soils which were probably deposited at this period are grouped in the Fox series, including the Fox very fine sandy loam and the Fox fine sandy loam, and also compose the Knox fine sand and Rodman sand. The Knox fine sand is the only soil in Will County which can properly be classed as a wind deposit.

During this stage of glaciation an immense lake probably existed along the present valley of the Kankakee River, principally to the southwest of its present channel. This lake received deposits of glacial material composed of sand and clay over gravel and sand and known as water-laid drift. The black soils resulting from this

deposition are classed in two series, distinguished by the character of the subsoil and substratum. The black soils underlain by heavier subsoils and gravel are mapped as Waukesha loam and Waukesha fine sandy loam. The dark soils underlain by sand and practically no gravel and having a clay substratum are represented by the Clyde fine sand and Clyde fine sandy loam.

The Clyde silty clay loam is a dark soil distinguished from the other soils by the entire absence of sand. It is probably not composed of water-laid drift but of a true lacustrine deposit. The formation of the Clyde clay is not well understood and it too may be a lacustrine deposit. The Clyde clay loam is apparently not alluvial but consists mainly of glacial till. There are no light-colored soils of this formation unless the Miami loam may be so considered, there being considerable doubt as to its derivation.

Of the soils deposited in slowly moving water there are two series of dark soils, each represented by one type in Will County. The deep black soil of the Wabash silt loam occupies stream bottoms. The shallow soil overlying limestone and occurring along the Des Plaines River north of Joliet is mapped as the Romeo silt loam. Of the light-colored alluvial soils, the Genesee silt loam and Genesee fine sandy loam are recognized.

Peat and Muck include areas of large accumulations of vegetable matter, and Meadow areas of alluvial and colluvial material which are wet and lack the uniformity necessary to the establishing of a definite soil type.

Including Muck, Peat, and Meadow, 24 distinct types have been mapped in Will County. The name and relative extent of each are given in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Carrington silt loam	147,776	67.5	Clyde silty clay loam	2,816	0.5
Rolling phase	216,832		Fox fine sandy loam	2,752	.5
Miami silt loam	48,192	9.0	Meadow	2,560	.5
Clyde fine sandy loam	20,224	4.3	Clyde clay loam	1,600	.3
Heavy subsoil phase	3,392		Peat	1,600	.3
Wabash silt loam	18,048	3.3	Miami loam	1,216	.2
Waukesha loam	14,720	2.7	Genesee silt loam	832	.2
Fox silt loam	13,696	2.5	Fox very fine sandy loam	832	.2
Fox clay loam	9,856	1.8	Rodman sand	576	.1
Millsdale silt loam	7,616	1.4	Genesee fine sandy loam	448	.1
Clyde fine sand	7,424	1.4	Clyde clay	384	.1
Romeo silt loam	7,168	1.3	Muck	320	.1
Waukesha fine sandy loam	4,928	.9			
Knox fine sand	4,352	.8	Total	540,160	

CARRINGTON SILT LOAM.

The Carrington silt loam is the most extensive type in the county. Typically it is a nearly black soil and has a level topography. There is a lighter colored phase which has a rolling surface.

The surface soil where typically developed is a very dark gray to almost black silt loam, with a depth of about 12 inches. While moist the soil has a blue-black color, but after drying it has a decided gray cast. It carries a high percentage of organic matter. The surface soil is not difficult to work as a rule, although it is slightly tenacious. The subsurface soil from 12 to 18 inches is black or very dark gray, somewhat mottled in places with dark gray, gray, yellow, and drab. The subsoil, extending from about 18 to 30 inches, is normally a yellowish or slightly mottled yellowish and gray silty clay loam to clay loam. In places the subsoil contains large quantities of gravel. At about 30 inches the yellowish material is much lighter in texture, being a coarse silt loam.

This type is subject to certain variations. In spots the soil is sufficiently heavy to be classed as a clay loam or even a clay. These spots are usually quite small, often covering but a fraction of an acre, although a few are large enough to be mapped as the Clyde clay loam. They are numerous in certain areas having considerable relief, and invariably occupy minor depressions in the main type.

In some areas of this type there is but little yellow in the subsoil, which has a gray or more extensively mottled color. In the large area west of the Dupage River the subsurface soil and subsoil material is somewhat heavier than in most other localities, being a clay or silty clay.

The Carrington silt loam is developed in all the upland parts of the county, except along the northeastern side. It is of more common occurrence from the center of the county westward, the largest areas lying west of the Dupage River. The areas vary in size from only a few acres to about 45 square miles.

In general the topography of the Carrington silt loam is flat, though depressions lying possibly 10 feet lower than the general surface are found, in which the soil is heavier than the typical. The most extensive tracts of this soil are found back from the watercourses on broad, extensive divides. Small areas occur on flat depressions along the watercourses above the limit of overflow. Other bodies occupy long gentle slopes, showing but little detailed relief. The large tract west of the Dupage River is of this character. Its slope is so gentle as to be imperceptible except when viewed from a distance. It rises from the west bank of the Dupage at an average rate of about 20 feet to the mile.

But few water courses traverse this type and artificial drainage must be relied upon for the proper removal of surplus water and the

aeration of the soil. For this reason it was probably the last soil of the county to be brought under cultivation. Although the slope is usually sufficient for artificial drainage it is not sufficient to carry off the surface water and the heavy subsoil prevents rapid seepage, so that tile drainage is generally necessary. While most of the type has received some artificial drainage there are few fields which could not be materially benefited by the installation of tiles. When strings of tile are laid at about every 8 rods most of this type can be effectively drained. If the coarse, active organic-matter content of the soil is maintained, drainage will be more rapid and complete.

The material forming this type is of glacial deposition, and is composed of drift from a number of geological formations, picked up, transferred, and redeposited during the late Wisconsin glaciation. This material has subsequently been modified by weathering under conditions of imperfect drainage, and by the accumulation of organic matter. The areas have been but little modified by any loess or wind-blown material since the withdrawal of the ice, nor has erosion modified the surface to any great extent. Some of these areas seem to have been covered by shallow temporary lakes.

