SOILS OF

LEEDS COUNTY

Report No. 41 of the Ontario Soil Survey

Prepared jointly by The Research Branch,
Canada Department of Agriculture and the Ontario Agricultural College

ONTARIO DEPARTMENT OF AGRICULTURE AND FOOD, TORONTO
CANADA DEPARTMENT OF AGRICULTURE, OTTAWA

Saint Lawrence River Counties
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1968

THE SOILS
OF
LEEDS COUNTY

by

J. E. Gillespie

R. E. Wicklund

Soil Research Institute
Canada Department of Agriculture
Guelph, Ontario

and

M. H. Miller

Ontario Agricultural College
University of Guelph
Guelph, Ontario

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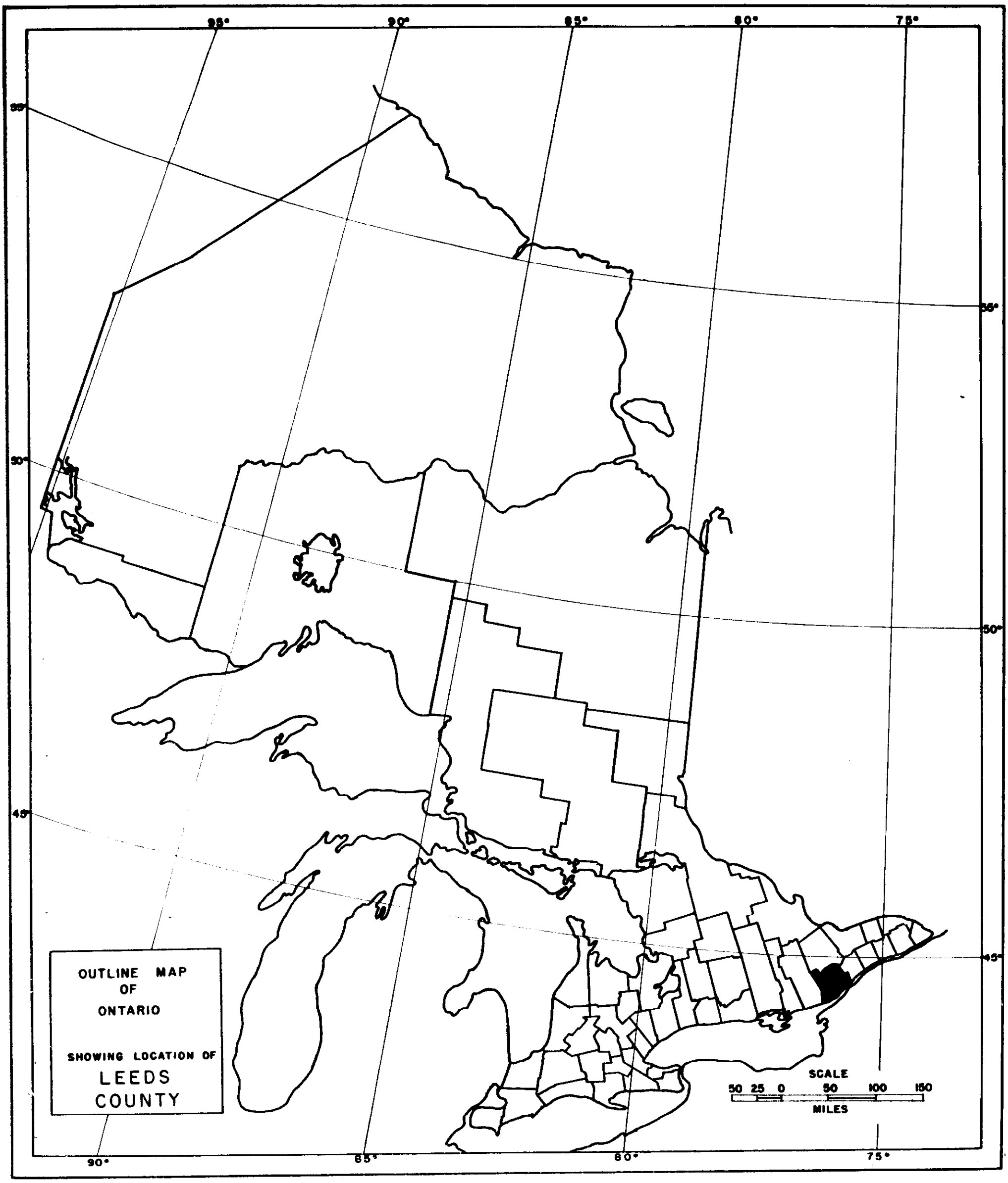


Figure 1 — Outline Map of Ontario showing location of Leeds County

The Soils of Leeds County

INTRODUCTION

This report and the accompanying soil map provide an inventory of the soil resources of the county at a reconnaissance level of detail. The project included the mapping of the various soils and the gathering of information about their characteristics and environment from which to judge their adaptability and use in the growing of agricultural crops. It is for this reason that the reader will find sections in the report that deal with the climate, bedrock geology, and other factors influencing the use of land.

A section is included on the rating and suitability of the various soils that occur in the county for agricultural use. The ratings are made chiefly on the basis of the physical and chemical characteristics of the soil.

The aim of the survey is to supply basic information about the soil such as its location, origin, characteristics, present use, and suggestions for its future use.

GENERAL DESCRIPTION OF THE AREA

Location and Size

The location of Leeds County within the province is shown in Figure 1. It is bordered on the south by the St. Lawrence River, on the west by Frontenac County, and on the east by Grenville County.

The total land area of the county is 576,000 acres.*

County Seat and Principal Towns

The county seat, Brockville, has a population of 17,744.* It is located in the southeastern corner of the county, Figure 2. Gananoque (population 5,097) is a pretty little town beautifully situated by the famous Thousand Islands of the St. Lawrence. The population of the town is easily doubled during the summer months by Canadian and American tourists attracted to this scenic area.

The remaining communities in Leeds County are small but important to the rural population. Some of these are: Lansdowne, Westport, Athens, Elgin, and Lyndhurst.

BEDROCK GEOLOGY

The bedrock geology of the county is shown in Figure 3, which is taken from Map 31C, County of Leeds, Ontario Department of Mines, 1922. The large area of Precambrian rock known as the Laurentian Shield has an east-west orientation across much of Canada. The Shield is composed of the oldest of known rocks, formed by the cooling of the earth's molten surface millions of years ago. These are similar to the Adirondacks in New York State, and these two, the Precambrian and the Adirondacks, are joined via the Frontenac Axis which passes through Leeds County. The Frontenac Axis is narrow, and in width extends from Brockville to within a mile or two of Kingston. The rock formations composing this ridge include black to green gneisses and schists usually rich in hornblende, pyroxene and biotite. There are also coarse- to medium-grained bosses and batholiths of pink granite and syenite in addition to considerable areas of marble.

*Canada Census 1961

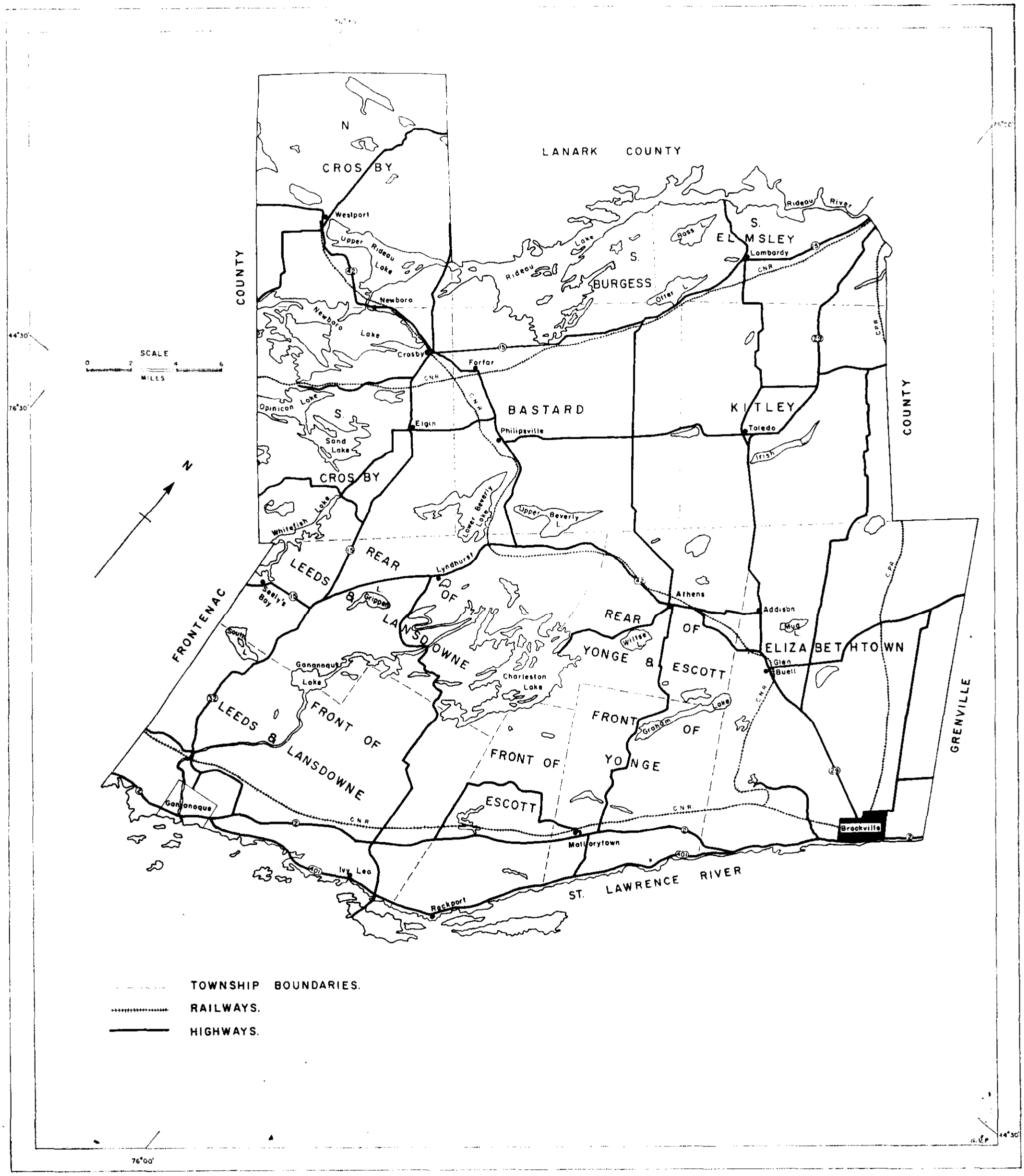


Figure 2 — Townships, principal towns, highways, and railways in Leeds County

The Axis is responsible for the rough hilly topography in much of the county. In the southern part of the county deep deposits of clay have produced large clay plains which cover all but peaks of some of the rocks.

The Precambrian rocks are overlain by Cambrian and Ordovician rock formations in the east and northeastern parts of the county. According to Liberty (personal communication) the Ordovician limestone can be subdivided into lower and upper groups on the basis of fossil species but are otherwise quite similar. The glaciation of these limestones produced a low yield of soil material, leaving large areas of Elizabethtown, Kitley, and Bastard Townships thinly covered.

Ordovician limestone overlies Precambrian rocks in easterly parts* of *the county

Surface Deposits

Surface deposits in this region originated through the action of ice or water. There are a few small beach lines which may owe their final landscape features to the action of wind, but these are relatively unimportant. The unsorted deposits laid down by moving ice, called till, cover the greatest part of the county. This material varies greatly, depending upon the nature of the underlying bedrock. The hard rocks of the Precambrian Shield resisted the abrasive action of ice with the result that much of the soil overlying these rocks is thin and very stony. The till soils overlying the Precambrian are therefore generally thin, a condition that has been aggravated over the years by the loss of protective cover by fire and subsequent washing of soil off the high to low areas. The soils overlying the Ordovician* limestone plains are mainly thin although there are exceptions. In a few areas, notably around Athens, there are deep loamy till ridges.

The soil materials along the southern border of the county consist of stone-free calcareous clay deposits, broken in places by numerous outcroppings of Pre-cambrian rock.

It has been established that the Champlain Sea extended as far west as Brock-ville, and sandy beach ridges are to be found north of Brockville, extending into Leeds County from the east, only to be lost in the rocky area to the west. It is

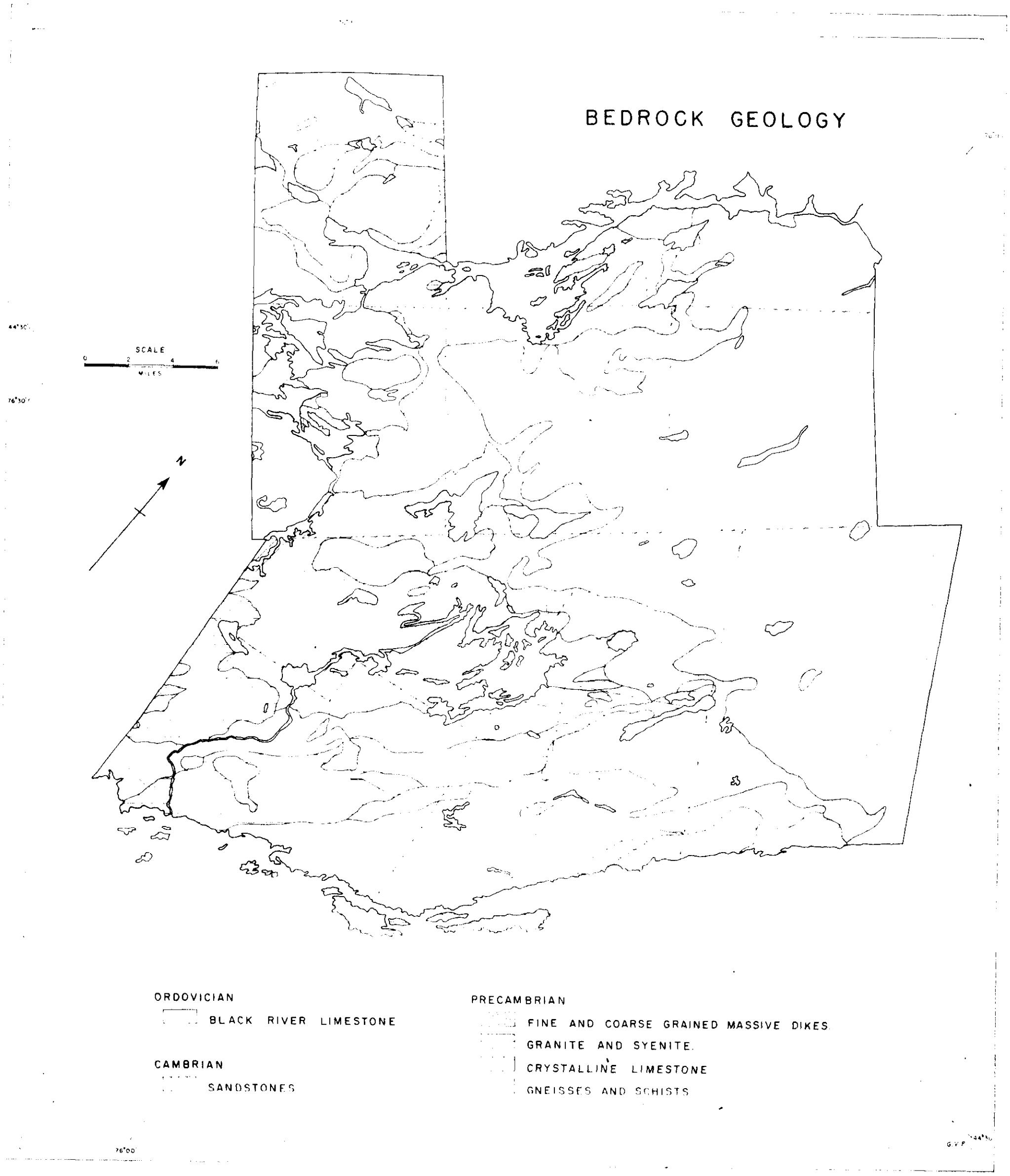


Figure 3 — Outline Map showing bedrock geology of Leeds County

therefore probable that much of the clay land in Leeds County has been deposited in at least a partial marine environment.

Silt-textured stone-free materials are found in a number of areas in the county such as the Morton, Seeleys Bay, Lyndhurst, and Brockville areas. These deposits occur on the fringe of the deep fine clay materials and represent deposits in shallow waters.

