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ORGANIC SOIL STUDY OF ALEXANDER L.G.D.

1975

AGRICULTURAL CAPABILITY CLASSIFICATION AND DEVELOPMENT DIFFICULTY RATINGS FOR THE ORGANIC SOILS OF THE L.G.D. OF ALEXANDER

by

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I. GENERAL DESCRIPTION OF THE L.G.D. OF ALEXANDER

1. Location

Starting from the bottom of Township 17 and working northward, the L.G.D. is bounded by Lake Winnipeg to the west, Traverse Bay to the north and the Winnipeg River to the east.

2. Relief and Drainage

The L.G.D. of Alexander is drained by two main creeks, the Catfish Creek in the central lowland section and Jackfish Creek in the western morainic section. Both these creeks empty into the Winnipeg River system. Many ditches have been put in and connected to Catfish Creek, to drain much of the lowland fen area. A contour map of the area is found in Figure 1.

3. Climate

The L.G.D. of Alexander occurs in an area designated by Koppen as Dfb in which the summer temperatures are higher and winter temperatures are lower and the annual range much greater than the world average for the latitude (Koppen, 1936). The area is subhumid with a definite summer maximum of precipitation. The mean annual air temperature within the region is about 35°F (Table 1). Annual average precipitation ranges from 19.4 at Great Falls to 22.6 at Pine Falls. The average number of frost free days[1] for the area is 127 with 154 days being the longest period and 100 being the shortest.

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[1] Data obtained from "Climatic Summaries" for Selected Meteorological Stations in Canada, Vol. 111, Frost Data, Meteorological Division, Canada Dept. of Transport, Toronto, Ontario. 1956. p. 36.

Table I. Mean Monthly Temperatures, Total Precipitation, and Number of Days with Frost Recorded at Great Falls and Pine Falls[1]

	Great Falls Lat. N 50° 28', Long. W 96° 00' Elev. 816 ft. a.s.l.					Pine Falls Lat. N 50° 34', Long. W 96° 13' Elev. 725 ft. a.s.l.				
	Total pptn inches	Mean Daily			No. of days with Frost	Total pptn inches	Mean Daily			No. of days with Frost
		Temp. °F	Max. °F	Min. °F			Temp. °F	Max. °F	Min. °F	
January	1.17	1.3	9.0	-11.6	31	1.26	- 3.6	7.9	-15.0	31
February	0.82	3.4	15.8	- 8.9	28	0.89	0.7	14.3	-12.9	28
March	0.87	17.4	29.2	5.6	30	1.11	15.0	28.3	1.7	30
April	1.11	36.6	46.6	26.6	22	1.56	35.9	46.8	24.9	24
May	1.91	50.4	60.9	39.8	7	2.43	49.1	61.1	37.1	10
June	2.59	61.4	71.4	51.4	*	3.20	60.0	71.2	48.8	1
July	2.80	67.4	77.5	57.5	0	2.92	66.1	77.5	54.7	0
August	2.38	65.4	75.0	55.6	0	2.77	63.9	75.2	52.6	*
September	2.23	54.3	63.1	45.4	2	2.47	52.6	63.6	41.5	4
October	1.24	43.8	51.9	35.6	12	1.51	42.2	52.1	32.2	16
November	1.17	24.5	30.7	18.2	27	1.34	23.3	30.4	16.2	27
December	1.13	7.1	15.6	- 1.5	31	1.15	5.1	15.2	- 5.1	31
Year	19.42	35.9	45.6	26.1	190	22.61	34.2	45.3	23.1	202

[1] Data obtained from Temperature and Precipitation Tables, Prairie Provinces, 1941-1970, Atmospheric Environment Service, Environment Canada, 490 Street, Downsview, Ontario.

* No data.

II. ORGANIC SOIL CAPABILITY FOR AGRICULTURE

The organic soils in the L.G.D. of Alexander have been rated for: (a) "potential" agricultural capability, and (b) degree of development difficulty involved in achieving this potential, after the method of Leeson, 1969[1]. This twofold approach to classifying organic soils recognizes that the agricultural suitability of most of these soils requires reclamation or development from their native state and that most organic soils in their native state have little or no value for agriculture. Rating degree of development difficulty takes into consideration intrinsic characteristics of the soils affecting development and also associated costs required for development.

The capability classes of organic soils established not only reflect potential for agricultural use but also identify the continuing limitation of these soils for agriculture after reclamation has been implemented or is assumed to have been implemented.