Probably all of the Carrington silt loam was originally prairie supporting a heavy growth of various grasses. The sod was very tough and difficult to break, and this was one of the reasons for its being one of the last types to be brought under cultivation. When its cultivation was undertaken, however, it was recognized as a very strong soil, and good crops were grown with little effort. It is still the most fertile and productive soil in the county. It is used chiefly for the production of grain, and is especially adapted to corn, being the best corn soil in the county, with the possible exception of some of the narrow bottom lands. It is not quite as easy to work as most of the other types, and where plowed while too wet or trampled by stock when soft it puddles and forms intractable clods. The average corn yield is estimated as 60 bushels per acre. Oats average about 50 bushels, and wheat 25 bushels per acre.

Carrington silt loam, rolling phase.—Certain areas of the Carrington silt loam differ from the typical in having a greater topographic relief and in possessing features incident to weathering under better conditions of drainage. Such areas are separated from the main type of nearly level topography and mapped as the rolling phase.

The surface soil of this phase, to a depth of about 8 inches, is a dark brownish gray silt loam. From 8 to 15 inches the subsurface material is not quite so dark as the surface soil, and is yellowish in places. Between 15 and 30 inches the subsoil is a yellow silty clay loam,rather crumbly and mealy when dry, but sticky and tenacious when wet. Below 30 inches the texture is usually somewhat lighter, and sand grains are present. More or less gravel of granite or other

crystalline rocks occurs throughout the profile, being normally in greater amount below 20 inches.

The soil is of floury texture when dry, but forms a rather heavy mud when wet. There is a wider range in color in this phase than is characteristic of the main type, as the more rolling topography has permitted erosion and the consequent removal of much of the darker surface soil. In places all of the dark-colored soil has been washed away, leaving the yellow or yellowish-gray subsoil exposed. Many of the slopes, immediately after plowing, are mottled with straw-colored spots where the soil has been removed, and black spots where probably more or less material has accumulated from the other spots to form an unusually deep black soil.

It is sometimes difficult to determine whether a particular area should be mapped with the main type or as the rolling phase, but in general the distinction is clear, as the rolling phase is usually lighter in texture throughout its profile than the main type, the surface soil is more friable in structure and generally shallower, and the subsurface and subsoil rarely contain as much clay. The color is rather variable or mixed, in contrast with the rather uniform, almost black, color of the typical soil. The main distinction is in the topography. One or two areas of rather flat surface, however, in which the lighter textured soil occurs, are included with the phase. Small spots of the typical soil occur in the rolling phase and scattered developments of the phase in the main type, which are too small to be shown separately on the map.

This phase occupies a greater total area than the typical Carrington silt loam in Will County. It occurs in the upland regions and is the predominating soil of the northern third of the county. Its most important development is in the northeastern part of the county, where in many places it closely approaches the Miami silt loam in color characteristics. It occupies two physiographic positions, occurring on the main divides and along the breaks of streams. In the southern part of the county it is confined principally to the breaks of the streams, the divides being occupied by the main type. In the northern part of the county, however, the streams are more numerous, and the divides narrower, and both the divides and the slopes are occupied by the phase.

Except for its occurrence on breaks in the southern part of the county, this might have been designated the moraine phase, as the more extensive areas on the divides in the northern part of the county comprise the crest of the Valparaiso moraine, which was built up by the Michigan lobe of the late Wisconsin glacier. The topography of this section is quite rolling, and although not in any sense rough there are small areas over which cultivation is impracticable because of steep slopes. Because of its topography the

natural drainage is good. Artificial underdrainage is beneficial, however, in getting the water down into the subsoil to be conserved for the future use of crops. This soil does not resist drought as well as the typical soil, largely because of the greater run-off. By underdrainage and the incorporation of more coarse vegetable matter in the surface soil more water could be made to sink downward to be retained by the soil particles until used.

This phase is not subject to erosion or gullying, except where the content of organic matter is depleted.

Like the main type, this phase is composed of material which has been transported and deposited by ice, much of it in the form of moraine. The material is of varied origin. Limestone, shale, granite, and several other rocks have all contributed to it. Some areas carry large quantities of shale chips. These are as numerous in places as in some of the soils derived entirely from shale. They are most conspicuous in the vicinity of Frankfort. In some localities the surface material closely resembles loess. About 2 miles northeast of Monee there is a narrow strip of soil, occupied principally by a road, which is apparently an esker. The soil of this development throughout its profile is a gravelly loam containing considerable sand. This is the only area of like material encountered in the county, and it is not sufficiently extensive to be mapped as a distinct type. Another small area of gravelly soil occurs about 6½ miles northeast of Plainfield, and is indicated on the map by gravel symbols.

Most of this type was originally prairie, but it is probable that a part of it was forested. Because of its better natural drainage and shallower soil the phase was more easily brought into cultivation than was the main type and was about the first upland soil broken.

All the general farm crops are grown on the rolling phase, but the farmers maintain that the small grains yield relatively better than corn. In general the soil contains less organic matter than the typical soil and is not so fertile. It is almost invariably somewhat acid, although considerable lime is present in the subsoil. The typical soil is rarely acid. Average yields reported on this soil are: Corn, 50 bushels; oats, 40 bushels; and wheat, 20 bushels per acre. These yields are obtained with the use of barnyard manure and some fertilizers.

MIAMI SILT LOAM.

The Miami silt loam is known locally as "timber land" or "clay land." It is the lightest colored soil in the county, the surface soil when dry being a very light gray to ashy white. When wet, however, it is darker and yellower. The soil to an average depth of about 7 inches is a floury silt loam. The depth ranges from 3 to 10 inches. The ashy color of the surface soil continues throughout the soil section, the material becoming yellowish below 7 inches. The

subsoil is normally a compact silty clay loam of yellowish-gray or brownish-gray color. When the subsoil is very dry it is hard and compact and boring with the soil auger is difficult. It is rather impervious, and becomes thoroughly saturated only after exceptionally heavy rains. The surface soil is easily tilled, but it has a tendency to puddle, and forms clods where plowed while wet. When left uncultivated a hard crust forms over the surface.