Coarse-textured soils, such as sands and gravels, are found scattered over the county. A few of these represent old beach lines but many are kames and eskers formed either at the front of retreating ice, or formed within the ice and deposited on the landscape when the ice melted.

Drainage

It will be seen from Figure 4 that the county is well supplied with lakes. The Rideau Lakes chain traverses the northern part of the county. Charleston Lake is a large deep body of water encased in Precambrian rock in the south central county area. The Gananoque River is the only sizable river in the county other than the Rideau. It is a short river flowing from Gananoque Lake into the St. Lawrence River. The clay plains in the southwestern part of the county are inadequately drained, and this is revealed in the figure. The lack of creeks in the area is possibly due to the inhibiting influences of rock ridges running in an east-west direction along the southern border.

Climate

Leeds County lies east of Lake Ontario, and is somewhat removed from the modifying influence of this large body of water. Brown et al, in "The Climate of Southern Ontario", places all of Leeds, with the exception of a small corner of North Crosby Township, in the Eastern counties climatic region. Elevations above sea level range from 300 to 350 feet in the south, to 444 feet at Westport. The county extends about 38 miles from south to north, and changes in elevation and latitude account for a small change in temperature over the county.

TABLE 1

CLIMATIC DATA FOR LEEDS COUNTY FROM BROWN ET AL

	South Leeds	North Leeds
Mean daily temperature for the year	44° F	43° F
Mean daily temperature for April	42° F	42° F
Mean daily temperature for July	70° F	69° F
Mean daily temperature for October	48° F	47° F
Start of growing season (> 42° F)	April 15	April 15
End of growing season (< 42° F)	October 31	October 26
Length of growing season	200 days	195 days
Length of frost-free period	140 days	133 days
Mean annual heat units for corn	2,700	2,600
Mean annual precipitation	34″	34″
Mean annual precipitation (May to Sept)	between 14 and 15 inches	
Moisture deficiency	2 inches	

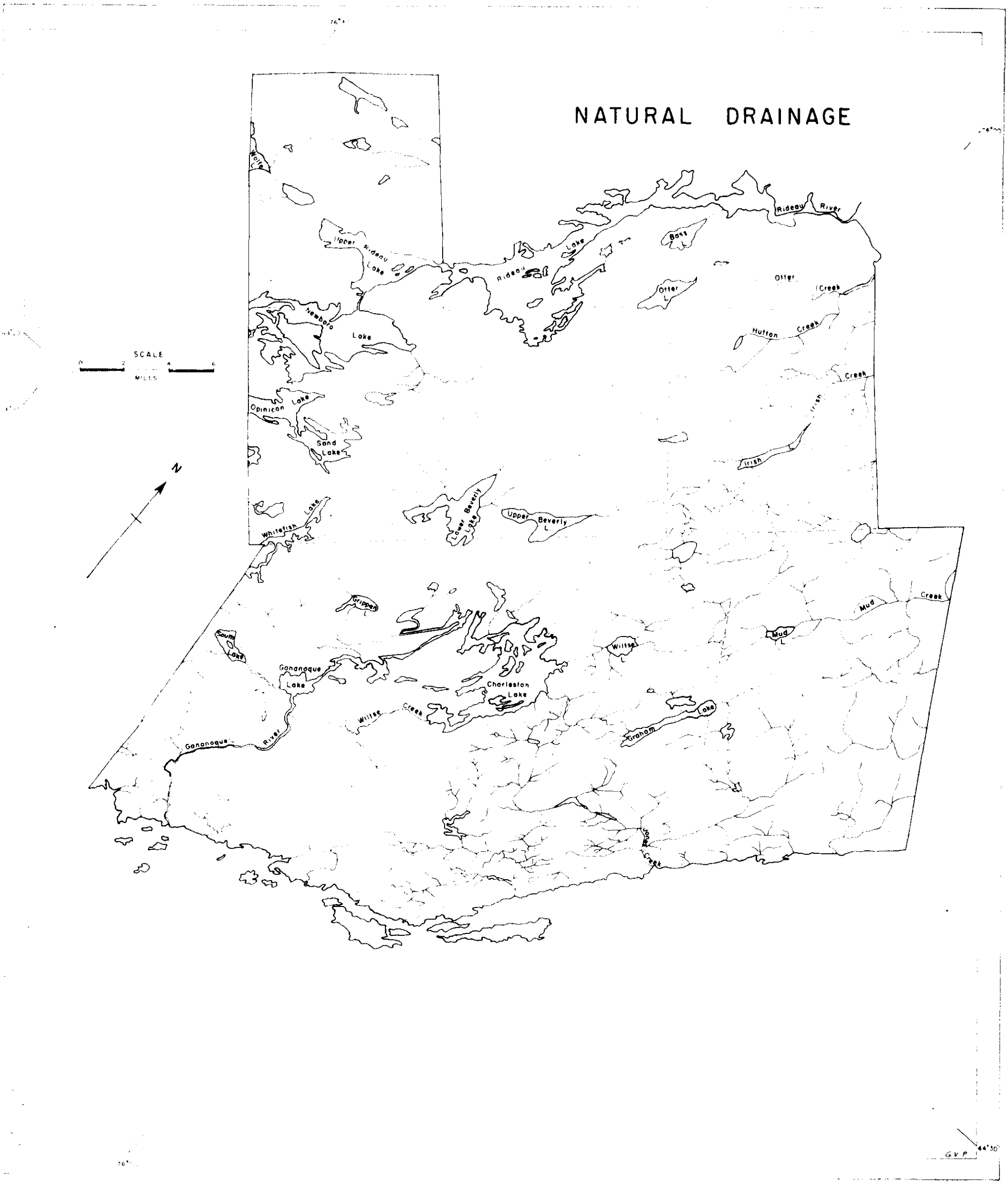


Figure 4 — Outline Map showing principal streams draining Leeds County

In general winter temperatures are higher than at Ottawa and lower than at Guelph, while summer temperatures are higher than in the Peterborough or Guelph areas.

The southern part of Leeds County has a mean annual heat unit rating for corn (CHU) of 2,700, dropping to 2,600 for the northern part of the county. Most shelled corn is grown in areas having 2,900 or more CHU, some is grown for grain in areas with as low as 2,500 CHU while corn ensilage can be grown in areas of only 2,100 CHU.

In climatic regions with high corn heat units, corn is a more efficient producer of energy than oats and barley. However, this advantage diminishes as the CHU approaches 2,300, which is the limit for present corn hybrids (Brown et al).

The moisture deficiency for the county is 2 inches as determined by the Thornthwaite method, assuming a soil moisture holding capacity to be 4 inches. The clay soils of the county have a greater storage capacity, and sandy soils a smaller capacity than this value. Therefore clay-textured soils in the county will have less than a 2-inch moisture deficiency, and sandy-textured and shallow soils over bedrock will have a larger deficiency.

Historical Development

Archaeological discoveries around the shores of the St. Lawrence River in Leeds County have established that man lived in this area 4,000 years ago, followed by successive cultures to the time of the Iroquois Indian. The latter were the occupants of the territory when Champlain reached this area in 1632. Between this time and the settling of Leeds County by United Empire Loyalists in 1783, history records many bloody skirmishes in this region.

One of the first settlers recorded to have settled in Leeds County was Captain Joel Stone, a Loyalist, who obtained a grant of 500 acres on the Gananoque River, with half the waterpower rights. The first iron foundry in Ontario was established in the county in 1825, the ore being obtained locally. It contributed to the early agriculture of the area by producing plows, pots and kettles, etc.

The war of of 1812-14 was an unsettling period in the development of the county. Numerous small but deadly encounters took place at Gananoque, Brockville, Morriston, Prescott, and Ogdensburg.

The Agricultural Commission Report of 1881 indicates that rural settlement had been completed in the county by that time. There was a large number of cheese factories, and lumbering was a big operation in the rear of Leeds and Lansdowne and in the rear of Yonge and Escott. It was reported also at this time that there was no standing timber in North and South Crosby Townships, the whole area having been burned over.

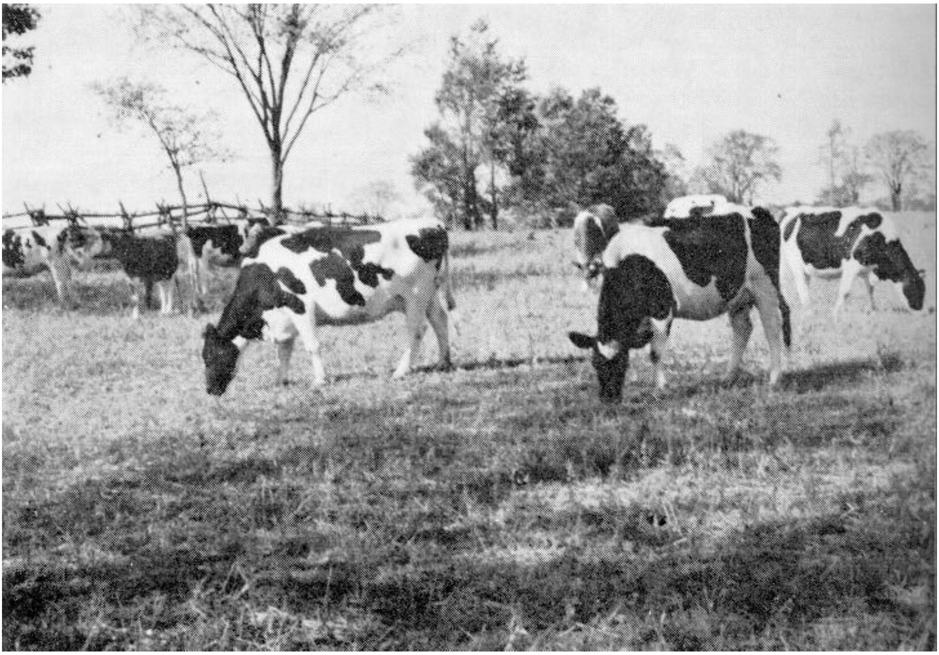
Yields of 30 bushels per acre of oats, 15 bushels per acre of peas, and 10 bushels per acre of spring wheat are reported. No yields for hay are recorded, but large acreages of land were sown to fall wheat, most of which was winterkilled. This was a period of trial and error. Wheat was in great demand in Britain at this time, and was a popular cash crop in Ontario.

The popularity of cheese production began early, and continued in Leeds County until the loss of overseas markets and drop in price in 1958.

Present Agriculture

In 1959 Leeds County was one of the leading cheese-producing counties in Ontario, producing 6,736,037 pounds of cheddar cheese. In 1964 cheese production had dropped to 1,554,674 pounds. No increase in butter production occurred during the same period, and the milk formerly used for cheese production must be going to the condenseries in the county, for which there are no data at hand.

An inventory of the livestock on the farms of Leeds County in 1964 as shown in the Agricultural Statistics for Ontario is given in Table 2. The data indicate that Leeds is still a predominantly dairy county.



Leeds County is noted for its dairy herds

TABLE 2

LIVESTOCK POPULATION IN LEEDS COUNTY (1964)

Cows for milk purposes, 2 years and over	-	15,800
Cows for beef purposes, 2 years and over	-	7,300
Total cattle, all ages	-	58,450
Swine, 6 months and over	-	1,800
Sheep, 1 year and over	-	2,100

The crops presently grown in Leeds County are essentially those which support the livestock industry. The acreage and average yield of these crops is given in Table 3.

The low average hay yields for the county may be a reflection of the large acreage of thin soils cultivated in the county, on which droughtiness is a real hazard. They may also indicate declining yields due to long rotations on the clay plains in the county. The data for grain corn production show that this crop is not extensively grown, but it is included for those who may be interested in the corn potential of Leeds County.

TABLE 3

ACREAGE AND AVERAGE YIELD OF CROPS COMMONLY GROWN IN LEEDS COUNTY

	Acreage	Average Yield
Hay	68,900	1.35 tons/acre
Mixed grain	1,000	38.0 bu/acre
Oats	27,800	40.7 bu/acre
Winter wheat	750	30.3 bu/acre
Corn for fodder	5,100	9.0 tons/acre
Corn for husking	450	70.0 bu/acre
Potatoes	500	239.0 bu/acre

Transportation and Markets

There are no problems involved in getting the agricultural produce of Leeds County to market. The railroads and Highway 401 provide direct access to markets in Toronto and Montreal. The proximity to the United States border has always provided an accessible market, especially in livestock, and large numbers of registered Holstein heifers cross the border annually.

THE CLASSIFICATION AND DESCRIPTION OF THE SOILS OF LEEDS COUNTY

The surface deposits previously described are the parent materials on which the soils of the county have developed. Differences in the kinds of soils are primarily due to differences in the parent materials but may also be due to differences in natural drainage and vegetation.

Under cool humid climate and forest vegetation, Ontario soils tend to become acid. The acidity is the result of the removal of bases, particularly calcium, from the surface layers of the soil by percolating water. The products of weathering may be transported through the soil either in solution or suspension to be deposited in lower layers or horizons, and this leads to the development of horizons within the soil that differ from one another in thickness, color, structure, and frequently in texture.

The vertical sequence of horizons in a soil is called the soil profile. In agricultural practice it is customary to refer to the different horizons as surface soil, subsoil, and parent material. However, because many soils have more than three horizons or layers, it is convenient to use the specific pedological terms, A horizon, B horizon, and C horizon, which are further subdivided into Ao, Ae, B_1, C, etc. These terms and symbols are used in the detailed soil descriptions given in the appendix. They are described in more detail in the glossary of this report.

The A horizon is the horizon of maximum weathering, from which bases are removed. In many soils the A horizon can be subdivided into Ah and Ae.

The Ah horizon contains the largest amounts of organic matter, and the Ae is the horizon with the lightest color. Some of the constituents (clay, iron, organic matter) leached from the Ah and the Ae accumulate in the B horizon. Hence, the B horizon is often finer in texture than other horizons in the profile. The C horizon, generally referred to as parent material, may be unaltered or only slightly altered by the soil-forming processes.

A Gray-Brown Podzolic Soil Profile (Gray-Brown Luvisol)[1]

Some of the soils in the southern part of the county are classified in the Gray-Brown Podzolic Great Group. These soils have a dark grayish brown Ah horizon, relatively high in organic matter, underlain by a yellowish Ae horizon that becomes lighter in color with depth. The B horizon is brown and finer in texture than any other horizon. It contains translocated concentrations of clay minerals and sesquioxides. The parent material is calcareous.

[1]New classification by N.S.S.C. 1968

A Brown Forest Soil Profile (Melanie Brunisol)[1]

The Brown Forest soils occur in calcareous till materials. These soils have a very dark brown Ah horizon, high in organic matter, which is underlain by a brown B horizon containing some accumulation of sesquioxides.

[1]New classification by N.S.S.C. 1968

A Podzol Soil Profile (Ferro Humic Podzol)[1]

The Podzol soils may have an L-F-H[2] horizon sequence which is underlain by a gray or white Ae horizon. The B horizon is reddish brown, grading to yellow-brown, and contains accumulations of sesquioxides or organic matter or both.

[1]New classification by N.S.S.C. 1968
[2]See glossary at back of report

A Gray Wooded Soil Profile (Gray Luvisol)

The Gray Wooded soils have a thin Ah horizon not more than 2 inches thick underlain by an almost white Ae horizon. The B horizon can generally be subdivided into two horizons, a Bt_1 having white coatings over the blocky aggregates, and a B_2 horizon in which the aggregates are coated with dark gray-brown clay skins. Soil reaction ranges from a pH of 5.2 in the A horizon to pH 8.2 in the parent material.

A Humic Gleysol Soil Profile

The Humic Gleysol soils are poorly drained. They have a dark-colored surface soil, high in organic matter, and a grayish subsoil with yellow and orange mottling.

Series Types, Phases, and Complexes

The principal unit of soil classification is the soil series, which in turn may be subdivided into two or more soil types or phases. Each soil series is defined in terms of the characteristics of the soil horizons, the soils included in a given series having similar horizon development. The series is given a geographic name usually taken from an area where its occurrence is most common, e.g. Otonabee series, a name taken from Otonabee Township, Peterborough County. A soil series may include two or more soil types. These are separations that are based on variations in the texture of the surface horizon. The name of the soil consists of the series name and the surface texture, for example, Otonabee loam. Phases are usually subdivisions of soil types, and are used to indicate external characteristics of the soil, such as slope, depth to bedrock, amount of stones on the surface, that affect the cultivation of the soil, for example, Otonabee loam—shallow phase.