To date, in Canada, no national system has been adopted for classifying organic soils for agricultural capability. The system and approach taken in Manitoba is basically a modification of the mineral soil capability classification for agriculture as described in Section A.

The Canada Land Inventory seven class soil capability classification system provides a suitable framework wherein various kinds of organic soils may be placed in order to show their relative value for agriculture along with mineral soils. This single framework for evaluating organic and mineral soils is very important in view of the potentially large sums of public funds normally required to reclaim and develop organic soils. The development

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[1] Leeson, Bruce, et al. 1969. An Organic Soil Capability Classification for Agriculture and a study of the soils of Simcoe County. Soil Sci. Dept., Ont. Agric. College, Guelph, Ont.

of mineral soils of equivalent agricultural capability normally does not require such expenditures and their management problems are usually such that they are within the capability of individual operators to overcome. A single framework embracing both groups of soils makes evaluations and recommendations for development of either group of soils more relevant.

While the above system may provide a framework for evaluating organic soils, it does not provide the guidelines and criteria necessary for adequate interpretive judgements. Leeson (1969)[1] outlines a system of rating organic soils, used in Ontario, reflecting their value for crop production and their relative degree of difficulty of development. These guidelines and criteria have been adopted and modified to more adequately suit conditions in Manitoba and more specifically in the L.G.D. of Alexander.

Water table control is the major reclamation requirement for the agricultural development of organic soils. Optimum water table control is necessary both for successful crop production as well as the long term maintenance of the soil itself. Improper manipulation of the water regime of an organic soil area can result in loss of the organic soil base through increased rates of subsidence, potential irreversible physical damage to the soil and increased hazards of wind erosion and fire damage. With water control at optimum levels (usually 45 to 90 cm below the surface) for both crop production and minimal subsidence rates, soil loss through subsidence can continue at rates of 2 cm to 5 cm annually. In consideration of eventual loss of the organic soil base, the capability ratings, therefore, reflect the continuing use-capability of such areas based on the character of underlying mineral substrates. Shallow organic soil areas underlain by unsuitable mineral substrates would preclude their

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[1] Leeson, Bruce, et al. 1969. An organic soil capability classification for agriculture and a study of the organic soils of Simcoe County. Soil Sci. Dept., Ontario Agricultural College, Guelph, Ontario.

long term utilization as a productive land base and should not be reclaimed for agricultural use.

The evaluation of organic soils for agriculture is carried out in two steps. Firstly, the organic soils are placed in "Capability Classes". This rating indicates the agricultural potential of the soil according to any hazards which reclamation is unable to remove and which, therefore, constitute a continuing limitation to agricultural production. The second step recognizes that the agricultural use of most organic soils necessitates reclamation or development from the native state with varying degree of difficulty and associated economic costs. The relative degree of difficulty of carrying out development is expressed in a "Development Difficulty Rating" that is assessed in terms of those properties and qualities of organic soils that significantly influence reclamation. For example, the presence or absence of trees; the content of large wood fragments; the permeability, density, and degree of decomposition of peat; and natural water table conditions all exert a very significant influence on reclamation of peatlands.

Recommendations for the development of organic soils is, therefore, based on both the Development Difficulty Rating and their continuing suitability after reclamation.

The Capability Classification of Organic Soils for agriculture is based on certain assumptions which must be understood by those using Capability maps or making Capability Ratings for various crops.

1. Capability ratings for drained conditions assumes continued subsidence rates of 2 cm to 5 cm annually; hence, depth of the organic layer and the nature of underlying mineral substrate is taken into account in evaluating organic soils for agriculture.

2. The organic capability grouping is an interpretive classification designed to assess the limitation of individual organic soils to development for production of cereal grains, forage and pasturage.

3. Good soil management, including drainage, control of subsidence, wind erosion, crop growing and conservation practices that are feasible under a mechanized system of agriculture are assumed.

4. The soils within a capability class are similar with respect to the degree of soil limitation but not necessarily similar with respect to the kind of limitation. The subclass provides information on the kind of limitation or hazard and the class indicates the intensity of the limitation. Organic soils in Class 1 have the least limitations and Class 7 have the most severe.

5. Organic soils which have been reclaimed and developed for agriculture are classified according to any continuing limitations which may affect the production of agricultural crops. Soils in the natural state are classified not only for the agriculture capability but also according to the apparent degree of difficulty in reclamation and development.

6. The location, distance to market, efficiency of transport, financial state of the market, farm size and sociological influences do not constitute criteria for capability groupings.