This soil constitutes a comparatively unimportant upland type, although it comprises several large areas. It is extensively developed in the extreme northeastern corner of the county north and east of Goodenow, northeast of Joliet, and southwest of Joliet. Typically, it occupies rather steep slopes, but frequently extends beyond the slopes upon the more level upland. It is usually bounded by the rolling phase of the Carrington silt loam. In some small areas these two soils are closely related, but only the uniformly very light ashy colored soil is mapped as the Miami silt loam, the Carrington silt loam being confined to areas of a more yellowish or brownish cast. In the northeastern part of the county a few areas of this type, too small to be mapped separately, have been included with the Carrington. In the areas southwest of Joliet this type adjoins the typical Carrington silt loam.

As it has for the most part a rather rolling topography, having more relief in fact than the rolling phase of the Carrington silt loam, the natural drainage varies from good to excessive. The run-off is relatively large, as the surface soil is not in a condition to absorb moisture and the slope permits the surface water to flow off rapidly. Some gullying is in progress, and the uneven topography is the result of extensive erosion in the past. Over the more nearly level areas tile drainage is beneficial, not so much in removing the water as in increasing the power of the soil to absorb and retain moisture, thus enabling it to withstand droughts more effectively.

The type is composed of the same kind of glacial material, deposited in exactly the same manner and at the same time, as the Carrington silt loam. Conditions subsequent to its deposition, however, were decidedly different. While the Carrington silt loam supported a luxuriant growth of grass, whose decay left large quantities of vegetable matter in the soil, the Miami silt loam was forested and conditions were unfavorable to the accumulation of much vegetable matter in the soil. Consequently this type is now very deficient in this important constituent. Much of this type supports a growth of oak, with some hickory and hazel brush.

All the general farm crops common to the region are grown on the Miami silt loam, but the yields are generally lower than on the Carrington silt loam. Yields of corn average about 35 bushels and of oats 25 bushels. Little wheat or barley is grown.

Barnyard manure, which is about the only fertilizer in common use on this type, gives good increase in yields. There is no reason why this land should not be made as productive as any soil in the county with proper management and fertilization. Much of the type is in need of lime and organic matter.

MIAMI LOAM.

The color of the Miami loam soil is gray, lighter than the Waukesha soils and darker than the Fox. In texture the soil is a loam which works easily and permits ready drainage. The subsoil is a yellowish silty loam. When dry it is rather compact and difficult to penetrate with the auger.

The type is not extensive. It occurs mainly in the southern part of the county, and is nearly always associated with stream channels, forming narrow strips where the stream bottoms merge with the main upland. Whether all of the areas of this type are of till origin is not definitely known. Certain areas bear a close resemblance to a terrace formation, though it is believed others have been formed merely by erosion of the till. The areas north of Wilmington have a rather prominent relief, standing several feet above the surrounding Waukesha loam. These may possibly constitute the remnants of a terrace.

This type is not important. The general farm crops are grown. The soil is somewhat acid and requires lime. Alfalfa should do well on this type and some trucking could be done profitably.

FOX SILT LOAM.

The soil of the Fox silt loam is a light to dark brownish gray silt loam and extends to a depth of about 10 inches. The subsoil is a yellowish-gray to brown silty clay loam, extending to 24 or 30 inches, underlain by a stratum of brownish-red sandy clay, which is quite gritty, but plastic and tenacious when wet and very hard when dry. Beneath this stratum a bed of stratified gravel and sand is encountered. The gravel bed is of varying thickness and is underlain by limestone rock. The surface soil is ordinarily mellow and easily cultivated. The material below the surface soil, while heavier, is not compact and impenetrable to water.

The largest area of this type occurs around Plainfield and east of the Dupage River. Other areas are encountered east of Channahon. The type is extensively developed and is confined to the immediate valleys of the Des Plaines and Dupage Rivers. The topography is characteristically that of a terrace. The Plainfield area is generally level, but merges with the upland to the east in a long, gradual slope. The areas between Joliet and Channahon have a rather prominent relief, occurring as large mounds with sharp escarpments rising 10 to

30 feet above the valley floor. The tops of these mounds are gently undulating. The elevation of the type ranges from 560 to 640 feet, while the upland in their vicinity attains a height of 670 feet.

The natural drainage is fairly good. There is but little run-off, as the texture of the soil, and particularly of the subsoil, permits the rapid absorption of rain water. While artificial underdrainage would no doubt be of some benefit, it is not nearly so essential as on the upland.

The material which constitutes the Fox silt loam is similar to that entering into the composition of the upland soils, but it has been reworked by water. It is possible that some wind-blown material is included. The Plainfield area evidently represents a delta formed by the junction of the outwash from the Dupage and that from the Des Plaines Valley through the cut-off valleys which still exist as abandoned channels.

Most of this type was originally prairie. The greater part of it is under cultivation. All of the general farm crops are grown, and a relatively large acreage is devoted to alfalfa and potatoes. Owing to the good drainage, alfalfa does well, although less of the crop is grown on this type than on the Fox clay loam. The type is not considered as fertile as the darker upland soils, but it is more productive than the Miami silt loam. The gravel substratum is generally cemented with lime and carries a large quantity of limestone fragments, but the surface soil is somewhat acid, owing, no doubt, to the leaching out of the lime carbonates. The application of limestone is therefore necessary in the improvement of this type. In some localities, where the soil is gray in color, the organic-matter content is very low. Rock phosphate has been used in conjunction with organic matter by a few farmers on this type with excellent results.

The following table gives the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Fox silt loam:

Mechanical analyses of Fox silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
291021	Soil	0.0	0.5	0.6	1.2	3.6	70.7	23.3
291022	Subsoil	.0	.7	1.2	3.1	5.9	66.0	23.2
291023	Lower subsoil	3.4	5.8	3.8	6.6	6.3	42.4	31.6

FOX CLAY LOAM.

In the principal areas the surface of the Fox clay loam is of a decidedly reddish-brown color, rather light when dry and dark when wet, though the color of some of the areas along the Kankakee River is grayer. The soil to a depth of 7 inches is a clay loam which is slightly

plastic when wet and carries enough sand to make it somewhat gritty. From 7 to 20 inches the subsoil is a brownish-red sandy clay loam or sandy clay. It is quite plastic and tenacious when wet and hard but rather easily crumbled when dry. Coarse sand and fine gravel are abundant. The subsoil is underlain by a bed of stratified gravel and sand several feet in thickness, beneath which bed limestone is encountered. The gravel is ordinarily cemented with lime, but no reaction for lime could be obtained either from the soil or the sticky subsoil. Small quantities of gravel are scattered over the surface, being abundant in places which have been subject to erosion. Such areas are too small, however, to be shown on the map.