Some of the map units used in this survey are shown as soil complexes, i.e. a combination of two or more soil series. Such map units are used where two or more soil series occur in such an intricate pattern in the field that their boundaries cannot be delineated on the map. The names of the two dominant soil series are used in designating a soil complex.

Soil Key

A. Soils developed on glacial till

	Acreage
I. Calcareous loam and sandy loam parent material	
(a) Well drained	
1. Grenville loam (Grl)	10,150
2. Grenville sandy loam (Grsl)	1,100
3. Grenville loam — shallow phase (Grl-sh)	5,650
4. Tennyson sandy loam (Tsl)	12,050
5. Tennyson sandy loam — shallow phase (Tsl-sh)	4,000
(b) Improperly drained	
1. Matilda loam (Ml)	8,450
2. Matilda loam — shallow phase (Ml-sh)	12,950
(c) Poorly drained	
1. Lyons loam (Lyl)	3,000
2. Lyons loam — shallow phase (Lyl-sh)	2,700
II. Calcareous stony loam and sandy loam parent material	
1. Tweed sandy loam (Tws)	
III. Noncalcareous stony sandy loam parent material	
1. Monteagle sandy loam (Msl)	

B. Soils developed on lacustrine deposits

I. Calcareous clay parent material	
(a) Well drained	
1. Gananoque clay (Gc)	1,450
(b) Imperfectly drained	
1. Lansdowne clay (Lc)	1,850
(c) Poorly drained	
1. Napanee clay (Nc)	55,400
2. Napanee clay — shallow phase (Nc-sh)	300

II. Calcareous silty clay loam parent material

(a) Well drained

(b) Imperfectly drained

1.	Carp clay loam (Ccl)	950
2.	Carp clay loam — shallow phase (Ccl-sh)	100

(c) Poorly drained

1.	North Gower clay loam (NGcl)	10,600
2.	North Gower clay loam — shallow phase (NGcl-sh)	100

III. Calcareous fine sand and silt or silty clay parent material

(a) Well drained

1.	Seeleys Bay silt loam (Sbsil)	8,950

(b) Imperfectly drained

1.	Battersea silt loam (Btsil)	900
2.	Battersea fine sandy loam (Btfsl)	600
3.	Picadilly loam (Pl)	200
4.	Picadilly fine sandy loam (Pfsl)	350
5.	Picadilly silt loam (Psil)	500

(c) Poorly drained

1.	Hinchinbrooke loam (Hl)	2,400
2.	Hinchinbrooke loam — shallow phase (Hl-sh)	900
3.	Hinchinbrooke fine sandy loam (Hfsl)	3,300
4.	Hinchinbrooke silt loam (Hsil)	1,800

IV. Sand deposits overlying clay

(a) Poorly drained

1.	Allendale sandy loam (Asl)	550

C. Soils developed on sand and gravel outwash

I. Noncalcareous parent material

(a) Well drained

1.	Uplands fine sandy loam (Ufsl)	4,900
2.	Uplands sand (Us)	4,100

(b) Imperfectly drained

1.	Rubicon fine sand (Rfs)	700
2.	Rubicon sand (Rs)	2,850

(c) Poorly drained

1.	St. Samuel fine sand (Sfs)	100
2.	St. Samuel sandy loam (Ssl)	1,700
3.	St. Samuel sandy loam — shallow phase (Ssl-sh)	50

II. Calcareous gravel parent material

(a) Well drained

1.	White Lake gravelly sandy loam (Wls)	1,650
2.	White Lake gravelly sandy loam — shallow phase (Wls-sh)	100
3.	Kars gravelly loam (Kg)	1,300

D. Soils developed on thin deposits over limestone bedrock

(a) Well drained

1.	Farmington loam (Fl)	173,960

E. Soils developed on organic materials

(a) Very poor drainage

1. Muck (M)	29,200
2. Muck — shallow phase (M-sh)	350
3. Peat (P)	11,550

F. Soil Complexes

1. Gananoque clay — Marsh (Gc-Ma)	700
2. Gananoque clay — Napanee clay (Gc-Nc)	900
3. Monteagle sandy loam — Rock (Msl-R)	28,100
4. Napanee clay — Marsh (Nc-Ma)	950
5. Rubicon sand — St. Samuel sandy loam (Rs-Ssl)	250
6. Tweed sandy loam — Rock (Tws-R)	8,700
7. Uplands fine sandy loam — Rock (Ufsl-R)	1,100
8. Uplands sand — Rock (Us-R)	450
9. White Lake gravelly sandy loam — Rock (Wls-R)	350

G. Miscellaneous Mapping Units

1. Marsh (Ma)	4,850
2. Rockland (Rl)	129,700
3. Rock outcrops (Ro)	2,700

TABLE 4

SOIL SERIES ACCORDING TO THEIR CATENARY RELATIONSHIP

Catena Name	Well Drained	Imperfectly Drained	Poorly Drained
Manotick	Manotick*	Mountain*	Allendale
Newburgh	Newburgh*	Picadilly	Hinchinbrooke
Carp	———	Carp	North Gower
Gananoque	Gananoque	Lansdowne	Napanee
Grenville	Grenville	Matilda	Lyons
Uplands	Uplands	Rubicon	St. Samuel
Seeleys Bay	Seeleys Bay	Battersea	———

*These series have not been mapped in Leeds County.

The catena is a grouping of soils developed on similar materials but differing in drainage. Blanks in the catenas (Table 4) mean that no series have been established for these members. Landscapes associated with these materials are such that the missing members may not exist.

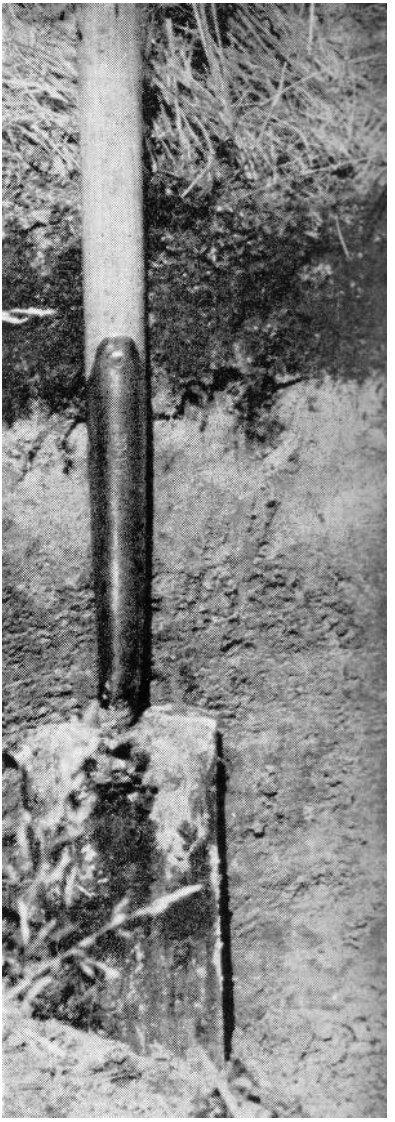
Allendale Series (550 acres)

Allendale sandy loam is the only series member mapped in Leeds County. This soil is quite extensive in Grenville and other eastern counties. It occurs on level to depressional topography, and is poorly drained. The lime content of the soil is fairly high; the surface reaction is neutral. The present tree vegetation is dominantly elm. The soil materials are bi-depositional—sand over clay—and the depth is variable, although generally 20 to 24 inches.

The cultivated surface is a very dark grayish brown sandy loam with loose crumb structure. This is underlain by grayish horizons with yellowish brown mottles. The intensity of mottling is greatest near the sand-clay junction. Lacustrine clay sediments are generally found at a depth of 24 inches.

The Allendale soils are generally used for permanent pasture but occasionally are brought under cultivation. They support poor quality grasses for pasture unless exceptionally well managed. They can be tiled for drainage if drainage outlets are available but this has to be combined with the production of high-value crops.

Ditch drainage and improved fertility could possibly improve the productivity of these soils.



A profile of Allendale sandy loam

Battersea Series (1,500 acres)

The Battersea soils are imperfectly drained, and occur in association with the well-drained Seeleys Bay Series, occupying lower topographical positions in the landscape. These soils have seemingly developed in sediments deposited in the embayments of Lake Frontenac or the Champlain Sea. -Battersea fine sandy loam and Battersea silt loam are members of the series and mapped along the northern fringes of the deep lacustro-marine sediments. The chief difference between these two types is in surface texture.

The surface is a very dark brown fine sandy loam or silt loam with crumb and granular structure. This is underlain by a grayish brown, slightly mottled horizon 4 to 7 inches thick and of similar texture. The underlying Bt horizon is a brown finer-textured layer of varying thickness. The parent material is grayish brown silt to silty clay loam and calcareous.

The Battersea soils are good agricultural soils and produce good crops of hay, grain, and ensilage corn. The imperfect drainage may restrict the choice of crops grown, alfalfa for example, but other forage crops can be used to offset any disadvantage.

Carp Series (1,050 acres)

The Carp soils are imperfectly drained, neutral to mildly alkaline soils developed in calcareous stone-free fine-textured materials. They occur in Leeds County on gently sloping landscapes around the Rideau Lakes drainage basin.

The Carp soils occur in association with the poorly-drained North Gower series and they are members of the same drainage catena. They are noted for their good soil structure-the result of high organic matter and carbonate content plus a favorable balance of sand, silt, and clay.

The cultivated layer is a dark gray-brown friable clay loam underlain by 3 to 6 inches of a grayish brown Ae horizon with weak subangular blocky structure. The Bt horizon is brown, about 4 inches thick, with medium subangular blocky structure. This horizon grades into the gray calcareous silty clay parent material.

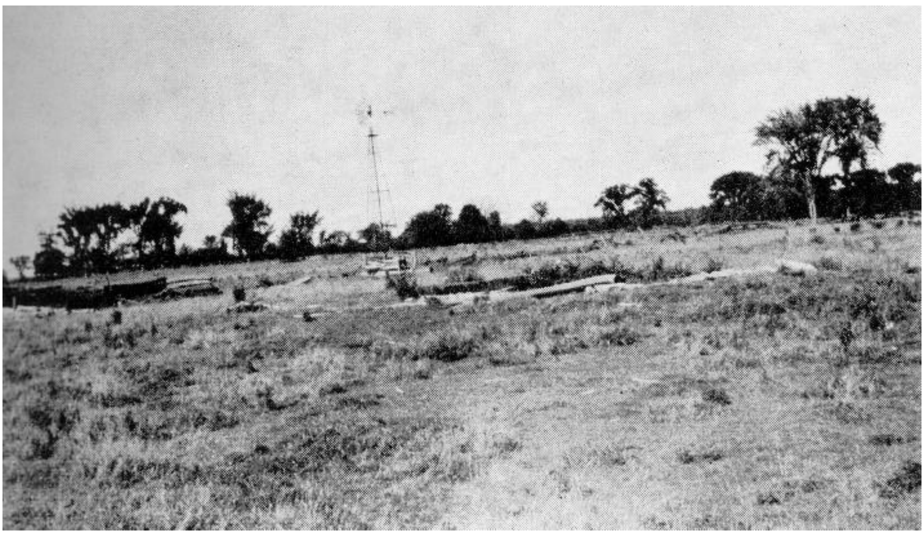
The Carp soils are good soils for the production of hay and feed grain crops. They are highly productive for ensilage corn but are outside of the favorable climatic zone for grain corn.

Carp clay loam — shallow phase

A small acreage of this phase has been mapped in which bedrock occurs within 15 to 24 inches from the surface. This substantially lowers its value for crop production but it does provide good pasture land.

Farmington Series (186,700 acres)

The Farmington soils, acreage-wise, represent a major soil series in Leeds County. They are mapped extensively in Kitley, Bastard, and Elizabethtown Town-



A landscape of Farmington loam

ships. These are thin soils with less than 12 inches of soil over limestone bedrock. The average depth to bedrock in these soils in Leeds County is possibly 4 to 5 inches. Two textural types are mapped: Farmington loam and Farmington sandy loam. The coarser texture is the result of water sorting and in some places long irregular shallow deposits may be lake shorelines. The irregular distribution of these latter deposits made it impossible to indicate them on the map as a separate series. These thin beach-like deposits generally have a truncated Podzolic profile in contrast to the thin Brown Forest profiles of the Farmington soils.

The surface horizon is 2 to 3 inches thick and dark gray-brown in color. The reaction is moderately alkaline. This is underlain by a reddish brown B horizon, iron-enriched, but showing no evidence of clay illuviation. This B horizon rests on the limestone bedrock.

The areas mapped as Farmington loam or sandy loam are really complexes with rock outcrop and soils varying in depth from 1 to 12 inches. The exception to this pattern is in Elizabethtown and part of Kitley where the depth to bedrock is fairly constant at or near the 10- to 12-inch depth, with pockets slightly deeper.

Large acreages of Farmington in Leeds County are too thin to be used for anything other than for grazing. However there are large acreages under cultivation in the Elizabethtown and Kitley Township areas. They appear to produce fair crops of hay and feed grain under favorable climatic conditions but are subject to crop failure in dry seasons.

The deeper phases of the Farmington soils have a good pasture potential, and if they become uneconomic for general farming, an alternate land use should be found in large-scale ranching. These soils would also provide a good site for a community pasture. Some areas underlain by sandstone occur as inclusions in the Farmington series as mapped in this county.

Gananoque Series (1,450 acres)

The Gananoque soils represent the moderately well-drained fraction of the large body of soils developed on lacustro-marine deposits in the southern part of

A profile of Gananoque clay

the county. These are deep water deposits and are very fine-textured sediments. The topography of the Gananoque soils is bedrock-controlled, deposited on very rough upward-thrusting Precambrian bedrock. There is evidence to show that these clay deposits have several discontinuities in the upper 5 feet of material.

The surface layer under virgin conditions is dark gray and 1 to 2 inches thick, underlain by a light gray Ae horizon from 2 to 6 inches thick. The B horizon is brown with clay illuviation confined to the upper portion. The depth to carbonates is about 36 inches. The soil reaction ranges from pH of 5.3 in the surface to 8.0 at the 36-inch depth.

The Gananoque clay is a good to fair soil for general farming. It requires good timing for plowing and seedbed preparation. These operations must be performed at the right soil moisture content. Applications of lime are required for good yields of legumes. These soils are inherently low in organic matter and regular applications of barnyard manure are necessary to maintain or improve soil structure. Hay, oats, and ensilage corn are the common crops presently grown.

Granby Series (200 acres)

The Granby is a poorly-drained, neutral to alkaline sandy loam. It *is* mapped in several small, slightly depressional areas south of the Upper Rideau Lakes.

A profile of Grady sandy loam

The cultivated surface of the Granby soil may vary from dark gray to black, depending on the content of organic matter. The underlying horizons are gleyed, mottled with a zone of concentrated mottling at 18 or 20 inches. The parent material is gray calcareous sand. The surface reaction of these soils is neutral to alkaline.

Granby sandy loam can be used for hay and pasture crops, especially if some drainage improvement can be made. It can perhaps be of greater value when used for the production of market garden crops. It is also a desirable soil for sod production.

Grenville Series (16,900 acres)

The Grenville series has developed on loamy limestone materials deposited in varying depths by melting ice. The till is composed largely of Ordovician limestones. These vary from the coarse-textured Leroy and Lowville limestones to the fine-textured Pamelia formation. The range in texture of the parent bedrock material is reflected in the texture of the soil materials, and both Grenville loam and Grenville sandy loam are mapped in the county.

The series occurs extensively throughout the eastern counties and has been classified as a Brown Forest soil. The Grenville mapped in Leeds County, although predominantly Brown Forest, does have inclusions of minimal Gray-Brown Podzolic soils in both textural types.

The surface cultivated horizon is very dark gray-brown in color, loam to sandy loam in texture, with friable crumb structure, and neutral to slightly alkaline in reaction. The dark yellowish brown B horizon is below the surface layer, about 10 inches thick with a friable crumb structure. The gray-brown calcareous parent material occurs about 16 inches from the surface. It is a gravelly loam or sandy loam till.

The topography varies from gently to moderately sloping. Some of the Grenville is drumlinized but most of it is associated with ground moraine landscapes.

The Grenville soils are used for general farming and dairying. They are well adapted to alfalfa, clover, timothy hay, and small grains.