7. Capability classes and capability definitions are subject to change as new information and methods concerning the manipulation of organic soils become available. At the present time, capability groupings do not have the benefit of extensive regional research and management experience in their use for agriculture as in the case of mineral soils.

III. THE CAPABILITY CLASSES AND SUBCLASSES

The seven Capability Classes for organic soils, together with guide numbers to aid in the proper placement of the soils, are given below:

Class 01 (85-100) - Organic soils of this group have no water, topographical or pH limitations, and are deep and level. They are located in areas having mild or warmer soil temperatures.

Class 02 (70-80) - Organic soils in Class 02 have on limitation which restricts their use in a minor way. The limitation may be soil temperature, coarse fragments, wood layers, salinity, depth or slope.

Class 03 (55-65) - Organic soils in this class have moderately severe limitations that restrict the range of crops or that require special management practices.

Class 04 (40-50) - Organic soils in this class have limitations which severely restrict the range of crops or which require special development and management practices.

Class 05 (25-35) - Organic soils of this class have severe limitations that restrict the production of perennial forage or other specially adapted crops. Large sclae reclamation is not feasible[1].

Class 06 (10-20) - Organic soils in Class 06 are capable of producing only indigenous crops and improvement practices are not feasible.

Class 07 (Less than 10) - Organic soils of this class have no potential for agriculture.

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[1] In the foregoing definitions the term feasible implies that it is within present day economic and technological possibility for an individual farmer to make such improvement and it does not require a major reclamation project to do so.

To determine the capability rating for organic soils, the relative penalty values assigned to the applicable soil features as indicated in Table II are added together. This total is subtracted from 100 to arrive at the guide numbers utilized for placement of the soil in the appropriate Capability Class.

Capability Subclasses indicate the kind of problem limiting suitability for agriculture, Table II. For example, if the only limitation a soil had was climate, a designation of 2c could be used or if depth was the limiting factor, 2d or 3d could be used to indicate that depth was the limitation. Usually, no more than two subclass limitations are used to describe a soil. If the cumulative severity of more than two limiting features necessitates placement in Capability Class 04 or lower, only the two major limiting factors are indicated.

IV. DEVELOPMENT DIFFICULTY RATINGS FOR ORGANIC SOILS

In addition to evaluation of potential capability, an attempt was made to arate relative degree of difficulty of carrying out reclamation or development on organic soils. These ratings are based on evaluations of the present or natural state of organic soils. The Degree of Development Difficulty ratings are important in priorizing areas of organic soils for reclamation. Three relative degrees of difficulty in overcoming limitations or hazards to use are recognized.

1. Minor Development Difficulty

Only minor reclamation is required to overcome limitations to use. Minor reclamation is considered to be those operations which can be carried out by a single operator and which do not require cooperation between adjoining operators. Such operations would include leveling

Table II. Soil Properties Utilized to Determine the Capability Classification of Organic Soils

Symbol	Soil Property and Guidelines to Use	Penalty Value
C	THERMAL REGIME - soil temperature classes as defined in the Revised System of Soil Classification for Canada (1973)	
	Mild — MAST 8-15°C, MSST 15-22°C	0
	Cool — " 5-8°C, " 15-18°C	0
	Cold — " 2-8°C, " 8-15°C	35
	Very Cold — " -7-2°C, " 5-8°C	60
	Extremely Cold — " <-7°C, " <5°C	90
W	EXCESS WATER - refers to groundwater level and flooding	
	Adequate: drainage provided for optimum crop yields and a water table sufficiently high to prolong the life of the soil (45 to 90 cm).	0
	Marginal: less than adequate; yields reduced and choice of crops reduced (water table 30 to 45 cm or 90 to 120 cm).	35
	None: no control measures (water table <30 cm or >120 cm)	55
L	COARSE WOOD FRAGMENTS (Wood >4" dia., volume % within depths of 130 cm).	
	None — Fen peat, <1%	0
	Moderate — Forest-Fen and Sphagnum peats, 1-5%	10
	High — Forest peat, >5%	25
H	DEGREE OF DECOMPOSITION - as related to permeability	
	Mesic forest-fen and forest peat	0
	Mesic to humic forest peat	10
	Fibric sphagnum peat and humic aquatic peat	20
F	NATURE OF SURFACE MATERIALS - fertility as related to soil reaction	
	Forest, forest-fen and fen peats, pH 4.5 to 7.5	0
	Sphagnum peats, pH <4.5	20
	Fen peats with pH >7.5	10
N	SALINITY	
	None - conductivity 0-4 mmhos/cm	0
	Slight - conductivity 4-8 mmhos/cm	20
	Moderate - conductivity 8-12 mmhos/cm	50
	High - conductivity 12-16 mmhos/cm	75
	Excessive - conductivity >16 mmhos/cm	80