The type occurs in the same parts of the county as the Fox silt loam. It has its greatest development between Joliet and Channahon. Other isolated areas are encountered throughout the valleys of the Des Plaines, Dupage, and Kankakee Rivers. This type occurs at lower elevations than the Fox silt loam.

Most of this type is under cultivation. All the general farm crops are grown and the yields are fair, although not so good as on the upland. The soil is naturally well drained and tile drainage is not necessary. The gravel subsoil absorbs water rapidly and the type is not subject to severe erosion. Alfalfa does well on this soil also, and is grown on many of the farms. However, the surface and subsurface soil is somewhat acid, and applications of rather coarse ground limestone are beneficial. The content of organic matter, while not particularly low, needs to be increased for maximum crop production. The addition of phosphatic fertilizers results in as good crop increases on this type as on the Fox silt loam.

In the following table the results of mechanical analyses of samples of the soil and subsoil of the Fox clay loam are given:

Mechanical analyses of Fox clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
291015	Soil	2.1	7.7	9.9	13.1	5.3	38.5	23.4
291016	Subsoil	4.0	11.2	10.6	13.3	6.9	30.8	23.2

FOX VERY FINE SANDY LOAM.

The soil of the Fox very fine sandy loam consists of about 8 to 10 inches of light yellowish gray very fine sandy loam. It is rather loose in structure and is apparently more sandy than the Fox silt loam, but the individual sand grains are not as easily seen as in the Fox fine sandy loam. The subsoil is a yellowish silt loam, becoming somewhat heavier with depth. Normally at about 24 inches it consists of a reddish sandy clay which is quite gritty, but plastic. This material

gives way to gravel and sand, usually within the 3-foot section, but sometimes below 36 inches. In places this type, the silt loam, and the fine sandy loam are very difficult to distinguish, as all three are more or less intermingled and an area of any one is likely to contain spots of the others.

The Fox very fine sandy loam occurs in small, unimportant areas in the Kankakee River region. It probably represents a terrace of the river formed during glacial times. The topography varies from flat to gently undulating. The elevation is less than that of the main upland. Drainage is usually good.

Most of this type is under cultivation. The general farm crops are grown, but the yields are not satisfactory. The ease with which this soil can be worked, its ability to hold fertilizers and moisture, and the rapidity with which it warms up make it a good soil for small fruits and truck crops. There is a good market for such fruits and their production on this soil is more profitable than that of the general farm crops.

FOX FINE SANDY LOAM.

The Fox fine sandy loam consists of 8 to 18 inches of a light yellowish gray fine sandy loam to loam, underlain by a reddish, sticky sandy clay, beneath which stratified gravel and sand are encountered. The material classified under this name in the present survey is variable and includes textures lighter than a very fine sandy loam. The depth to the sticky sandy clay varies widely, but this material is nearly always encountered at depths of less than 3 feet. Some small gravel is normally present on the surface.

This type is inextensive, occurring in small areas in the immediate vicinity of the Kankakee River. The topography is flat to gently undulating. The material from which the soil is derived was probably deposited by water, but whether it is a true terrace is problematical. The similarity of its subsoil to that of the Fox silt loam indicates a terrace formation.

Most of the type is in cultivation, but only fair yields are obtained. The soil is usually acid and requires applications of lime.

The results of mechanical analyses of samples of the soil and subsoil of the Fox fine sandy loam are given in the following table:

Mechanical analyses of Fox fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
291005	Soil	0.0	2.2	9.5	36.5	23.0	22.4	6.0
291006	Subsoil	.0	3.0	11.0	32.4	23.1	20.0	10.2

MILLSDALE SILT LOAM.

The area mapped as Millsdale silt loam in Will County includes three soil types. Where the material overlying bedrock is more than 30 inches deep it is the Waukesha silt loam if its color is black and should have been mapped as such. Where the color is brown or gray this soil is the Fox silt loam. The shallower soil belongs in a new series, the various members of which will be recognized in the future as the Millsdale. This soil is closely related to the Farmington soils of New York State, differing from them mainly in color, the Farmington soils being darker colored.

This type, as mapped in Will County, is relatively inextensive and of comparatively little agricultural value. In general the surface soil is a dark-gray to black silt loam. It varies in depth, being underlain by limestone, which may be encountered at any depth within 36 inches of the surface and outcrops in places. Where the limestone occurs at less than 12 inches from the surface the soil is a black silt loam. In such places small limestone fragments are scattered over the surface and throughout the soil. Where the limestone is encountered at depths greater than 12 inches the dark silt loam soil extends to a depth of about 10 inches, and the subsoil is a yellow or yellowish-gray silt loam to silty clay loam. Usually the deeper the soil overlying the limestone, the grayer the surface soil.

The Millsdale silt loam as mapped in this county is developed principally around the borders of the Des Plaines River Valley. One area of the shallow phase occurs near Joliet, and no more is encountered down the valley until the vicinity of Millsdale is reached. The largest area of the type lies west of Drummond. There is one small area in the Kankakee River basin where that stream enters the county.

The topography of the shallow areas is flat and the limestone near the surface prevents the escape of water, so that during wet seasons water stands in ponds over the surface. When the soil dries out it is almost like dust. The deeper phase has some slight relief. Where the soil is more than 2 feet in depth it is slightly acid at the surface, and need for the application of lime is indicated.

The area occupied by this type is evidently an ancient bench along the Des Plaines River. It was possibly covered at one time with gravel, such as that forming the subsoil of the Fox silt loam. The materials of this type are probably partly residual and partly glacial. The subsoil in some places is obviously at least partly residual because of its similarity to rotten limestone.

Tillage of the shallow areas of the type is practically impossible and they are used only for pasture. The areas of deeper soil produce fair crops. Even in these areas droughts are likely to prove injurious.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Millsdale silt loam:

Mechanical analyses of Millsdale silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
291017	Soil	0.6	3.7	6.5	17.2	16.1	48.0	7.9
291018	Subsoil	1.6	3.6	5.0	13.3	19.2	45.2	12.0

The following samples contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 291017, 14.13 per cent; No. 291018, 23.90 per cent.