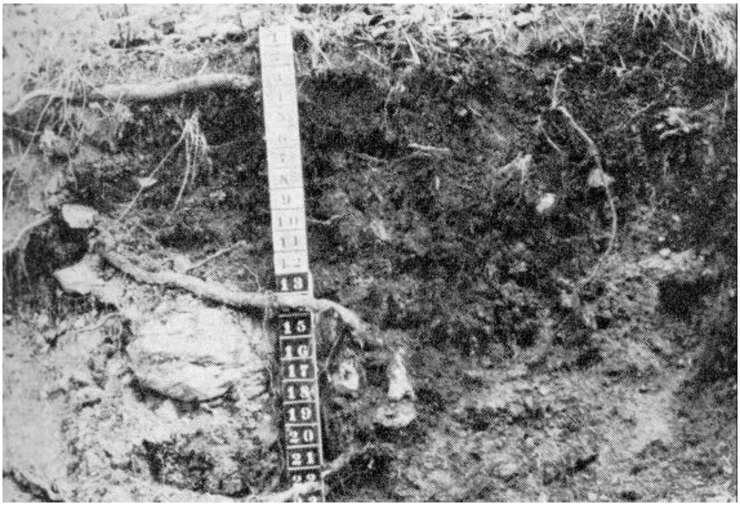
The gravelly composition of the Grenville soils reduces moisture retention, and they are susceptible to drought.

Since dairying is common a good supply of barnyard manure is usually available to return to the soil. Legumes grow well and help to maintain the organic matter supply as well as to add nitrogen.

Grenville loam — shallow phase

This phase has less than 2 feet of soil overlying bedrock and is generally under cultivation. The profile characteristics are similar to the Grenville series. The chief limitation is moisture. The thin soil mantle can dry out to wilting conditions during July and August.

The phase is used for hay and pasture, and in normal or wet seasons will produce good to fair crops of hay, oats, and ensilage corn, but in an unusually dry summer these crops may fail completely.



A profile of Grenville loam

Hinchinhrooke Series (8,400 acres)

The Hinchinbrooke series is the poorly-drained catenary member of the Newburgh catena. The imperfectly-drained member of the catena is the Picadilly series. These soils have developed on fine sandy loam to silt loam alluvial deposits. The Hinchinbrooke soils in the western part of the county are generally found in long narrow channels bordered by Precambrian rocks which were probably inlets of a former post-glacial lake.

Three textural members of the series were mapped in the county: Hinchinbrooke loam, Hinchinbrooke fine sandy loam, and Hinchinbrooke silt loam. The general profile characteristics are similar except for texture and minor variations in thickness of horizons.

The surface cultivated layer may be 6 to 8 inches in thickness, fine sandy loam to silt loam with friable crumb structure. Soil reaction is neutral. The underlying layers are a drab grayish brown with varying amounts of yellowish brown mottles. Soil reaction increases with depth until free carbonates are encountered at about 30 inches.

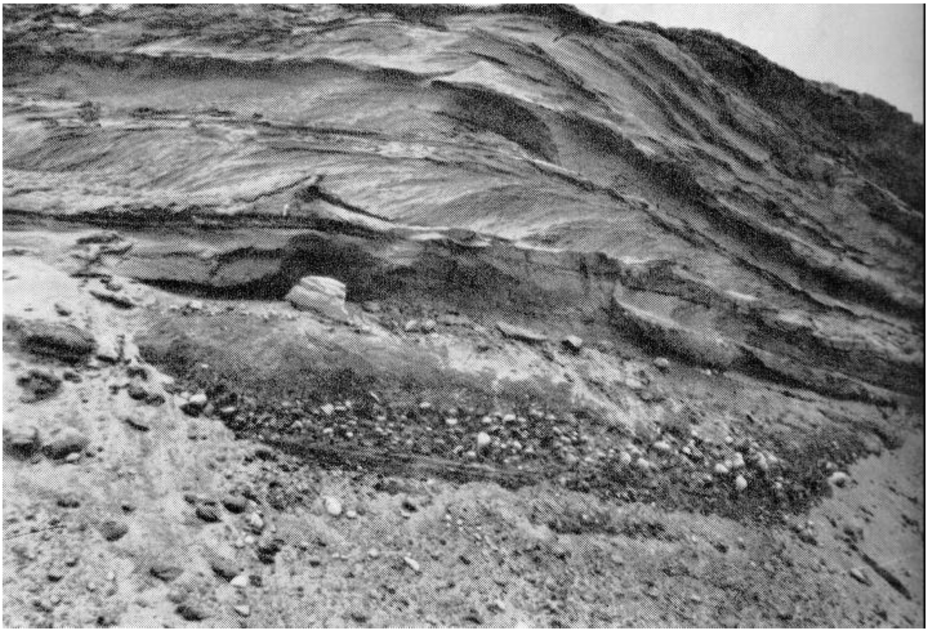
Some of the rock-enclosed areas of Hinchinbrooke have a high water table for much of the year, and their use for agriculture is limited. However, in many areas such as in the Lyndhurst area and northwest of Brockville, the Hinchinbrooke soils occur in fairly large level plains. In these areas the water table in midsummer is at about 3 feet, and hay (ladino clover, brome) and spring grains are successfully grown.

Hinchinbrooke loam — shallow phase (900 acres)

This phase was mapped where bedrock occurred within 2 feet of the surface. This shallow phase can be cultivated but may or may not produce a crop. In an abnormally dry summer crop failure may result from lack of moisture. In a wet year the soil may be waterlogged and a crop failure result. It can be used as improved pasture land and will provide good to fair pasture, again depending on the climate.

Kars Series (1,300 acres)

The Kars series has developed on calcareous poorly-sorted sands and gravels. They are of fluvio-glacial origin, having formed at the front of a receding glacier. The topography varies from irregular moderately sloping to steeply sloping.



Sand and gravel materials are associated with kames

The Kars gravelly sandy loam is the only series member mapped in the county, and these soils are found in the southern portion of the county. Ordovician limestones make up a significant part of the soil material.

The surface horizon (uncultivated) is dark gray-brown sandy loam about 3 inches in thickness. This is underlain by a yellowish brown Ae horizon quite variable in thickness over a 6-inch B horizon, brown in color, and containing some illuviated clay that is sesquioxide-enriched. The underlying materials are sands and gravels formed from both Ordovician and Precambrian rocks.

A relatively small fraction of the Kars is under cultivation in areas located on the more favorable slopes. The soils are mostly exploited for building materials since these kames are the-only source of gravel in the county.

The cultivated areas are rated as fair for the production of cereal grains, hay, and pasture.

Lansdowne Series (1,850 acres)

The Lansdowne soils are the imperfectly-drained members of the Gananoque catena and generally occur in association with the poorly-drained Napanee soils. These soils have developed on very fine-textured stone-free clay sediments that lie in the southern part of the county.

Lansdowne soils occur on gently sloping sites which provide opportunity for some surface drainage. Although only 1,850 acres are mapped, there will be some Lansdowne soils occurring as inclusions with the Napanee series. Lansdowne clay is the only series member occurring in the county.

The cultivated surface layer is a dark gray-brown clay-textured soil, sticky when wet and hard when dry. The gray-mottled Ae horizon is 3 to 4 inches thick overlying a gleyed B horizon about 10 inches thick. There is usually a foot of gleyed carbonate-free soil underlying the B horizon above the calcareous clay sediments. Horizon expression is weak.

Lansdowne clay — gently sloping topography

The Lansdowne soils are good to fair soils for general farming. They will produce excellent crops of hay, spring grain, and corn in good seasons but can be disappointing in unusually wet and late seasons. Alfalfa is grown but will not persist for many seasons. Brome, alsike, timothy, and red clover are extensively grown on these soils and grow well. Trefoil should perform well on the Lansdowne soils, and once established should persist for years. This is a good soil for ensilage corn but under natural drainage a little late for present grain corn hybrids.

These soils seem inherently low in organic matter which is reflected in harsh structure and hard consistence. Management should include methods of overcoming this defect, and this includes applications of barnyard manure and plowing in of crop residues. Timing of cultivation operations is very important, and soil moisture conditions must be right in order to obtain a desirable seed bed.

Lyons Series (5,700 acres)

The Lyons series is the poorly-drained member of the Grenville catena. It has been mapped in most counties in Ontario as a poorly-drained limestone till soil. Hence it occurs in several catenas under our present system of classification. It is mapped in Leeds county in association with the Matilda and Grenville soils, and is found in level to depressional areas.

A landscape of Lyons loam

The cultivated surface layer is a very dark brown loam 6 to 7 inches thick, friable, and neutral to slightly alkaline in reaction. This is underlain by 8 to 10 inches of grayish brown loam, massive in structure but friable. A zone of intense mottling may occur in the lower part of this horizon. Soil reaction ranges from neutral to alkaline. The gray calcareous stony till is encountered at 15 to 20 inches. In many cases the depth to bedrock may not exceed 3 feet.

Because of its topographic position the natural drainage is poor. This condition is often aggravated by seepage from the surrounding higher land.

A large proportion of the Lyons remains in woodland. Areas not under trees are often used for permanent natural pasture. When cultivated it is a late soil in the spring and even at the best only a fair soil for the production of cereal grains. Timothy hay and permanent pasture do fairly well on these soils.

Lyons loam — shallow phase (2,700 acres)

This phase is mapped in areas where the soil materials and profile morphology is similar to Lyons, but the depth to bedrock is less than 24 inches.

This phase is generally used for permanent pasture.

Marsh (4,850 acres)

Marsh areas are inundated areas of mineral soil usually associated with lakes and rivers. They support a marsh vegetation of reeds, cattails, etc, and are generally of no value for agriculture. Marsh hay is harvested from a few such areas but this acreage is small. Marshes are of most value as breeding and feeding grounds for wildlife.

A marsh

Matilda Series (21,400 acres)

The Matilda soils are the imperfectly-drained members of the Grenville catena. The soil parent material is a moderately stony calcareous till. The Matilda soils occupy gently sloping sites in association with the moderately sloping Grenville soils, and receive runoff from the higher elevations. These soils are therefore moister than the Grenville soils for a longer period of the year.

Mottled colors associated with inadequate internal drainage show up in the subsoil.

The surface horizon is dark-colored, and has a fairly high content of organic matter. It is a friable loamy soil, neutral in reaction. The subsoil is a yellowish brown loam, the color indicating an accumulation of iron but showing no particular zone of clay accumulation. The depth of the soil to the calcareous parent material may vary between 12 and 18 inches.

Matilda soils are used to produce hay, spring grains, and fodder corn but yields vary according to climate. Poor growing conditions exist in this soil in late wet seasons.

Matilda loam — shallow phase (12,950 acres)

The shallow phase of these soils has generally less than 18 inches of soil over limestone bedrock. These soils have been mapped in Elizabethtown and Kitley Townships, and are generally surrounded by Farmington soils. They vary from the modal Matilda soils in being somewhat finer in soil texture.

A large acreage of this phase is cultivated. It is better supplied with moisture than the surrounding areas because of its lower topographical position. Hay and grain crops are grown.

Droughtiness seems to be a major problem on these soils and crop failures occur in particularly dry years.

Napanee Series (55,700 acres)

The Napanee soils are the poorly-drained clay-textured soils that occupy the level and slightly depressional areas extending from the Frontenac-Leeds boundary across the southern part of the county. Large, nearly level clay plains are to be found north of Gananoque and in the Lansdowne area. Many smaller areas of Napanee clay occupy the depressional areas between the outcroppings of Pre-cambrian bedrock in the Gananoque area. Since much of the agricultural production of the county is dependent upon the productivity of these clay-textured soils the present and future use of the soils is of considerable importance.

Napanee clay — nearly level topography

These soils have a low organic matter content in the surface except in very poorly-drained positions. The average clay content of the cultivated surface is about 45 percent, and increases with depth to 55 or 60 percent. These clay materials were probably deposited at the western limit of the Champlain Sea in a mixing basin of fresh and salt water. The weakly calcareous parent materials are found at about 4 feet below the soil surface. The surface horizon is moderately acid in reaction.

The soil characteristics that make the Napanee soils difficult to work are high clay content, low organic matter content, and poor drainage. An increase in organic matter content will improve the structure of the clay, and these soils should serve as excellent disposal areas for composted municipal wastes. Perhaps the most serious handicap of these soils is the poor drainage. Large scale municipal drainage programs are required to provide adequate drainage for some of these large clay plains. The long-term returns from such improvements could be very substantial.

The present land use is dairy farming with long hay rotations, corn for silage, and oats.

Napanee clay — shallow phase (300 acres)

This small acreage is mapped where the depth of clay material overlying limestone bedrock ranges between 1 and 2 feet. These areas are used for pasture and are rarely cultivated.

North Gower Series (10,700 acres)

The North Gower series are poorly-drained, neutral to alkaline soils developed in calcareous stone-free fine-textured materials. They occur in Leeds County on nearly level landscapes around the Rideau Lakes drainage basin.

The North Gower soils occur in association with the imperfectly-drained Carp soils and they are members of the same drainage catena. They are noted for their good soil structure—the result of high organic matter and carbonate levels, plus a favorable balance of sand, silt, and clay.

The surface cultivated layer is very dark brown or black in color, 6 to 9 inches thick, and very friable. Surface soil reaction is slightly alkaline. The underlying gleyed horizon is dark gray, mottled, and friable. The mottling is generally intense at the lower limits of the horizon. The gray, calcareous, relatively unweathered materials may occur at depths ranging from 15 to 20 inches.

There are North Gower soils on gently sloping topography with sufficient natural drainage which are fairly well adapted for the production of hay, spring grain, and fodder corn. The more poorly-drained North Gower soils on level or slightly depressional areas provide a more difficult problem in the removal of surface water. They are not suitable for sustained crop production until some type of drainage system has been installed.

North Gower clay loam — shallow phase

The depth of clay overlying bedrock ranges between 12 and 24 inches. These soils are generally used for hay and pasture.

Organic Soils (40,750 acres)

The organic soils are composed of plant remains in various stages of decomposition. Organic matter will accumulate as a deposit in a poorly-drained environ, being derived mainly from the leaves and plant debris of sedges, mosses, shrubs,

A Peat bog — moss and tamarack vegetation

and certain tree species. High water table levels prevent or retard the rate of decomposition of the dead plant remains. Borings in some of these bog areas reveal layers of different plant remains, indicating a history of plant succession from one plant species to another.

Black well-decomposed organic residues over a foot in depth are called muck. This material has been derived from various plant species, but mainly woody plants, and has undergone almost complete decomposition. As a result there are few fibers remaining, and the material is granular, loose, and powdery when dry.

Organic deposits that have undergone little or no decomposition are called Peat soils. In these soils the fibrous nature of the material is still present, giving it a felty, compact characteristic.

A classification system for organic soils in Canada has recently been introduced by ‘the National Soil Survey Committee of Canada. This system introduces new names for those soils that have been designated as muck or Peat, but recognizes degree of decomposition as an important characteristic of all organic soils.

Three divisions at the Great Group level are as follows:

1. Fibrisol—organic soils in the least decomposed stage
2. Mesisol—organic soils in an intermediately decomposed stage
3. Humisol—organic soils in a decomposed stage.

Each of the above groups has nine divisions at the subgroup level which identify the layering of material or conversely the uniformity of the deposit in a depth of 60 inches.

The areas mapped as muck occur in depressional locations under a dense tree cover of white cedar, balsam, white ash, elm, spruce. soft maple, and white and yellow birch. The water table is usually at the surface in May and June but may drop to 2 feet or more by late summer. The depth of muck on these sites seldom exceeds 4 feet, and in many areas may not be greater than 3 feet. The black, well-decomposed organic material varies little from the surface to the underlying mineral soil or bedrock. However, some of these bogs may have a black, well-decomposed surface layer up to 2 feet in thickness, apparently derived from leaves and woody residues overlying a matted layer of sedge plants showing little decomposition.

Areas mapped as muck-shallow phase have depths of organic accumulation ranging between 1 and 2 feet overlying mineral soil. The muck soils of the county belong to the Humisol Great Group in the new classification. There are 29,200 acres mapped as muck in the county.

The Peat soils in the county occur in areas in which mosses and sedges are the dominant vegetation. The water table in these areas appears to remain at or near the surface for most of the year, and as a result has discouraged tree growth except for a few tamarack and spruce trees. The organic material shows little decomposition, and these soils belong to the Fibrisol Great Group in the new classification. There are 11,550 acres of Peat soils mapped in the county.

Picadilly Series (1,050 acres)

The Picadilly soils have developed in a mixture of silt and fine sandy deposits under imperfectly-drained conditions. These materials were deposited in shallow water pondings of glacial meltwater at the close of the late Wisconsin glaciation. A large percentage of the Picadilly soils are found in the Lyndhurst-Elgin area of the county, deposited at a time when Beverley Lake was considerably larger than at present.