Table II (cont'd)

Symbol	Soil Property and Guidelines to Use	Penalty Value
D	DEPTH OF ORGANIC MATERIALS AND NATURE OF UNDERLYING SUBSTRATE*	
	Deep to very deep deposits underlain by sandy, loamy or clayey stone-free lacustrine sediments	0
	Shallow deposits underlain by loamy lacustrine sediments	0
	Shallow deposits underlain by clayey lacustrine sediments	10
	Shallow deposits underlain by sandy lacustrine sediments	20
	Shallow to very deep deposits underlain by skeletal loamy till, marl or diatomaceous earth	30
	Shallow to very deep deposits underlain by bedrock	50

* Penalty values for shallow depth of organic materials relates to the eventual loss of the land resource through subsidence. Shallow organic soils underlain by clays, sands, stony till, marl or bedrock have varying capability for agriculture when the organic layer has disappeared. These soils are therefore downgraded for the nature of the underlying mineral material, as well as for shallow depth.

rough surfaces, removal of surface woody layers and land clearing.

2. Major Development Difficulty - Reclamation Warranted

Major reclamation is required but is warranted when soil potential is high. Major reclamation is that requiring cooperation between adjoining operators or outside financial assistance or both. Major reclamation operations include drainage, construction of water control works or correction of very low pH or very high pH.

3. Major Development Difficulty - Reclamation Seldom Warranted

These organic soils can be developed only by very large reclamation projects. Major reclamation is seldom warranted here because the hazards are so serious that they constitute some continuing limitation which reduces the agricultural capability.

Many features of organic soils which affect their agricultural capability also affect the degree of development difficulty experienced in reclaiming organic soils and the relative costs associated with maintaining their productive capacity. The relative importance of these soil properties may be adjusted when considering development difficulty. In addition, factors such as vegetative cover, inundation and surface roughness must be evaluated. The features of organic soils important to the evaluation of degree of development difficulty ratings are listed in Table III. The relative limitation of each feature to reclamation is often related to organic materials and soil types; in other cases, the relationship is with the physiographic position of the soil area relative to other organic and mineral soils. In all cases, the applicable feature is ranked by means of penalty values as to its relative effects on development difficulty.

To determine the relative degree of development difficulty the

Table III. Physical Features Utilized to Determine Development Difficulty Rating of Organic Soils

Symbol	Physical Features and Guidelines to Use		Penalty Value
V	Vegetative Cover - Light, grasses, reeds		0
	Moderate, brush, small trees		10
	Heavy, numerous large trees		20
W	Excess water - Underground seepage and surface runoff from surrounding highlands into undrained depressional organic soil areas	Upper slope, marginal sites and raised central portion of peatlands	10
		Depressional catchments	20
		Floating peatlands	40
I	Inundation - Overflow from nearby large bodies of water or poorly defined rivers		
	None		0
	Slight		10
	Severe		20
T	Surface Roughness - Mounds, hummocks, ridges and holes		
	None		0
	Holes & mounds 25-50 cm microrelief		10
	Holes and mounds >50 cm microrelief		20
L	Coarse Wood Fragments - Wood >10 cm diameter, percent by volume within depths of 130 cm		
	<1%	Fen peat	0
	1-5%	Forest-Fen peat, Sphagnum peat	10
	>5%	Forest peat	20
H	Degree of Decomposition - permeability and hydraulic conductivity		
	Mesic	Fen peat	0
	Mesic to Humic	Forest peat	10
	Fibric	Sphagnum Peat	20
	Humic	Aquatic Peat	20
D	Depth of Organic Materials - Shallow to deep 30 to 130 cm		0
	- Very deep >130 cm		20

penalty values for the features applicable to each soil are added together and subtracted from 100. This figure is used as a guide by comparing with the following ranges for each degree of development difficulty group. The following ranges of penalty values for each group were used in the L.G.D. of Alexander:

Minor	>70
Major - Reclamation Warranted	25 - 69
Major - Reclamation Seldom Warranted	<24

V. THE AGRICULTURE CAPABILITY AND DEGREE OF DIFFICULTY RATINGS FOR THE ORGANIC SOILS IN THE L.G.D. OF ALEXANDER (Table IV)

Class 03 - Organic soils in this class have moderately severe limitations that restrict the range of crops that can be grown or that require special development and management practices.