KNOX FINE SAND.

The Knox fine sand comprises dunes of light yellowish gray fine sand which occur in association with the soils of the Clyde series. It occupies narrow hogback ridges and mounds, usually very irregular in outline, which rise abruptly to 10 or 20 feet above the level of the surrounding land. This soil is droughty and ordinary farm crops suffer from lack of moisture.

The largest areas lie about 3 miles south of Wilmington and 1 mile south of Braidwood. Since its original deposition, probably by lacustrine or alluvial agencies, there is no doubt that wind has been an important agency in the formation of this soil.

Most of the type supports a growth of stunted scrubby oak. A part of it is cultivated. Where this land is cleared and uncultivated it is generally barren because of its susceptibility to drifting, particularly in early spring. Rye is the principal crop grown, and yields of 15 to 20 bushels per acre are obtained. Yields of 40 bushels of corn are reported where the land is manured. The soil needs lime and organic matter.

RODMAN SAND.

The Rodman sand throughout its profile of 36 inches is a yellowish-gray medium to coarse sand. It is loose and incoherent and can be worked at almost any time. This type is very limited in extent and occurs only along the Kankakee River above Wilmington. Its surface has considerable relief, being characterized by ridges and knolls and intervening potholes or depressions. In low places the soil usually contains considerable organic matter and is heavier and quite different in profile arrangement from the typical sand, but these areas are too small to be mapped separately. Drainage is free and crops suffer during periods of drought. Under ordinary conditions, however, this type holds moisture remarkably well, considering its coarse texture. In one or two exposures it is seen that below 36 inches there is a substratum of reddish sandy clay similar to that underlying

the heavier soils of the Fox series. Whether this material underlies all of the type or not could not be determined. In one place there are a few large glacial bowlders.

This soil does not drift as badly as the Knox fine sand, and while it is probable that wind has played some part in the formation of the present areas, it is evident that either water or ice, possibly both, was the main agency of deposition.

Where well manured this soil produces fair crops of corn, oats, and barley. It is of a class usually better adapted to trucking. Watermelons do especially well.

WAUKESHA LOAM.

The soil of the Waukesha loam to an average depth of 10 inches is a black heavy loam or silt loam, though it carries a relatively high percentage of sand. It is somewhat stiff, slightly tenacious, and plastic, but the sand grains impart a gritty feel. The clay content is relatively high also, but the large amount of organic matter present aids in giving the type some of its heavier characteristics. The sandy texture of the immediate surface is evidently due to the translocation of silt and organic matter downward by percolating rain water, leaving the free sand grains exposed. The subsoil is somewhat variable, but typically consists of a yellowish-gray or yellow, rather stiff sandy clay or clayey sand to a depth of 22 inches, where gravel embedded in a matrix of clay and sand occurs. In places the subsoil is almost a sand and in others almost a clay, and the depth to gravel ranges from 12 to 36 inches or more. Glacial bowlders are of common occurrence on the surface and throughout the substratum.

The Waukesha loam occurs predominantly on the terracelike bench north of the Kankakee River and directly north of Wilmington. A few areas occur south of the river. Another is encountered in the northeastern corner of Wesley Township, extending into Florence and Wilton Townships. Other areas occur along the Des Plaines and Dupage Rivers.

In general the surface of the type is flat, although there may be a detailed relief of a few feet. The elevation ranges from 530 to 570 feet. Because of the flat topography the natural drainage is poorly developed. The soil is absorptive, and the gravelly and sandy subsoil permits the free movement of water, but the water table is high. The only remedy for this is thorough drainage. Good outlets for the drains are available in nearly all areas of the type.

The formation of this soil is not definitely understood. It lies below the gravel terrace soils of the Fox clay loam, but is 20 to 30 feet above the bed of the Kankakee River. The bluff or upland to the east has an elevation of 30 to 40 feet above this type.

All the areas mapped, with the exception of the one southeast of Symerton, are clearly defined water-laid terraces. In the latter case the origin is not so clear, at least for part of the area. Along a strip of undetermined width lying on both sides of the small stream that drains it the soil is composed of well-defined terrace material with brownish gravelly and sandy material below and silt loam above, the whole resting at a depth of about 6 feet on a very light-colored glacial till made up mainly of limestone material. The outer boundaries of this belt are not established. The boundary line between this type and the flat phase of the Carrington silt loam is an arbitrary one and could have been drawn almost anywhere between the stream and the outer boundary of the latter soil. There is no question of the occurrence of terrace material, but its boundaries are not determined. The two soils are, however, so much alike that the agricultural difference is negligible. Some narrow strips of the Waukesha loam southwest of Joliet are much like some of the Millsdale soils. They are old stream channels, rather marshy or at least poorly drained, with a thin layer of more or less bowldery material overlying the rock.

The soil was originally prairie, but it is now largely under cultivation. The excessively stony areas are used for pasture. All the general farm crops common to the region are grown, and the yields are usually good. The alkali spots discussed in subsequent pages are prevalent in this soil and materially reduce the average yields. Yields of 60 bushels of corn and oats per acre are not uncommon, although above the average. In the improvement of this type drainage is the first requisite.

WAUKESHA FINE SANDY LOAM.

The soil of the Waukesha fine sandy loam is typically a black or very dark gray sandy loam with a depth of about 12 inches. It contains a high percentage of organic matter and is rather loose and incoherent. It closely resembles the soil of the Clyde fine sandy loam, except that it is not uniform in texture. The subsoil from 12 to 22 inches is usually a yellowish-gray or yellow sandy clay which is rather sticky and somewhat plastic. It closely resembles the subsoil of the Waukesha loam, but the average texture is not quite so heavy. Normally at about 22 inches a gravel embedded in sandy clay, similar to that which underlies the other members of this series, is encountered. There is more or less variation in this type. The surface soil may vary in short distances from a loam to a light sandy loam, and the type includes some small areas of silt loam. In spots the subsoil is not very sticky, and the gravel may not lie within reach of the 3-foot section.