Several textural soil types were mapped: loam, fine sandy loam, and silt loam. They have dark surface horizons well supplied with organic matter. The soils are friable, easy to work, and are slightly acid in reaction. These soils are frequently banded with alternating fine sand and silt layers. They have a mottled, weakly-expressed Bt horizon overlying calcareous fine sand or silty material.

The principal crops grown are hay, spring grain, and ensilage corn. Because of the friable nature of these soils and their good workability, they are suitable for a variety of crops, including vegetable crops. When internal drainage of the soil is a problem, tile drainage can be satisfactorily installed.

Rubicon Series (3,550 acres)

The Rubicon soils have developed in noncalcareous outwash sand. These sandy areas are associated with old beaches of the Champlain Sea. The greater portion of the Rubicon soils are mapped in the eastern side of the county in the general area of Brockville. They occur on gently sloping topography, and are imperfectly drained. They are associated with strands of raised sandy beach lines, the latter mapped as Uplands sandy loam.

The uncultivated surface horizon of the Rubicon is a very dark gray, thin layer of organic and mineral soil. This is underlain by a gray leached horizon several inches thick. The iron-enriched B horizon is dark brown and often indurated. This grades through a brownish yellow transitional zone to gray noncalcareous sand.

Agriculture on the Rubicon soils in the county is varied. North of Brockville, land use is limited to hay and pasture crops. These soils are at the lower limits of imperfect drainage. The Rubicon soils mapped just west of Brockville are fine-textured sandy materials. They are producing fair crops of hay, grain, and corn.

Seeleys Bay Series (8,950 acres)

The Seeleys Bay series is the well-drained member of the catena carrying the same name. The other catenary member is the imperfectly-drained Battersea. These soils have developed in a calcareous silty clay loam lacustrine material, and the surface texture is generally silt loam. The topography varies from gently to moderately sloping. In some areas where the slopes are short, the percentage of poorly-drained soils in the depressions between slopes is fairly high.

The cultivated layer is dark gray in color, about 6 inches thick, and friable. It is slightly acid in reaction. The underlying Ae horizon is a pale brown silt loam, 4 to 5 inches thick, overlying a brown silty clay loam Bt horizon. This horizon, about 8 inches thick, has medium angular blocky structure with firm consistence. The underlying gray calcareous parent material has a silty clay loam texture. The silty soil material in the upper part of the profile may be a surficial deposit.

The Seeleys Bay soils are good agricultural soils, and are used for the production of hay, grain, and ensilage corn. During the course of the survey, the best corn in the county was being grown on these soils. Alfalfa does not persist in these soils, and this may be due to the fine-textured subsoil. High water concentrations at the silt-clay junction may cause serious root damage during the spring freeze-thaw cycles.

St. Samuel Series (1,850 acres)

The St. Samuel series is the poorly-drained member of the Uplands catena. These are medium noncalcareous sands, which in Leeds County generally indicate the shoreline of the Champlain Sea. The St. Samuel soils are found on level to depressional areas in front of the Uplands sandy ridges. The high temporary water table associated with the St. Samuel soils is due to finer-textured materials underlying the sand.

The surface horizon is very dark gray to black in color, 6 to 8 inches thick, containing a high percentage of organic matter. This is underlain by a gray gleyed horizon with some mottling. At 14 or 15 inches, mottling may become intense, overlying a gray noncalcareous sand.

The St. Samuel soils are used to a limited extent for agriculture in Leeds County. They produce some hay and pasture but are rarely used for grain production. These are late soils, too late for cereal grains except in particularly dry seasons. They are also of low fertility, and unless both of these limitations are corrected, they can only be classed as poor soils. If the above limitations are corrected, the St. Samuel soils can be used for the production of small fruits and vegetables in addition to general farm crops.

Tennyson Series (16,050 acres)

The Tennyson series has developed on stony, mildly calcareous till. These soils are found mainly in North Crosby Township around Westport. The Tennyson soils are well drained; the topography is generally smooth, moderately sloping. They are moderately stony to stony, the stones being mostly Precambrian boulders which were carried in by glacial ice.

The soil parent material is a sandy loam till containing a fairly high proportion of Precambrian material but calcareous due to additional incorporated limestone material derived from the underlying Black River limestone. The profile has been classified as Brunisolic Gray-Brown Podzolic.

The cultivated surface soil is a dark brown sandy loam with crumb structure. Soil reaction is slightly acid. This is underlain by a dark yellowish brown sandy loam horizon about 3 inches thick, over 7 or 8 inches of a yellowish brown sandy loam Ae horizon. The Bt horizon is a 6-inch dark brown sandy loam layer with very weak subangular blocky structure. This horizon would appear to be degraded. There is a 10-inch layer of soil material below the B which has been leached almost free of carbonates, and the material at 48 inches effervesces slightly with HCl.

The Tennyson soils are the best agricultural soils in this part of Leeds County, and have been used quite extensively for general farming. They produce good yields of hay and grain, and the chief limitation in many areas is one of stoniness.

Tennyson sandy loam — shallow phase (4,000 acres)

This shallow phase over bedrock is either in woodlot or used for pasture when cleared.

Uplands Series (9,550 acres)

The Uplands soils have developed in well-sorted sandy materials deposited by still or slowly moving water. The materials usually have a low lime content and are stone-free. The Uplands series is the well-drained member of the Uplands catena, and series members mapped in Leeds County are Uplands fine sandy loam and Uplands sand. The largest area in the county is located in the Briar Hill-Sweet Corners district, and this is mapped as Uplands fine sandy loam. The cultivated surface is 6 inches of dark brown fine sandy loam. Remnants of a white Ae horizon can generally be found. The Bf horizon is yellowish brown in color, 10 inches thick, grading into a pale brown fine noncalcareous sand. Thin parallel strands of dark brown fine sandy loam material may be encountered in the upper part of the C horizon.

The Uplands fine sandy loam soils are used for general farming in Leeds County. Natural fertility is low but can be supplemented by applications of barnyard manure and commercial fertilizers. These are early soils and are producing good crops of hay (alfalfa, red clover, timothy, and brome). Ensilage corn and oat crops were good on well-managed farms.

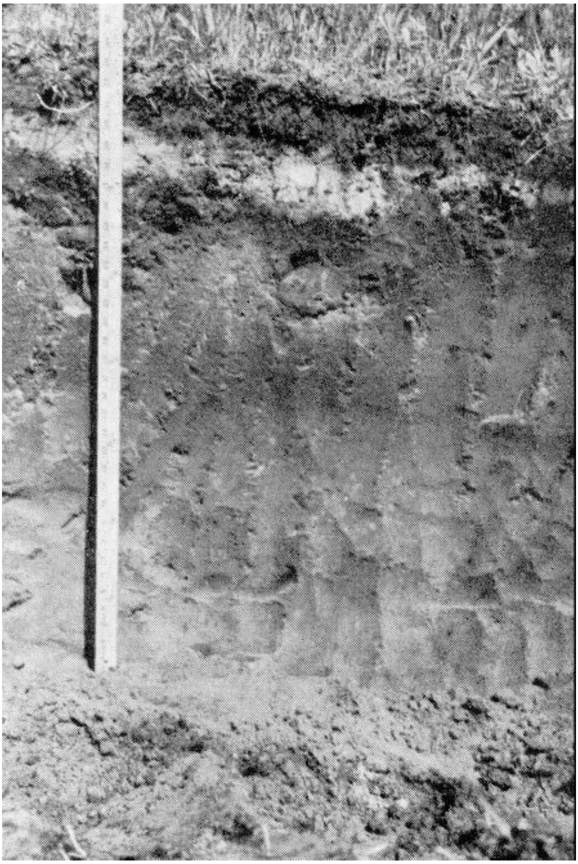
Uplands sand is not a productive agricultural soil, being droughty and low in fertility. The best land use for this type is possibly the production of trees.

Uplands sand — shallow phase

The small acreage of Uplands sand mapped as a shallow phase has less than 2 feet of sandy soil overlying bedrock. These areas are best left in woodlot because they are not arable land areas, and are too droughty to have much value as pasture land.

White Lake Series (1,750 acres)

The materials in which the White Lake soils developed were deposited by fast-flowing water, and consist of gravel formed from many kinds of rocks such as granite, sandstone, and crystalline limestone. The gravel is poorly sorted, ranging in size from fine gravel to large boulders. The topography is irregular, moderately to steeply sloping. The soil has developed the characteristics of a thin Podzol in the surface horizons with evidences of a Gray-Brown Podzolic textural horizon in the



A profile of Uplands sandy loam

lower part of the profile. Soil reaction in the upper part of the profile is moderately acid but reaches the neutral point at about 15 inches.

These soils are scattered in small kame-like areas in the county. Many are being used as sources of gravel while some are used for agriculture. They are one of the few soils in the Precambrian that can be cultivated, although they are droughty and low in fertility. They will produce fair crops of alfalfa, cereal grain, and pasture.

Soil Complexes

Soil complexes are intimate associations of two or more soil series occurring in a repetitious pattern that have been mapped as single cartographic units. It will be noted that some of the complexes mapped in Leeds County are combinations of one or more soil series plus rock outcrop; the latter, although not a soil series, is an important part of the complex from a land use standpoint. The complexes are described in relation to the landscape pattern and its overall effect on land use. Information on the characteristics of the individual components of the complex can be obtained by referring to the soil series descriptions.

Gananoque — Marsh (700 acres)

This is a complex of clay knolls with numerous very poorly-drained depressions which are flooded for most of the year. Although the Gananoque portion of the complex can be cultivated, the numerous marshy depressions present serious difficulties in cultivation and harvesting operations.

Gananoque clay — Napanee clay (900 acres)

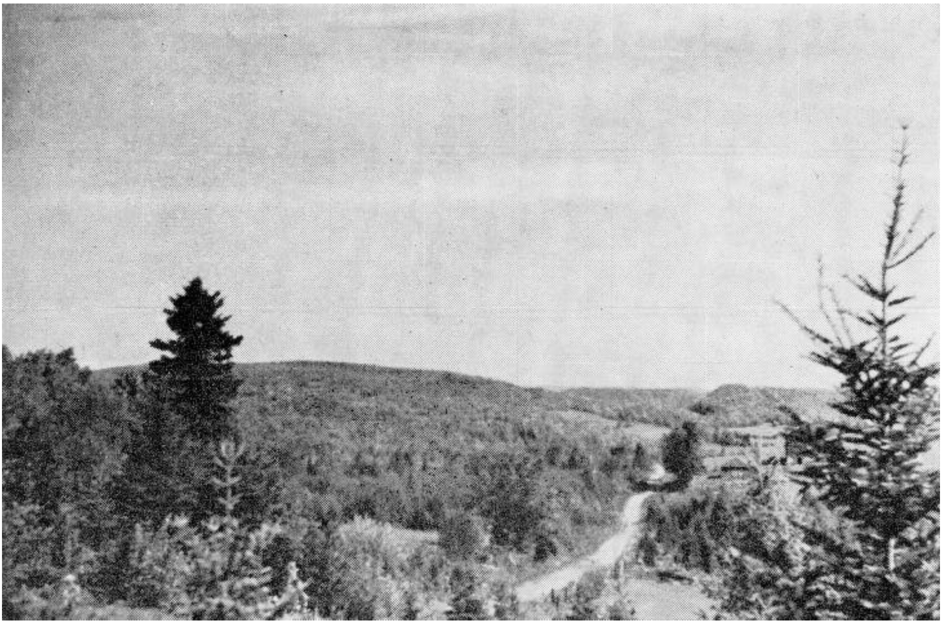
This complex has short-sloped ridges of Gananoque in close association with level or slightly depressional areas of poorly-drained Napanee clay. This is not a desirable complex since the two components cannot be worked separately, and are ready for cultivation at different times.

Monteagle sandy loam — Rock (28,100 acres)

This complex is mapped chiefly in North and South Crosby, Elmsley, and Bastard Townships. The landscapes are bedrock-controlled, consisting of irregular hilly topography with numerous outcroppings of bedrock. The depressions are generally marshy or filled with organic sediments.

The Monteagle soils are composed of very stony glacial till derived chiefly from the local granitic rocks. The lack of carbonates in the parent material has permitted the development of a Podzol profile. The surface leaf mat in undisturbed locations is underlain by a gray leached layer 1 or 2 inches in thickness. The subsoil, which is brown, loose, and porous, grades into the very stony parent material at 14 to 22 inches.

Much of the complex is too rough for cultivation but some areas, especially in North Crosby Township, are used for general farming. The cultivated areas are small, scattered, and stony.



A landscape of Monteagle sandy loam

Napanee clay — Marsh (950 acres)

This is a complex of nearly level Napanee clay with numerous small marshy depressions which are flooded for most of the year. The marshy depressions create difficulties in cultivating the Napanee portion of the complex.

Rubicon sand — St. Samuel sandy loam (250 acres)

This complex north of Brockville and along the Leeds-Grenville boundary occurs in an old beach line of probably the Champlain Sea. It is a landscape of gently sloping and depressional topography. Little agricultural use is being made of the complex at the present time, but perhaps with some improvement in drainage it could be of value for the production of small fruits and vegetables.

Tweed sandy loam — Rock (8,700 acres)

The Tweed soils occurring in Leeds County have been mapped as part of a complex consisting of rock and organic soils in addition to the Tweed.

The landform is bedrock-controlled, irregular, medium to steeply sloping. The bedrock outcroppings are dominantly crystalline limestone, but granite outcroppings do occur.

The Tweed series are soils overlying the crystalline limestone and considered to be derived from the weathered rock. They are well-drained, and they are classified as Orthic Brown Forest soils.

The surface horizon in forested areas is 3 to 5 inches thick, and very dark gray-brown in color. The surface reaction is slightly acid to neutral. The subsoil is reddish brown, friable, and 5 to 9 inches thick, overlying crumbling crystalline limestone.

The Tweed soils are cultivated in some areas but the frequency of rock outcroppings prevents any extensive use of the complex for cultivated crops. These soils have a high base status, and where conditions are suitable can be used for improved pasture.

Uplands fine sandy loam — Rock (1,100 acres)
Uplands sand — Rock (350 acres)

These two complexes have little value for agriculture. The best land use would possibly be in growing trees.

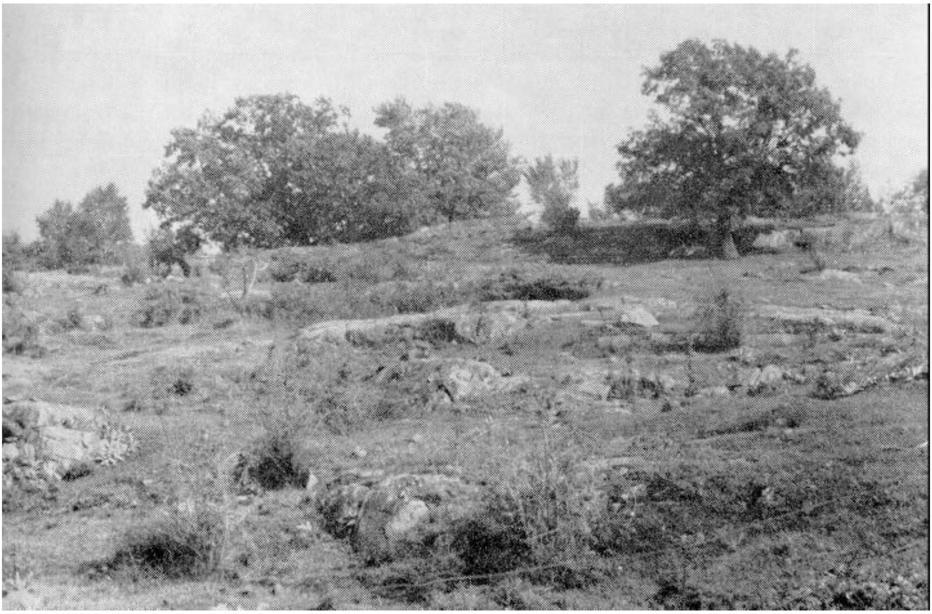
White Lake gravelly sandy loam — Rock (350 acres)

This complex is unsuited for agriculture, and exploitation of the gravel for construction is the optimum land use.