03W - These are poorly to very poorly drained soils that are derived from moderately decomposed fen peat. These smooth, level organic deposits range in depth from 50 cm to more than 3 m in places. They are normally very uniform with respect to degree of decomposition and nature of plant residues from which the peat has been derived. They usually range from medium acid to neutral in reaction and have a high water holding capacity. Movement of water in these organic soils is moderately slow and is similar to that in a uniform, medium textured mineral soil. They are usually underlain by calcareous, clay textured lacustrine sediments.

The shallow member of this group, Cayer, has a minor degree of development difficulty rating. In the case of these soils lowering and controlling the water table between 18 and 36 inches of the surface is not a major reclamation problem.

Table IV. Agricultural Capability Classification and Development Difficulty Ratings for the Organic Soils of the L.G.D. of Alexander.

Symbol	Name	Reclaimed Capability	Major Subclass Limitation	Developmental Difficulty
Bm	Baynham	04	WL	2
Ca	Cayer	03	W	1
Ca(d)	Cayer (drained)	03	W	1
Hw	Howell	05	WF	2
Kt	Katimik	05	WF	2
Jk	Jackhead	05	WF	2
Ok	Okno	04	WL	2
Ok(d)	Okno (drained)	04	WL	2
Or	Orok	04	WL	2
Ov	Overflowing	07	W	3
Rr	Rat River	04	WL	2
Sd	Stead	03	W	1
Wk	Waskwei	04	WL	2

The deeper Stead soils have a major degree of development difficulty rating. Most of these soils normally occur in the central section of large peatland areas and usually serve as catchment to adjacent shallow Cayer soils and upland mineral soils. Because of this, major reclamation is required to remove large volumes of water. The soils in this subclass are:

Cayer
Stead

Class 04 - Organic soils have severe limitations which restrict the range of crops or which require special development and management practices.

4WL - These poorly drained organic soils are derived from moderately well to well decomposed forest peat. These densely tree covered, hummocky surfaced, woody organic deposits range in depth from 1 m to more than 3 m in thickness. They are found on slightly better drained, upslope or very gently sloping to nearly level sites near the margins of peatlands.

Forest peat is derived from black spruce, some tamarack, feather-mosses, some ericaceous shrubs and other herbaceous plants. The peat material is usually very dark brown to nearly black in color, amorphous in structure with variable layers of coarse, woody fragments, black spruce and tamarack roots, stems and branches. The peat is usually strongly acid to neutral in reaction. Water movement in these soils is variable, being moderately slow to slow in the dense well decomposed layers and very rapid in the coarse, woody, less well decomposed layers. The underlying fine textured lacustrine soils are smooth and usually moderately calcareous.

These soils have a major degree of development difficulty rating because of the dense forest cover, excess water from surrounding

uplands, their hummocky surface, and most important the rather high content of coarse woody material in the material itself. This woody material is much more resistant to decomposition than herbaceous material and contributes significantly to rough and uneven seedbed. The high degree of decomposition in some layers of these soils contribute to poor water movement in these soils and consequently impart a further limitation to the control of water table at 45 to 90 cm of the surface. The soils in this subclass are:

Baynham
Okno
Orok
Rat River
Waskwei

Class 05 - Organic soils of this class have severe limitations that restrict use of these soils to production of perennial forage or other specially adapted crops.

05WF - These poorly drained organic soils are derived from thin layers of extremely acid, relatively undecomposed Sphagnum moss that overlies forest and/or fen peat which, in turn, is underlain by moderately calcareous lacustrine clay. These soils occur under open stands of stunted black spruce and tamarack. Sphagnum mosses and ericaceous shrubs such as Labrador tea and leatherleaf form the dominant vegetation.

Sphagnum moss peat is usually found in a well preserved or fibric state. It is usually light yellowish brown in colour, loose in the near surface layers and entire Sphagnum plants are readily identified. The material is usually extremely acid to very strongly acid. Water movement in the Sphagnum layer is very rapid.

Within the same subclass, fen peats with marly layers which bring the pH up to and greater than 7.5 are included. Such a soil

is Jackhead.

The soils in this subclass are:

Howell
Jackhead
Katimik

Class 06 - Organic soils in this class are capable of producing indigenous crops and improvement practices are not feasible. No soils were rated in this capability class.

Class 07 - Organic soils of this class have no potential for agriculture.