This is not an extensive type. The largest area occurs near Lorenzo. Other small areas lie in the Kankakee River region, and

are usually associated with the Waukesha loam and the Clyde fine sandy loam, forming in many cases a gradation between the two. There is usually more surface relief in this type than in either of the others. In areas of the Waukesha loam some of the slight elevations are occupied by this type. The soil does not suffer from lack of drainage as much as the two types with which it is associated.

The Waukesha fine sandy loam is probably derived from water-laid glacial material and possibly outwash gravels, as is the Waukesha loam.

Crops are usually more certain on this type than on the Waukesha loam, because of its somewhat better drainage. The soil throughout is easily cultivated and can be worked early in the season. More thorough drainage and the use of legumes or other green manures will greatly improve the crop yields. It does not require lime.

The results of mechanical analyses of samples of the soil and subsoil of the Waukesha fine sandy loam are given in the following table:

Mechanical analyses of Waukesha fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
291001	Soil	0.4	6.3	15.8	25.4	9.6	29.0	13.5
291002	Subsoil	.5	5.0	15.2	27.4	13.8	24.8	13.2

The following samples contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 291001, 1.18 per cent; No. 291002, 2.72 per cent.

CLYDE FINE SAND.

The immediate surface of the Clyde fine sand usually has a light-grayish color, but below this the soil to a depth of 20 inches is rather dark. It is a loose, rather incoherent fine sand. The subsoil, extending to depths greater than 36 inches, is a light yellowish gray, loose, incoherent fine sand. The texture is fairly uniform throughout the profile, the line of demarcation between the soil and subsoil being marked by the depth to which organic matter has been incorporated.

This type is developed in many small areas south of the Kankakee River and is nearly always associated with the Clyde fine sandy loam. It occupies low, turtle-back ridges which rise 3 to 10 feet above the general land level. It is also associated with the Knox fine sand, but lies lower than that type and does not have the characteristic dunelike topography. It is well drained, where the water table is not too near the surface, but for a sand soil holds moisture well. It is doubtful if the areas now too wet can be satisfactorily drained until a general system of drainage is provided for this region as a whole.

A part of this type was originally forested and a part was prairie. It is now nearly all in cultivation. The general farm crops are

grown, and in addition some trucking is practiced. The soil is well fitted for the latter use. Only moderate yields are secured, yet they are fairly good for so sandy a soil. Corn commonly produces 40 bushels or more per acre. Rye is a popular small-grain crop and yields from 15 to 20 bushels per acre. Alfalfa succeeds on well-drained areas. Barnyard manure is the main dependence of the farmers on this type. Most of the soil is slightly acid, and therefore in need of lime.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Clyde fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
291009	Soil	0.0	1.2	10.8	61.5	13.7	8.0	4.8
291010	Subsoil	.0	1.0	12.0	64.8	14.2	4.7	3.4

CLYDE FINE SANDY LOAM.

The soil to a depth of about 12 inches is a dark-gray to black fine sandy loam carrying a comparatively large proportion of sand of the fine and very fine grades. The soil when wet packs after the manner of quicksand and when dry is very loose. The dark color is due to the large admixture of organic matter in the surface soil. The subsoil from 12 to 36 inches is a loose, incoherent sand which ranges in color from almost white to a dark ochreous yellow. The color changes frequently within small areas. The depth of this quicksand stratum varies considerably. It is usually underlain by blue clay at depths of 10 to 25 feet.

The Clyde fine sandy loam is the predominating soil of the county south of the Kankakee River, and is practically confined to this region. Its continuity is broken by the low turtle-back ridges of the Clyde fine sand and the sand dunes of the Knox fine sand. The topography is characteristically flat. In detail there is some minor relief, but probably nowhere a slope or rise of over 5 feet to the mile. The type as a whole ranges in elevation from about 540 to 590 feet above sea level, but the slopes are gradual.

Drainage is not well established. Horse Creek is the only stream of any consequence, although there are one or two smaller water-courses. A dredged ditch through a part of the type was completed in 1912, but as yet there are no data as to the results obtained. During the early spring practically all of this soil is in a very wet condition. Water does not stand over it except in numerous sloughs and ponds, but it remains wet and spongy and in many places impos-

sible to work because of the danger of the horses sinking into the quicksand. By the last of May the surface soil of the higher areas ordinarily becomes dry enough to plow, but the subsoil is wet and the water table can usually be reached within 3 feet of the surface until about the 1st of August. It is evident in studying this type in the field that this region must be effectively drained in order that maximum yields may be secured.

The sand of which this soil is mainly formed was brought in originally by the glacier and subsequently reworked and deposited either by or in water, probably both.

Nearly all of the Clyde fine sandy loam was originally in prairie. Water grasses no doubt formed the principal vegetation, as they still grow in the low places, which remain wet nearly all the year. Most of the type has been broken and is cultivated when possible. In dry seasons corn and oats do fairly well, but the average yields are relatively low. As a rule the farms are not highly improved, and this country does not have the prosperous appearance of the upland regions.

There is no ground for the general impression that these sandy soils are of poor quality and unproductive and can not be improved. While the sand content predominates, it is not all quartz sand, but includes grains of granite and other minerals carrying plant food.

Some commercial fertilizer is used on this soil, with varying results. A low-grade mixture analyzing about 2–8–2 is ordinarily used in the hill for corn at the rate of 50 to 100 pounds per acre.

The type is mainly in need of drainage. Where effectively drained and properly fertilized it is an excellent truck soil and under present economic conditions the trucking industry could apparently be extended. Chicago is an excellent market for such crops, and is within easy reach of this region.

In its present condition this soil has a value of $20 to $60 an acre.

Clyde fine sandy loam, heavy subsoil phase.—West of Wilmington, between the Kankakee River and the county line, are several areas over which drainage is exceptionally poor. The soil is inundated during the spring and no effort is made to cultivate it. Grazing is not safe until summer because of the soft ground. This area is devoted to the production of wild hay, which consists largely of water grasses. The soil of this area is not quite so dark as the typical Clyde fine sandy loam, and the subsoil, instead of being a loose, incoherent sand, contains enough clay to make it slightly sticky. It is not as sticky as the subsoil of the Waukesha soils, however, and is also distinguished from the Waukesha fine sandy loam by having a somewhat lighter colored surface soil. There is an excellent opportunity in the drainage and cultivation of this area.