MISCELLANEOUS MAPPING UNITS

Rockland (129,700 acres)

The large acreage of Rockland mapped in the county has very limited use for agriculture. In the past, some farmsteads were established on this map unit, cultivating small patches of arable land, while a major portion of the income came from the forest. These farms can no longer support families due to the diminishing returns from the woodlots, and many are abandoned. The soils in this map unit include the Tweed and Monteagle series, their poorly-drained associates, and some organic soils.



Submarginal Rockland

Presently large acreages of Rockland are cleared or sparsely populated by trees, and are being utilized for pasture. The carrying capacity is low because of the high percentage of bare rock. However, it does provide a source of pasture which perhaps could be more fully exploited.

Rock outcrop (2,700 acres)

Areas of bare rock large enough to be delineated on the map at this scale of mapping are shown as Rock outcrop. These areas have no potential value for agriculture or forestry.

SOIL CAPABILITY CLASSIFICATION FOR AGRICULTURE

This capability classification is one of a number of interpretive groupings for agricultural or other purposes that may be made from soil survey data. In this classification the mineral soils are grouped into seven classes on the basis of their suitability and limitations for agricultural use. The first three classes are considered suitable for sustained production of common field crops, the fourth is physically marginal for sustained arable agriculture, the fifth is capable of use only for permanent pasture and hay, and the sixth is capable of use only for wild pasture. While the soil areas in Classes 1 to 4 are suited for cultivated crops, they are also suited for permanent pasture. Soil areas in all classes may be suited for forestry, wildlife, and recreational uses. For the purpose of this classification, trees, tree fruits, cranberries, blueberries, and ornamental plants that require little or no cultivation are not considered as cultivated or common field crops.

Assumptions

This soil capability classification is based on certain assumptions which must be understood by those applying this interpretive classification, if the soils are to be assigned consistently to the various classes, and if those using the soil capability maps and statistical data are to derive full benefit from such information and avoid making erroneous deductions. These assumptions follow:

1. The soil capability classification is an interpretive one based on the effects of combinations of climate and soil characteristics on limitations in use for agriculture, risks of soil damage, and general productive capacity for common field crops. Shrubs, trees, or stumps are not considered as limitations to use unless it is entirely unfeasible to remove them. While present forest cover is not generally considered a factor in this soil capability system, it may be used in the placement of soil areas in Class 7, where costly clearing will only result in placing the areas in Class 6.

2. Good soil management practices that are feasible and practical under a largely mechanized system of agriculture are assumed.

3. The soils within a capability class are similar only with respect to degree but not to kind of limitations in soil use for agricultural purposes or hazard to the soil when it is so used. Each class includes many different kinds of soil and many of the soils within any one class require unlike management and treatment. The subclass provides information on the kind of limitation, and the class indicates the intensity of the limitation. Capability Class 1 has no subclasses. Information for specific soils is included in soil survey reports and in other sources of information.

4. Soils considered feasible for improvement by draining, by irrigating, by removing stones, by altering soil structure, or by protecting from overflow, are classified according to their continuing limitations or hazards in use after the improvements have been made. The term "feasible" implies that it is within present-day economic possibility for the farmer to make such improvements, and that it does not require a major reclamation project to do so. Where such major projects have been installed, the soils are grouped according to the soil and climatic limitations or risks that continue to exist. A general guide to what is considered a major reclamation project is that such projects require cooperative action among farmers or between farmers and governments. (Minor dams, small dykes, or field conservation measures are not included.)

5. The capability classification of soils in an area may be changed when major reclamation works are installed that permanently change the limitations in their use or reduce the hazards of risks of soil or crop damage for long periods of time.

6. Distance to market, kinds of roads, location, size of farms, characteristics of landownership and cultural patterns, and the skill or resources of individual operators are not criteria for capability groupings.

7. Capability groupings are subject to change as new information about the behavior and responses of the soils become available.

8. Research data, recorded observations, and experiences are used as the basis for placing soils in capability classes and subclasses. In areas where such

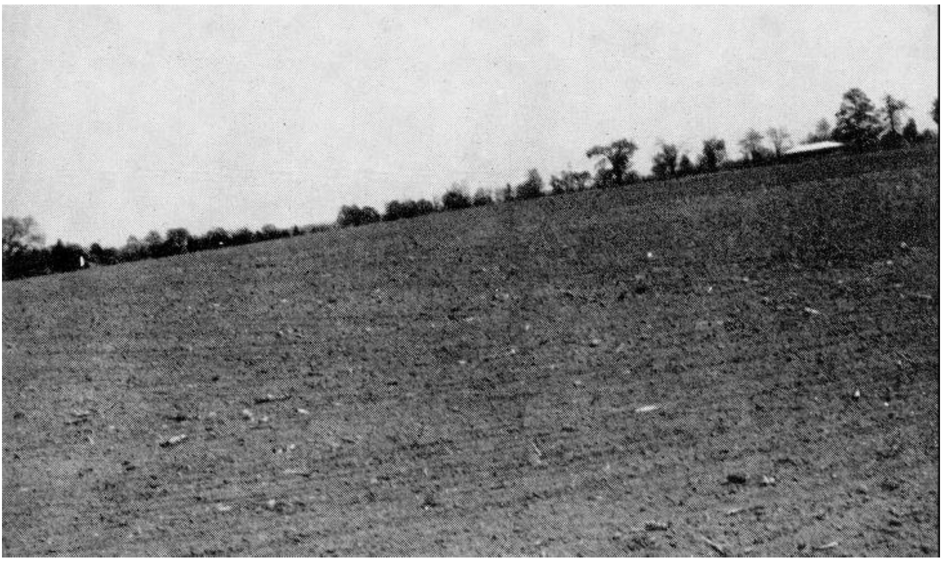
information is lacking, soils are placed in capability classes and subclasses by interpretation of soil characteristics in accord with experience gained on similar soils elsewhere.

9. The level of generalization of the soil capability classification is indicated by the scale on which the information is published.

Soil Capability Subclasses

Subclasses are divisions within classes that have the same kind of dominant limitations for agricultural use as a result of soil and climate. Twelve different kinds of limitations have been recognized to date at the subclass level. They are:

Climate (C)
Structure and permeability (D)
Erosion (E)
Nutrient deficiencies (F)
Overflow (I)
Soil moisture deficiencies (M)
Salinity (N)
Stoniness (P)
Lack of depth of soil (R)
Adverse inherent soil characteristics (S)
Topography, slope or pattern (T)
Excess water rather than due to overflow (W)



Class I Land
***Use** — intensive cultivation*

The soils of the county can be grouped into classes as follows:

Class 1

Class 1 soils have no significant limitations that restrict their use for crops. The topography of these soils ranges from level to gently sloping. They are deep, well to imperfectly drained, have good water holding capacity, and are reasonably well supplied with plant nutrients. They are easily maintained in good tilth, and damage from erosion is slight. Their productivity level is high for a wide range of field crops.

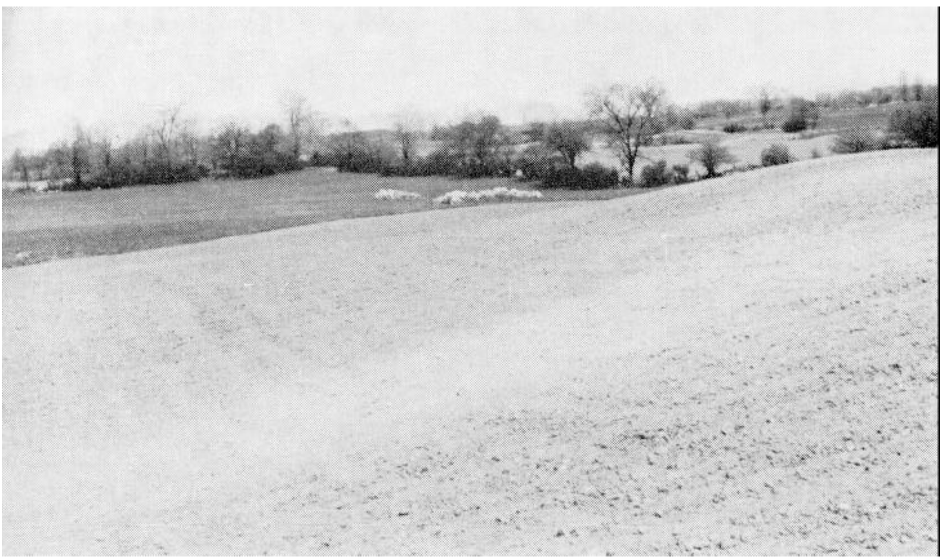
Class 1 soils in Leeds County are —

Grenville series —	0-5 % slopes
Tennyson series —	0-5 % slopes
Matilda series —	
Seeleys Bay series —	0-5 % slopes
Battersea series —	
Picadilly series —	
Carp clay loam —	
Gananoque clay —	0-5 % slopes

Class 2

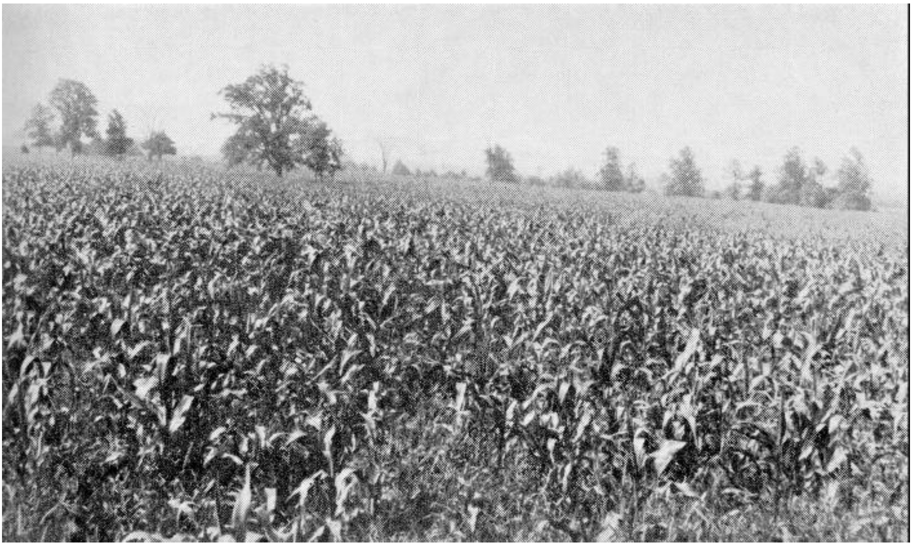
These soils have moderate limitations that reduce the choice of crops or require moderate conservation practices. They have good water holding capacity, and, if not of high natural fertility, are highly responsive to fertilizer amendments.

Limitations result from one of the following characteristics: moderate erosion, stoniness, structure or permeability, low fertility or wetness.



Class 2 Land
Subclass 2e

Light areas indicate the parts of the slope where the surface soil has been removed by erosion
Use — minimum intertilled crops, longer rotations under sod



Class 2 Land
Subclass 2 w

Use — intensive cultivation
Requirements - drainage improvement

Class 3 Land
Subclass 3r

Rock knob outcrop surrounded by clay sediments

Subclass 2D

Lansdowne clay

High clay content retards the downward movement of water. Some artificial drainage is necessary to increase the productivity of this soil.

Subclass 2T

Grenville series	—	6–9% slopes
Gananoque series	—	6–9% slopes
Seeleys Bay series	—	6–9% slopes
Tennyson series	—	6–9% slopes

Strip cropping or contour plowing may be required on long slopes. Those soils with short slopes in this class require longer rotations under sod.

Subclass 2W

Carp series
Hinchinbrooke series

These soils require drainage improvement.

Class 3

Soils in this class have moderately severe limitations that reduce the choice of crops and crop yields. They affect one or more of the following farm practices: the timing and ease of cultivation, planting, and harvesting.

The limitations include low fertility, low permeability, erosion, wetness, stoniness, and depth to bedrock.

Subclass$^{\mathbf{W}}_{\mathbf{D}}$

Napanee clay
North Gower clay loam

These are late wet soils and require improved drainage.

Subclass 3P

Tennyson series	—	stoniness 3
Grenville series	—	stoniness 3

Soils in this subclass require frequent stone removal.

S
Subclass 3M
P

Kars series — 0–6% slopes
Uplands fine sandy loam

These soils have low fertility and are droughty.

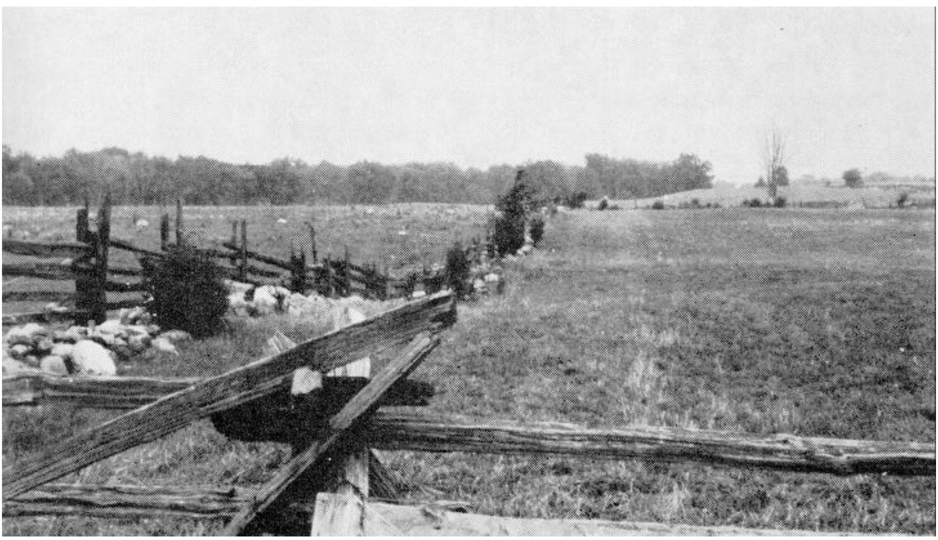
Subclass 3R

Napanee clay — rock 1 and 2
Frequent outcrops of bedrock interfere with cultivation.

Class 3 Land

Subclass 3^{w}_{d}

Use — general farm crops if drainage is improved



Class 4 Land
Subclass 4p

Use — improved pasture, hay, spring grain
Requirements — continual stone removal

Class 4

The soils in this class have limitations that may either restrict the choice of crops which may be grown, or they may have low yield potential.

The limitations include one or more of the following: low fertility, low moisture-holding capacity, poor structure or permeability, wetness, stoniness, rockiness, depth to bedrock.

Subclass 4R

Grenville series — shallow phase
Tennyson series — shallow phase
Matilda series — shallow phase
Carp series — shallow phase
Hinchinbrooke series — shallow phase
Napanee series — rocky 3

The shallow phases are droughty in July and August. The risk of crop failure is moderately high.

Subclass 4^{P}_{W}

Lyons loam

This poorly-drained till soil is often bouldery and thus difficult to drain.

Subclass 4$\overset{S}{\underset{P}{M}}$

Monteagle series — 0–9% slopes plus 3 stoniness
Tweed series — 0–9% slopes plus 3 stoniness
White Lake series — 0–9% slopes plus 3 stoniness
Kars series — 0–9% slopes plus 3 stoniness

These soil series tend to be droughty, stony, and low in fertility.

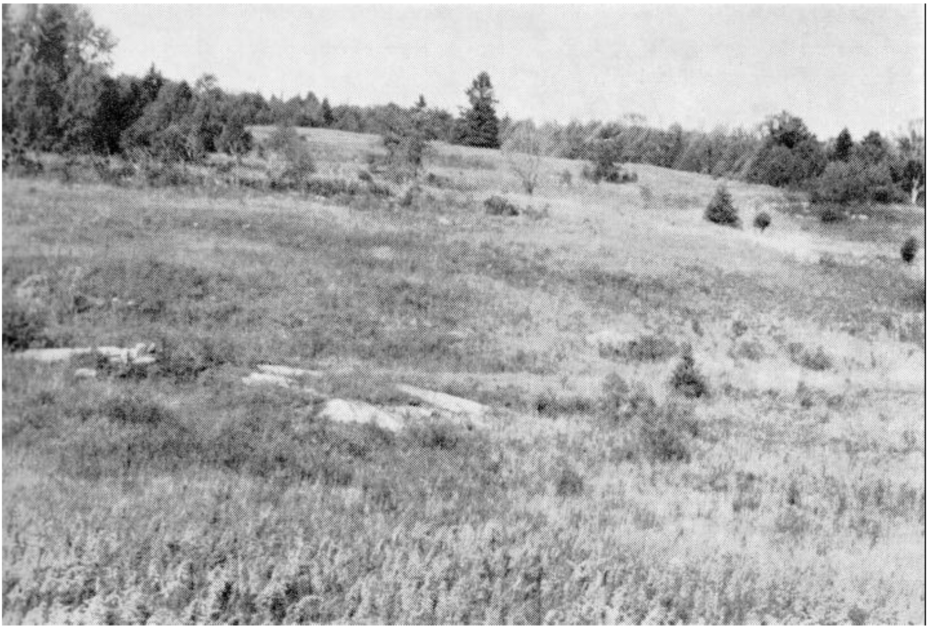
Subclass 4^{S}_{M}

Uplands sand
Rubicon series

The Uplands and Rubicon soils are low in fertility and droughty.