In the following table the results of mechanical analyses of samples of the soil and subsoil of the typical Clyde fine sandy loam are given:

Mechanical analyses of Clyde fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
291003	Soil	0.0	0.6	8.6	53.0	17.0	16.5	4.3
291004	Subsoil	.0	1.5	15.0	60.9	15.7	4.6	2.3

CLYDE SILTY CLAY LOAM.

The Clyde silty clay loam consists of about 10 inches of very dark gray silty clay loam underlain by a heavier silty clay loam or silty clay subsoil, which is yellowish gray or brownish gray or frequently mottled yellowish gray and drab. The soil is sticky and plastic when wet, but crumbly and friable when dry.

This type is mapped in one area in the vicinity of Drummond. Its surface is nearly flat. Owing to the topography and compact subsoil, drainage is not well developed and tile drains are necessary to remove the excess water. While this type adjoins the Millsdale silt loam, limestone is not encountered within 3 feet of the surface and is believed to lie at much greater depths. It is very probable that this soil was deposited by water. Its origin is not definitely known. It is correlated with the Clyde on the basis of its flat topography, poor drainage, black color of the soil, and gray to yellowish-gray color of the subsoil.

Most of this soil is under cultivation and yields above the average for the county are obtained.

CLYDE CLAY.

The Clyde clay consists of a very dark gray clay, underlain at a depth of about 8 inches by a yellowish, somewhat mottled, sticky clay containing a high percentage of silt. The type is inextensive in Will County, and occurs in a few small areas south of the Kankakee River. One area occupies a depression and is possibly partly alluvial. The area near Diamond is slightly elevated above the general area of Clyde fine sandy loam, and includes patches of sand (Clyde fine sand). The heavy texture does not permit the free absorption of moisture and drainage is rather slow. In profile this type is almost identical with the Clyde clay loam, but it is so different in its association with terrace types and those of water-laid drift that it was separated as a distinct type. Its occurrence and formation are peculiar, and are not definitely understood.

CLYDE CLAY LOAM.

The soil of the Clyde clay loam is a black or very dark gray, rather plastic and tenacious clay loam, with a depth of about 10 inches. More or less variation occurs in the subsoil, but typically it is a rather dark yellow somewhat mottled clay to a depth of 36 inches. More or less gravel and calcareous material occurs throughout the soil profile.

This is not an extensive type. It occupies slight depressions within the Carrington silt loam on the upland. The type is generally encountered near a watercourse, but it is not subject to overflow and is apparently not an alluvial soil, consisting rather of glacial till which has possibly received some wash material on the surface.

The type is usually deficient in drainage, but where well drained it produces good crops of corn and oats. It yields particularly well of corn, and will stand continuous cropping for a long period with little apparent deterioration. Drainage and the application of phosphate will probably improve the type.

WABASH SILT LOAM.

The Wabash silt loam consists of 12 to 15 inches of black, rather heavy silt loam, underlain by a subsoil of dark brownish gray to black silty clay loam. In some areas the material is practically the same throughout the soil profile.

This is a bottom-land, overflowed type, and is well distributed over the county in narrow strips along streams. Because of the uncertainty of crops due to overflows and poor drainage, but little of it is under cultivation. It is, however, regarded as a strong soil, and where cropped produces high yields.

ROMEO SILT LOAM.

The Romeo silt loam consists of a few inches, seldom more than 12, of black silt loam, underlain by limestone bedrock. It is developed in only one area, which is quite extensive, comprising practically all of the flood plain of the Des Plaines River north of Joliet. The type is overflowed with practically every high-water stage of the river.

In general it is a nonagricultural type, and very little of it is cultivated. It is used mainly for pasture or mowing land.

GENESEE SILT LOAM.

The Genesee silt loam consists of a light brownish gray silt loam, underlain at a depth of about 10 inches by brownish-yellow material of about the same texture as the surface soil. The subsoil in places, however, varies from a silty clay loam to a loam. This type is unim-

portant in extent and occurs in only a few small areas along the lower course of the Kankakee River. The surface comprises low ridges and shallow intervening depressions, in which the soil is much darker and somewhat heavier than the typical. This soil is composed of alluvial material, and while it is not now subject to regular overflow, it has evidently been inundated at some earlier time. It is considered a good soil.

GENESEE FINE SANDY LOAM.

The Genesee fine sandy loam consists of a brownish loam to sandy loam. The material is generally uniform throughout the soil profile, although in some places the subsoil below 10 inches is somewhat heavier, in such cases being a loam. This soil is not extensive, and occurs only along the banks of the lower Kankakee River. While not frequently overflowed, it has evidently been subject to inundation by rapidly moving water in the past, as the surface is a series of narrow ridges and hollows, the latter evidently having been washed out by flowing water. This soil seems to lie between the Fox soils, which are not subject to overflow, and the Genesee soils, which are.

The soil is well drained and easily tilled, and yields good crops of corn, wheat, and oats. As much as 40 bushels of wheat per acre has been produced on this soil with the use of about 1,000 pounds of rock phosphate. Alfalfa should do well on the higher areas, but the hollows are not adequately drained for the production of this crop.

PEAT.

Peat consists of fine vegetable matter which has accumulated to depths varying from 12 inches to several feet. The color is almost always brownish, and the fiber of the plants forming the material is still distinct. More or less mineral matter is mixed with this material, and this may be either sand, silt, or clay. The substratum is nearly always a bluish, mottled heavy clay.

The largest area of Peat occurs in the old Eagle Lake bed, covering an area of nearly 2 square miles, in the extreme east-central part of the county. The depth of the peaty material in this area varies considerably. Around the sloping boundaries it is shallower and contains more sandy mineral matter than in the center of the area, where it is quite deep and composed almost entirely of fine vegetable remains. A few other small areas occur in the eastern half of the county. This material accumulates only in depressions where the drainage is very poor and water stands most of the time. Some of the areas are undrained, but Eagle Lake has been ditched and effectively drained. The Eagle Lake area produces exceptionally good crops of corn. Soil of this character is in some places well adapted to celery.