Class 5

Soils in this class are restricted to producing only perennial forage crops. They have such soil or external characteristics as impede their use for the production of annual field crops. They are responsive to improvement practices.



Class 5 Land
Subclass 5r

Use — improved pasture

Subclass $5\begin{smallmatrix}S\\T\\P\end{smallmatrix}$

Monteagle series	—	10- 15 % slopes and stoniness 3
Tweed series		1 0-l 5 % slopes and stoniness 3
White Lake series	—	1 0-l 5 % slopes and stoniness 3
Kars series	—	I0- 15 % slopes and stoniness 3

Slope and stoniness restrict the use of the series in this subclass.

Subclass S^{W}_{R}

Lyons series	—	shallow phases
North Cower series	—	shallow phases
Hinchinbrooke series	—	shallow phases

These soils are poorly drained and also shallow, limiting their use to improved pasture.

Subclass 5^{W}_{S}

Allendale series

This poorly-drained soil is also low in fertility.

St. Samuel series

This is a poorly-drained soil with low inherent fertility. This series, if adequately drained, can be used for specialized crops such as small fruits and vegetables.

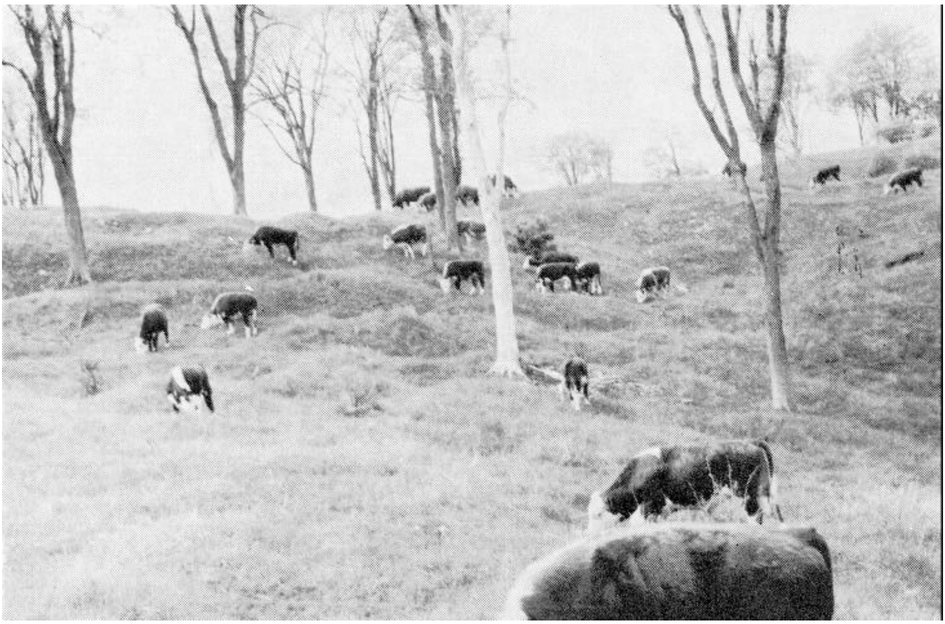
Subclass 5^{W}_{R}

Napanee clay — r4

The use of farm machinery is impracticable. This soil can be used for improved pasture.

Class 6

Soils in this class are capable only of producing perennial forage plants and improvement practices are not feasible.



Subclass $6\begin{smallmatrix}S\\M\\T\end{smallmatrix}$

White Lake series — rock complex
Monteagle series — rock complex
Tweed series — rock complex

These soil-rock complexes can be used for rough unimproved pasture. The carrying capacity is low.

Class 7

Soils in this class have limitations so severe that they are not capable of use for arable agriculture or permanent pasture. They may or may not have a high capability for trees, wild fruit, wildlife or recreation.

Marsh
Rockland
Rock outcrop

Class 7 Land

Subclass 7 r

Use— recreation, wildlife, forest products

TABLE 5

SOIL RATINGS FOR PRINCIPAL CROPS

SOIL TYPE	Ratings For							
	Hay				Spring grain	Corn		Other
	Alfalfa	Clover	Trefoil	Timothy	Oats & Barley	Ensilage	Grain	Pasture
Allendale sandy loam	P	F-P	F-P	F-P	P	P	P	F
Battersea fine sandy loam	F	G	G	G	G	G	F	G
Battersea silt loam	F	G	G	G	G	G	F	G
Carp clay loam	F	G	G	G	G	G	F	G
Carp clay loam—shallow phase	P	F-P	F-P	F	F-P	P	P	F
Farmington loam	P	P	P	F-P	P	P	P	F-P
Farmington sandy loam	P	P	P	P	P	P	P	P
Gananoque clay	G-F	G	G	G	G	G	G-F	G
Granby sandy loam	P	P	F-P	F	P	P	P	F-P
Grenville loam	G	G	G	G	G	G	G-F	G
Grenville loam—shallow phase	F	F-P	P	F-P	F-P	P	P	F
Grenville sandy loam	G-F	G-F	G-F	G	G	G	G-F	G
Hinchinbrooke loam	P	G-F	G-F	G-F	F	F	P	G-F
Hinchinbrooke loam—shallow phase	P	P	P	F-P	P	P	P	F-P
Hinchinbrooke fine sandy loam	P	G-F	G-F	G-F	F	F	P	G-F
Hinchinbrooke silt loam	P	G-F	G-F	G-F	F	G-F	P	G-F
Kars gravelly loam	F	F-P	F-P	F-P	P	P	P	F-P
Lansdowne clay	F-P	G	G	G	G-F	G-F	F	G-F
Lyons loam	P	F-P	F-P	F-P	F-P	F-P	P	F
Lyons loam—shallow phase	P	P	P	P	P	P	P	F-P
Matilda loam	F	G	G	G	G-F	G	F	G
Matilda loam—shallow phase	P	P	P	F-P	F-P	F-P	P	F

G—Good F—Fair P—Poor
G-F—Good to fair F-P—Fair to Poor

TABLE 5 (Continued)

SOIL TYPE	Ratings For							
	Hay				Spring grain	Corn		Other
	Alfalfa	Clover	Trefoil	Timothy	Oats & Barley	Ensilage	Grain	Pasture
Monteagle sandy loam—Rock complex	P	P	P	F	F	F-P	P	F-P
Napanee clay	P	G-F	G-F	G-F	G-F	F	P	G-F
Napanee clay—shallow phase	P	P	P	F-P	F-P	P	P	F
North Gower clay loam	P	G-F	G-F	G-F	F	F	P	G-F
North Gower clay loam—shallow phase	P	P	P	F-P	P	P	P	F
Picadilly loam	F-P	G-F	G	G	G-F	G-F	F-P	G
Picadilly fine sandy loam	F-P	G-F	G	G	G-F	G-F	F	G
Picadilly silt loam	F-P	G-F	G	G	G-F	G-F	F	G
Rockland	P	P	P	P	P	P	P	P
Rock outcrop	P	P	P	P	P	P	P	P
Rubicon fine sandy loam	P	P	P	G-F	F-P	P	P	F
Rubicon sandy loam	P	P	P	F	F-P	P	P	F
Seeleys Bay silt loam	G	G	G	G	G	G	F	G
St. Samuel sandy loam	P	P	P	F-P	P	P	P	F-P
St. Samuel sandy loam—shallow phase	P	P	P	P	P	P	P	P
Tennyson sandy loam	G-F	G-F	G-F	G-F	G-F	G-F	F-P	G
Tennyson sandy loam—shallow phase	P	P	P	F-P	F-P	P	P	F
Tweed sandy loam	F	F	F	F	F	F-P	P	G-F
Uplands fine sandy loam	P	P	P	F	F-P	F-P	P	F-P
Uplands sand	P	P	P	F-P	P	P	P	F-P
Uplands sand—shallow phase	P	P	P	P	P	P	P	P
White Lake gravelly sandy loam	F	F	F-P	F	F-P	P	P	F
White Lake gravelly sandy loam—shallow phase	P	P	P	P	P	P	P	F-P

G—Good F—Fair P—Poor
G-F—Good to fair F-P—Fair to Poor

TAXONOMIC CLASSIFICATION

The taxonomic classification for Canadian soils was revised in 1968 by the National Soil Survey committee. The soil map for Leeds County was in press at the time and the old classification is found in the map legend. The same classification has been used to classify the soils in this report.

The changes in classification which will apply to soils in Leeds County are briefly outlined in this appendix.

Under the new scheme the Podzolic Order has been split into two Orders. The Podzols and Degraded Acid Brown Wooded soils remain in the Podzolic Order. A new name, Luvisolic Order, has been established for those soils in which clay eluviation and illuviation are major genetic processes.

An outline of the classification follows with the old system indicated in brackets.

OUTLINE OF REVISED SOIL CLASSIFICATION FOR THE PODZOLIC AND BRUNISOLIC ORDERS

	Order		Great Group		Sub Group
4.0	Podzolic (Podzolic)	4.2	Ferro Humic Podzol (Podzol)	4.21	Ortho Ferro-Humic Podzol (Orthic Podzol)
				4.23	Minimal Ferro-Humic Podzol (Degraded Acid Brown Wooded)
3.0	Luvisolic (Podzolic)	3.1	Gray Brown Luvisol (Gray Brown Podzolic)	3.11	Orthic Gray Brown Luvisol (Orthic Gray Brown Podzolic)
				3.12	Brunisolic Gray Brown Luvisol (Brunisolic Gray Brown Podzolic)
				3.13	Bisequa Gray Brown Luvisol (Bisequa Gray Brown Podzolic)
				3.1-/8	Gleyed Gray Brown Luvisol (Gleyed Gray Brown Podzolic)
		3.2	Gray Luvisol (Gray Wooded)	3.21	Orthic Gray Luvisol (Orthic Gray Wooded)
				3.21/8	Gleyed Gray Luvisol (Gleyed Gray Wooded)
5.0	Brunisolic	5.1	Melanic Brunisol (Brown Forest)	5.11	Orthic Melanic Brunisol (Orthic Brown Forest)
				5.12	Degraded Melanic Brunisol (Degraded Brown Forest)
				5.1-/8	Gleyed Melanic Brunisol (Gleyed Brown Forest)

TAXONOMIC CLASSIFICATION, PROFILE DESCRIPTIONS, AND ANALYTICAL DATA

Horizon	Depth Inches	Description
		Allendale Series
	Classification:	Order — Gleysolic Great Group —Gleysol Subgroup — Orthic Humic Gleysol Family — Kenabeek
Ap	0–6	Very dark brown (10YR2/2) dry; sandy loam; fine granular structure; friable; pH 6.4.

Horizon	Depth Inches	Description
Bmg1	6–9	Gray (10YR6/1) dry; sand; single grain structure; loose consistency; mottled; pH 6.4.
Bmg2	9–25	Gray (10YR6/1) dry; sand; single grain structure; loose consistency; strongly mottled; pH 6.5.
Cg	25–32	Gray (10YR6/1) dry; sand; single grain structure; loose consistency; pH 6.8.
IIC		Gray (10YR6/1 dry; amorphous; plastic consistency; pH 7.0.

Battersea Series

Classification: Order — Podzolic
Great Soil Group — Gray-Brown Podzolic
Soil Group — Gleyed Gray-Brown Podzolic
Family — Tuscola

Ap	0–6	Very dark gray (10YR3/1) silt loam; small subangular blocky and granular structure; friable consistency; pH 6.4.
Ae	6–10	Gray-brown (10YR5/2) silt loam; mottled; small subangular blocky structure; friable consistency; pH 6.5.
Bt	10–15	Dark yellowish brown (10YR4/4) silty clay loam; small to medium angular blocky structure; firm consistency; some yellowish mottles; pH 7.0.
BC	15–24	Dark gray-brown (10YR4/2) silty clay loam; medium angular blocky aggregates; hard consistency; pH 7.2.
Ck	24+	Gray (10YR5/1) silty clay loam; medium angular blocky aggregates; calcareous; pH 7.8.

Carp Series

Classification: Order — Podzolic
Great Group — Gray-Brown Podzolic
Soil Group — Gleyed Gray-Brown Podzolic
Family — Perth

Ap	0–6	Very dark grayish brown (10YR3/2) dry; silty clay loam; medium granular structure; friable consistency; stone-free; pH 7.0.
Aeg	6–9	Pale brown (10YR6/3) dry; with yellowish brown mottling (10YR5/4), silty clay loam, fine crumb and granular structure; friable pH 7.1.

Horizon	Depth Inches	Description
Btg	9–16	Brown (10YR5/3) dry; clay loam; mottled; small angular blocky structure; friable when moist, hard when dry; stone-free; pH 7.2.
Ck	16″	Gray (10YR5/1) dry; silty clay loam; low contrast mottling; small angular blocky structure; friable when moist, firm when dry; stone-free. pH 7.4 plus.

Farmington Series

Classification: Order — Brunisolic
Great Group — Brown Forest
Subgroup — Orthic Brown Forest
Family — Farmington

Ah	0–3	Dark gray (10YR4/4) loam; crumb structure; friable; pH 6.8.
Bml	3–8	Yellowish brown (10YR5/3) loam; subangular blocky structure; friable; pH 6.8.
Bm2	8–10	Brown (7.5YR5/4) loam; subangular blocky structure; friable; pH 7.0.
IIC	10+	Limestone bedrock.

Granby Series

Classification: Order — Gleysolic
Great Group — Humic Gleysol
Subgroup — Orthic Humic Gleysol
Family — Granby

Ah	0–9	Very dark brown (10YR2/2) sandy loam; crumb structure; very friable consistency; pH 7.3.
Bmg	9–17	Gray (10YR6/1) sand; mottled; single grain structure; loose consistency; pH 7.4.
Bmk	17–27	Light brownish gray (10YR6/2) sand; mottled; single grain structure; free carbonates; pH 7.6.
Ck		Gray sand; calcareous; pH 8.2.

Gananoque Series

Classification: Order — Podzolic
Great Soil Group — Gray Wooded
Soil Group — Orthic Gray Wooded
Family — Haileybury

L	1–0	Undecomposed twigs, leaves, etc.
Ah	0–2	Light brownish gray (10YR6/2) clay; medium subangular blocky structure, friable.

Horizon	Depth Inches	Description
Ae	2–6	Light gray (10YR7/2) clay; medium subangular blocky with some indications of platy structure; firm consistency.
BA	6–12	Light gray (10YR7/2) coating over dark brown (10YR4/2) clay, medium blocky structure; hard consistency.
Bt	12–22	Very dark gray-brown (10YR3/2) clay; strong medium blocky structure.
BC	22–28	Gray-brown (10YR5/2) clay; coarse blocky structure tending to columnar; hard consistency.
CK1	28–36	Gray (10YR5/1) clay; fine to medium blocky structure; hard consistency; calcareous.
Cca	36–48	Gray (10YR5/1) clay; carbonate enriched.
CK2	48+	Gray-brown (10YR5/2) clay; calcareous.

TABLE 6

CHEMICAL AND BULK DENSITY DATA

Horizon	Depth Inches	Dithionite Fe %	Oxalate Fe %	Carbonate Equivalent $CaCO_3$ %	Cation Exchange Capacity me/100 gm	Bulk Density gm/cc	Organic Matter %
Ah	0–2	1.25	.74	.65	24.8	1.17	4.6
Ae	2–6	1.18	.56	.21	16.2	1.34	1.45
BA	6–12	1.56	.64	.63	20.2	1.39	0.46
Bt	12–22	.58	.54	.63	26.0	1.32	0.32
BC	22–28	.60	.30	.83	16.8	1.48	0.18
CK_1	28–36	.64	.22	12.6	15.8	1.47	0.10
Cca	36–48	.56	.26	16.3	12.4	—	—
CK_2	48+	.78	.32	12.6	15.6	1.38	0.10

Grenville Series

Classification: Order — Podzolic
Great Group — Brown Forest
Soil Group — Orthic Brown Forest
Family — Grenville

Ap	0–6	Very dark gray-brown (10YR3/2) (moist) sandy loam; medium crumb structure; very friable consistency; a few stones.