MUCK.

Muck consists of a black, rather sticky material, with a depth of 15 to 24 inches, underlain by bluish or mottled, heavy, plastic clay. Muck is distinguished from Peat by its almost black instead of brown color, its higher content of mineral matter, and the more advanced stage of decomposition of the vegetable matter.

Only a few isolated areas of Muck are mapped, and owing to its poor drainage the type is unimportant. It has been formed in much the same manner as Peat, but decomposition has been more thorough and greater quantities of mineral matter have been washed in and mixed with the vegetable débris.

MEADOW.

The term Meadow is applied to those areas along the streams and other depressions in which the soil profile is not at all uniform in character. It generally consists of numerous spots of sandy and silty or clayey material which are too small to be shown separately on the soil map. Some of these areas are cultivated, while in others the drainage conditions prohibit cultivation. The latter are pastured or mowed for wild hay. Meadow is not an extensive or important type in the present survey.

ALKALI SPOTS.

In numerous small patches, varying from a small part of an acre to several acres in size and occurring throughout the Waukesha loam, the Waukesha fine sandy loam, and the Clyde fine sandy loam types and in a few places over the upland, peculiar soil conditions exist. These areas are locally known as alkali spots, and are frequently slightly depressed. While they do not constitute the greater part of any farm, they are widely distributed and have an extensive total acreage.

Where uncultivated a whitish covering forms over these spots during dry periods, which, although plainly visible, is rarely sufficiently thick to be scraped off of the surface without removing some of the earth. Where corn is planted in such areas the seed usually germinates and the plant grows well for a short time, but it soon becomes yellow and sickly and frequently dies. The outline of the spots can usually be traced in corn fields by the appearance of the plants. While the spots are less easily determined in fields devoted to small grain, they produce a ranker growth of straw. The grain does not fill properly, and at harvest time the crop is usually lodged so badly that cutting is extremely difficult.

Different methods of treatment have been tried on these spots, but no effective means of reclamation has been discovered. There is a

general impression that they are most in need of drainage, and drainage is in most cases beneficial. In several areas that have been thoroughly drained, however, the conditions are no better, and in one instance are worse, than before drainage. It thus appears that drainage is not the only requisite in reclaiming these spots, and this indicates that the abnormal soil condition is not due to the presence of true alkali. In some areas the white crust effervesces with acid, but in most cases it does not. The soil solution is usually neutral to litmus paper, though in some instances it appears to be slightly alkaline. So the conclusion drawn from field observations is that there is very rarely sufficient alkali (which where present is probably an excess of magnesium carbonate) to cause crop injury.

The remedy most commonly used by the farmers consists of applying horse manure, and this practice is in a large measure effective, although the remedy is not permanent, more frequent applications being required than are practicable on the average farm. Horse manure is more effective than cow manure. A chemical analysis of the soil from one of these alkali spots showed a comparatively low potash content. In one case the application of potash produced very satisfactory results. The soil of these spots does not differ physically from that of surrounding land on which crops make a healthy growth. In general it appears that only rarely is the excess of soluble salts accountable for the poor crop condition, and that the whitish surface crust probably has little or nothing to do with the real trouble.

The only practical means of reclaiming these spots seems to be, first, the application of potash. If after such treatment good crops can not be produced, true alkali is probably present, and this can only be removed by thorough drainage and cultivation. The use of potash is preferable to that of horse manure, since the manure carries large quantities of nitrogen, which is not needed on these spots. If potash can not be obtained, heavy applications of straw would probably be beneficial.

SUMMARY.

Will County is in the northeastern part of Illinois, bordering the Indiana line. It comprises 844 square miles, or 540,160 acres.

The county comprises three physiographic divisions—bottom lands, terraces, and uplands. The topography varies from flat to rolling. Surface drainage for the most part is well established, but underdrainage is usually poor.

Joliet is the principal town and county seat. Transportation facilities are excellent, and markets are readily available for all produce. Chicago is about 40 miles from the center of the county.

The county has a typical north-temperate climate, with long and cold winters, and short, hot summers. The normal growing season

covers a period of about 168 days. The average date of the first killing frost in the fall is October 7 and of the last in the spring, April 23.

Agriculture is highly developed. The principal products, in order of their importance, are corn, oats, wheat, rye, and barley. Dairying is an important industry, and some cattle, sheep, and hogs are annually shipped in for feeding and fattening. Some trucking is done. There are a few commercial fruit orchards.

All the soil material is of glacial origin. Of the black till soils the Carrington silt loam, with a rolling phase, is recognized. The typical soil gives the best results with corn. The rolling phase, which has a slightly lighter soil and is better drained, does better in the production of small grains. This is the most extensive type mapped. It covers 67.5 per cent of the county.

A number of soils derived from glacial terrace materials have been correlated in the Fox series. The Fox clay loam and Fox silt loam give fair yields of the general farm crops. Alfalfa does well and could be more extensively grown than at present. The Fox very fine sandy loam, Fox fine sandy loam, the Knox fine sand, and Rodman sand, derived from somewhat similar material, are better trucking soils than general farming soils. The Fox very fine sandy loam is especially suited to strawberries and other small fruits.

The Millsdale silt loam consists of a black or yellowish soil directly overlying limestone. The deeper areas produce fair crops during seasons of adequate precipitation, but where the limestone is within 12 inches of the surface cultivation is impracticable.

The Clyde series includes soils of mainly lacustrine origin. The Clyde silty clay loam is considered a strong general crop soil. The Clyde fine sand and Clyde fine sandy loam are better suited to the production of truck crops.

Of the soils deposited in standing water, those consisting of water-laid drift are the Waukesha loam and Waukesha fine sandy loam. The Waukesha soils are much stronger than the Clyde, as shown by the usually better crop yields.

Of the alluvial soils the Wabash silt loam is a black silt loam which becomes slightly lighter in color and heavier in texture with depth. But little of this type is in cultivation because of the frequent overflows. It has a small total area.

The Romeo silt loam is a nonagricultural soil consisting of a few inches of black, silty material overlying bed limestone.

The Genesee silt loam and Genesee fine sandy loam have brownish soils overlying heavier brownish subsoils. These types are inextensive, but produce fair yields of the general farm crops.

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