Horizon	Depth Inches	Description
B	6–16	Dark yellowish brown (10YR4/4) (moist) loam; yellowish brown (10YR5/6) dry; crumb and very weak subangular blocky structure; very friable consistency; a few stones.
CK	16+	Dark gray-brown (10YR4/2) (moist); moderately stony; calcareous.

TABLE 7

GRENVILLE SANDY LOAM

Horizon	Particle Size Distribution Sand %	Silt %	Clay ($<2\mu$) %	pH	O.M. %
Ap	53	29	18	6.0	5.2
B1	53	29	18	7.2	3.7
B2	59	23	18	7.4	1.3
C	50	32	18	7.9	0.2

Hinchinbrooke Series

Classification: Order — Gleysolic
Great Soil Group — Humic Gleysol
Soil Group — Orthic Humic Gleysol
Family — Osgoode

Ae	0–8	Dark gray-brown (10YR3/1) loam; subangular blocky structure; friable consistency; pH 6.8.
Aeg	8–12	Gray (10YR5/1) sandy loam; mottled; subangular blocky structure; very friable; pH 6.5.
Bmg1	12–22	Gray-brown (10YR4/2) fine sandy loam; mottled; crumb structure; very friable; pH 6.6.
Bmg2	22–28	Gray (10YR5/1) silt loam; severely mottled; subangular blocky structure; friable; pH 6.8.
CK	–	Gray-brown (10YR5/2) silt loam; calcareous; pH 7.8.

TABLE 8

HINCHINBROOKE SILT LOAM

Horizon	pH	Particle Size Distribution Sand %	Silt %	Clay ($<2\mu$) %	O.M. %
Ap	6.6	8.7	67.9	23.4	4.61
Bmg	7.1	11.7	66.1	22.2	0.47
C	7.4	10.6	56.9	32.5	0.27

Horizon	Depth Inches	Description

Kars Series

	Classification:	Order — Podzolic Great Group — Gray-Brown Podzolic Subgroup — Brunisolic Gray-Brown Podzolic Family — Burford
Ap	0–4	Dark grayish brown (10YR4/2) gravelly sandy loam; fine crumb structure; very friable consistency; pH 6.7.
Ae1	4–7	Yellowish brown (10YR5/6) gravelly sandy loam; fine granular structure; very friable consistency; pH 6.6.
Ae2	7–12	Pale brown (10YR6/3) gravelly sandy loam; fine granular structure; very friable consistency; pH 6.6.
Bt	12–17	Brown (10YR6/3) gravelly loam; fine to medium subangular blocky structure; very friable consistency; pH 7.0.
CK	–	Coarse sand and limestone gravel with Precambrian gravel inclusions; pH 8.0.

Lansdowne Series

	Classification:	Order — Podzolic Great Soil Group — Gray Wooded Soil Group — Gleyed Gray Wooded Family — Renfrew
Ap	0–6	Light gray (10YR7/2) dry; clay; hard angular blocky structure.
Ae	6–9	White (10YR8/1) dry; clay; hard thick platy aggregates; mottling at junction with B.
Btg	9–17	Pale brown (10YR6/3) dry; clay; small to medium blocky aggregates; more readily crushed than those above; mottled.
BC	17–48	Very pale brown (10YR7/3) dry; clay; medium blocky aggregates; firm consistency.
CK		Light gray (10YR7/2) dry; clay; medium blocky aggregates; hard concretions; free carbonates.

TABLE 9

LANSDOWNE CLAY

Soil Horizons	Depth	pH	O.M. %	Clay ($<2\mu$) %
Ap	0–6″	5.2	5.6	52
Ae	6–9″	5.2	0.8	73
Btg	9–17″	7.1	0.3	79
BC	17–48″	—	—	—
C	48″+	7.9	0.2	77

Horizon	Depth Inches	Description

Lyons Series

	Classification:	Order — Gleysol Great Group — Humic Gleysol Subgroup — Orthic Humic Gleysol Family — Lyons
Ap	0–8	Black (10YR2/1) moist; loam; granular structure; very friable consistency; few stones; pH 7.2.
Bmg	8–13	Gray (10YR5/1) moist; loam; mottled, medium subangular blocky structure; friable; pH 7.2.
Bmgk	13–18	Gray (10YR5/1) moist; loam; mottled; coarse subangular blocky structure; free carbonates present; pH 7.4.
Ck		Gray (10YR5/1) moist; stony, calcareous; pH 8.2.

Matilda Series

	Classification:	Order — Podzolic Great Group — Brown Forest Soil Group — Gleyed Brown Forest Family — Matilda
Ap	0–6	Very dark gray-brown (10YR3/2) moist; loam; small to medium crumb and granular structure; friable consistency; few stones; pH 7.2.
Bm	6–14	Brown (10YR5/3) moist; loam; slightly mottled weak medium subangular blocky and granular structure; friable; some stones; pH 7.2.
CK	14+	Dark gray-brown (10YR4/2) moist; moderately stony; calcareous; pH 7.8.

Monteagle Series

	Classification:	Order — Podzolic Great Group — Podzol Subgroup — Orthic Podzol Family — Wabi
L	2–1	Leaf layer.
F	1–0	Organic layer containing partially decomposed leaves.
Ae	0–3	Light gray (10YR6/1) dry; sand; single grain structure; loose consistency; pH 4.6.
Bfh1	3–12	Dark reddish brown (5YR3/4) dry; sandy loam; granular structure; friable pH 4.8.
Bfh2	12–22	Yellowish brown (10YR5/6) dry; sandy loam; weak granular structure; friable; stony; pH 5.3.
C		Light olive-brown (2.5YR5/4) dry; sandy loam; very stony; pH 5.4.

TABLE 10

MONTEAGLE SANDY LOAM

Horizons	Sand %	Silt %	Clay (<2μ) %	pH	O.C. %	M.E./100 gm soil Ca	Mg	K	H+	CEC	% Base Sat.
F	—	—	—	4.5	—	—	—	—	—	—	—
Ae	63	26	11	4.75	1.17	1.0	0.08	0.06	4	4.9	26
Bfh1	64	21	14	4.75	2.40	0.6	0.48	0.04	11	12.0	9
Bfh2	81	8	11	5.3	0.69	0.3	0.24	0.02	4	5.0	11
C	70	19	11	5.4	0.69	0.25	0.16	0.07	2	2.0	20

Horizon	Depth Inches	Description

Napanee Series

Classification: Order — Gleysolic
Great Soil Group — Humic Gleysol
Soil Group — Orthic Humic Gleysol
Family — St. Rosalie

Ap	0–6	Dark gray-brown (10YR4/2) moist; clay; mottled; angular blocky structure; hard consistency; pH 5.8.
Bmg1	6–16	Very dark gray (10YR3/1) moist; clay; mottled; angular blocky structure; hard consistency; pH 6.2.
Bmg2	16–25	Dark gray (10YR4/1) moist; clay; mottled; angular blocky structure; hard consistency; pH 7.0.
CK		Gray (10YR5/1) moist; clay; mottled; calcareous; stone-free; pH 7.9.

TABLE 11

NAPANEE CLAY

Horizons	Particle Size Distribution Sand %	Silt %	Clay (<2μ) %	pH	Dithionite Fe %	Carbonates %
Ap	20	27	53	5.6	2.2	0.4
Bmg1	17	35	48	6.0	2.0	0.4
Bmg2	18	40	42	6.8	1.9	0.4
CK	15	24	61	7.4	1.4	4.5

North Gower Series

Classification: Order — Gleysolic
Great Group — Humic Gleysol
Soil Group — Orthic Humic Gleysol
Family — Brookston

Ap	0–8	Very dark gray-brown (10YR3/2) moist; clay loam; small subangular blocky structure; friable consistency when moist; stone-free; pH 7.1.

Horizon	Depth Inches	Description
Bmg1	8–15	Gray-brown (10YR5/2) moist; clay loam; low contrast mottling; small subangular blocky structure; friable when moist; stone-free; pH 7.2.
Bmg2	15–24	Gray-brown (10YR5/2) moist; clay; low contrast mottling; small angular blocky structure; friable when moist; stone-free; pH 7.3.
CK	24+	Gray (10YR5/1) moist; clay; low contrast mottling; friable when moist; stone-free; pH 7.4.

Osgoode Series

Classification: Order — Gleysolic
Great Group — Humic Gleysol
Subgroup — Orthic Humic Gleysol
Family — Bainesville

Ap	0–6	Very dark grayish brown (10YR3/2) loam; fine crumb and granular structure; friable consistency; pH 6.8.
Bmg1	7–14	Light brownish gray (10YR6/2) loam; coarse granular structure; friable consistency; stone-free; pH 6.6.
Bmg2	14–26	Light brownish gray (10YR6/2) loam; medium subangular blocky structure; friable consistency; strongly mottled; pH 7.0.
Ck	26+	Gray (10YR6/1) loam and silt loam; calcareous; pH 7.4.

Picadilly Series

Classification: Order — Podzolic
Great Group — Gray-Brown Podzolic
Soil Group — Gleyed Gray-Brown Podzolic
Family — Tuscola

Ap	0–4	Gray (10YR5/1) dry; loam; subangular blocky structure; friable consistency; pH 6.2.
Aeg	4–10	Light gray (10YR7/2) dry; silt loam; mottled; platy structure; friable; pH 6.2.
Btg	10–16	Dark gray-brown (10YR4/2) moist; silty clay loam; mottled; subangular, blocky structure; friable; pH 6.8.
CK		Dark gray (10YR4/1) moist; silt loam; mottled; stone-free; pH 8.0.

Horizon	Depth Inches	Description

Seeleys Bay Series

Classification: Order — Podzolic
Great Soil Group — Gray-Brown Podzolic
Soil Group — Orthic Gray-Brown Podzolic
Family — Huron

Horizon	Depth Inches	Description
Ap	0–6	Very dark gray (10YR3/1) dry; silt loam; small subangular blocky and granular structure; friable consistency; pH 6.5.
Ae	6–10	Pale brown (10YR6/3) dry; silt loam; small to medium subangular blocky structure; friable consistency; pH 6.4.
Bt	10–18	Dark yellowish brown (10YR4/4) dry; silty clay; medium angular blocky aggregates; firm consistency; pH 6.8.
BC	18–24	Dark gray (10YR4/1) dry; silty clay loam; medium angular blocky aggregates; hard when dry; pH 7.0.
CK	24+	Gray (10YR5/1) dry; silty clay loam; medium angular blocky aggregates; calcareous; pH 8.0.

TABLE 12

SEELEYS BAY SILTY CLAY

Horizon	pH	Particle Size Distribution			O.M.
		Sand %	Silt %	Clay ($<2\mu$) %	%
Ap	6.0	10.5	45.8	43.7	3.16
Ae	5.8	2.1	63.3	34.6	0.97
Bt	6.4	1.5	44.1	54.4	0.40
C	7.4	4.3	54.6	41.1	0.24

St. Samuel Series

Classification: Order — Gleysolic
Great Group — Gleysol
Subgroup — Humic Gleysol
Family — Kenabeek

Horizon	Depth Inches	Description
Ap	0–6	Very dark gray (10YR3/1) fine sand; fine granular structure; very friable consistency; pH 5.4.
Aejg	6–14	Gray (10YR5/1) fine sand; weak granular structure; loose consistency; some faint mottling; pH 5.4.
Bfjg	14–18	Gray (10YR6/1) fine sand; many coarse prominent dark reddish brown mottles; granular structure; loose consistency; pH 5.8.
Cg	18	Light olive-gray (5Y6/2) fine sand; single grain structure; mottled; pH 6.0.

Horizon	Depth Inches	Description

Tennyson Series

Classification: Order — Podzolic
Great Group — Gray-Brown Podzolic
Subgroup — Brunisolic, Gray-Brown Podzolic
Family — Vasey

Ap	0–6	Dark brown (10YR3/3) dry; sandy loam; crumb and granular structure; friable; moderately stony; pH 6.5.
Bf	6–9	Dark yellowish brown (10YR4/4) dry; sandy loam; crumb structure; friable; moderately stony; pH 6.4.
Ae	9–16	Yellowish brown (10YR4/4) dry; sandy loam; crumb structure; friable; moderately stony; pH 6.4.
Bt	16–22	Dark brown (7.5YR3/2) dry; loam; medium subangular blocky aggregates; friable; moderately stony; pH 7.0.
BC	22–36	Brown (7.5YR4/4) dry; sandy loam; weak subangular blocky structure; friable consistency; stony; pH 7.2.
CK	36+	Gray-brown (2.5YR5/2) dry; sandy loam; slightly calcareous; stony; pH 7.4.

TABLE 13

TENNYSON SANDY LOAM

Horizon	Particle Size Distribution			pH	O.M.	M.E./100 gm Soil		
	Sand %	Silt %	Clay ($<2\mu$) %		O.M. %	Ca	Mg	C.E.C.
Ap	56	26	18	5.9	3.6	0.8	1.8	—
Bf	60	22	18	5.6	0.9	0.5	1.2	9.0
Ae	57	24	19	5.8	0.4	0.3	0.6	11.0
Bt	55	21	24	6.0	0.4	0.7	2.2	23.0
BC	55	22	23	6.6	0.3	0.6	1.6	14.0

Tweed Series

Classification: Order — Brunisolic
Great Soil Group — Brown Forest
Soil Group —Orthic Brown Forest
Family — Tweed

Ah	0–4	Very dark gray-brown (10YR3/2) dry; sandy loam; crumb structure; friable consistency; pH 6.8.
B	4–12	Dark reddish brown (5YR3/4) dry; sandy loam; granular structure; friable consistency; pH 7.2.
D	–	Crystalline limestone; the surface usually broken and weathered.

Horizon	Depth Inches	Description
		Uplands Series
	Classification:	Order — Podzolic Great Group — Podzol Subgroup — Orthic Podzol Family — Wendigo
L	2–1	Undecomposed leaf mat.
F	1–0	Partially decomposed organic material.
Ae	0–2	White (10YR8/1) dry; sand; single grain structure; loose consistency; pH 4.7.
Bf1	2–6	Very dark grayish brown (10YR3/2) dry; sandy loam; granular structure; friable; pH 5.0.
Bf2	6–11	Dark yellowish brown (10YR4/4) dry; sandy loam; granular structure; very friable; pH 5.4.
BC	11–17	Yellowish brown (10YR5/6) dry; sand; single grain structure; loose consistency; pH 5.6.
C	17+	Pale brown (10YR6/3) dry; sand; pH 5.6.
		White Lake Series
	Classification:	Order — Podzolic Great Group — Podzol Subgroup — Bisequa Podzol Family — Tioga
L, F	2–0	Loose leaf mat mostly coniferous.
Ae	0–2	Light gray (10YR6/1) dry; sand; loose; single grain structure; pH 5.0.
Bf	2–10	Brown (10YR5/3) dry; sandy loam; weak granular structure; numerous small pebbles; pH 5.8.
Ae	8–21	Pale brown (10YR6/3) dry; loamy sand; granular to single grain structure; some large cobbles; pH 6.4.
Bt	21–24	Very dark brown (10YR2/2) dry; gravelly sandy loam; fine subangular blocky structure; very friable; very stony; pH 7.2.
IIC		Multicolored coarse, cobbly gravel; calcareous.

GLOSSARY OF HORIZON DESIGNATIONS

Organic Horizons

L — an organic layer in which structures are definable.
F — an organic layer in which structures are definable with difficulty.
H — an organic layer in which structures are undefinable.

Master Mineral Horizons

A — Horizons formed at or near the surface in the zone of maximum removal of materials in suspension or solution and/or maximum accumulation of organic matter. Includes:

1. horizons in which organic matter has accumulated (Ah) or which have been cultivated (Ap)
2. horizons that have been eluviated of clay, iron, aluminum, and/or organic matter (Ae)
3. horizons transitional to the underlying layer (AB) (AC).

B — A mineral horizon or horizons characterized by one or more of the following:

1. an enrichment of clay (Bt), iron (Bf), or organic matter (Bh)
2. a horizon altered by oxidation to give a change in color and/or structure only (Bm)
3. horizons transitional to the underlying layer (BC).

C — A mineral horizon comparatively unaffected by the pedogenetic processes in A and B.

1. Material of similar lithologic composition to that of the solum (C).
2. Material of different lithologic composition to that of the solum (IIC).