07W - These poorly drained organic soils are derived from fen peat which have a floating mat or a hydric layer below the surface mat which fluctuates rapidly with water flows. In such soils it would be impossible to regulate the water table if the surface mat is always floating. The soil in this subclass is:

Overflowing

Table V gives the estimated acreage of organic soils in the L.G.D. Some chemical and physical data are presented for the more dominant series found in the area (Appendix I). The chemical and physical analysis are from similar soils in a different area.

VI. OVERVIEW OF THE L.G.D.

Approximately 26,380 acres or 35 percent of the soils in the L.G.D. are found in Capability Class 03 (Table VI). The majority of Capability Class 03 soils (85 percent) are found in the central lowland section, which is underlain by lacustrine clay. Smaller isolated tracts of class 3 are found in the eastern bedrock controlled section (8 percent) and in the western morainic section (6 percent). The soils in this class (Cayer and Stead) have moderately severe limitations that restrict the range of crops

Table V. Estimated Organic Acreages of the L.G.D. of Alexander.

Name	Symbol	Western Section	Central Lowland Section	Eastern Section	Acreage	Percent of Area
Baynham	Bm	1,620	640	1,280	3,540	4.81
Cayer	Ca	840		2,240	3,080	4.18
Cayer (drained)	Ca(d)		22,000		22,000	29.42
Howell	Hw	400		480	880	1.19
Katimik	Kt	2,120	800	100	3,020	4.10
Jackhead	Jk	40			40	.54
Okno	Ok	8,800	7,150	13,000	28,950	39.31
Okno (drained)	Ok(d)		1,200		1,200	1.62
Orok	Or	1,660	320	1,470	3,450	4.68
Overflowing	Ov	1,000			1,000	1.35
Rat River	Rr	1,040			1,040	1.41
Stead	Sd	700	500	100	1,300	1.77
Waskwei	Wk	2,840	1,300		4,140	5.62
		21,060	33,910	18,670	73,640	100.00%
Percent of Area		28.59	46.06	25.35	100%	

Table VI. Estimated Area and Distribution of Soil Capability Classes for Agriculture in the L.G.D. of Alexander.

Capability Class	Western Section	% of Capability Class Total	Central Lowland Section	% of Capability Class Total	Eastern Section	% of Capability Class Total	Total Acres of Capability Class	Percent of Total Area
3	1,540	5.84	22,500	85.29	2,340	8.87	26,380	35.82
4	15,960	37.71	10,610	25.07	15,750	37.22	42,320	57.46
5	2,560	65.00	800	20.30	580	14.70	3,940	5.36
6	-	-	-	-	-	-	-	-
7	1,000	100.00	-	-	-	-	1,000	1.36
Acreage Totals	21,060		33,910		18,670		73,640	100.00
Percent of Total Area	28.59		46.06		25.35		100.00	

grown. The major subclass limitation in these fen peats is control of excess water (W) in these poorly to very poorly drained soils.

Capability Class 4, are the dominant soils in the L.G.D. occupying approximately 42, 320 acres (57 percent) of the organic acreage (Table VI). Capability Class 4 soils are found throughout the L.G.D., 37 percent in the western morainic section, 25 percent in the central lacustrine lowland section and 37 percent in the bedrock controlled eastern section. The soils in Class 4 (Baynham, Okno, Orok, Rat River, and Waskwei) have severe limitations which restrict the range of crops grown. The major subclass limitations in these treed forest peats are control of excess water (W), and the occurrence of coarse wood fragments (L).

Limited acreage of Capability Class 5 soils are found in the L.G.D. There are approximately 3,940 acres or 5 percent of the total organic acreage (Table VI). Capability Class 5 soils are found throughout the L.G.D. with 65 percent found in the western morainic section, 20 percent in the central lacustrine lowland and 15 percent in the bedrock controlled eastern section. The soils in this class (Howell, Jackhead and Katimik) have severe limitations that restrict use of these soils to production of perennial forage or other specially adapted crops. The major subclass limitations in these sparsely treed forest and fen peats, are control of excess water (W) and nature of surface material (F) (e.g. raw Sphagnum layers in Howell and Katimik series and marl layers in Jackhead series).

No soils fell into Capability Class 6 in the L.G.D.

Capability Class 7 accounted for 1.3 percent or 1,000 acres which was a minor portion of the total area. The total acreage of Class 7 was found in the western morainic section. The soil in this class (Overflowing) has no potential for agriculture. The major subclass limitation in this

floating fen peat is the control of excess water (W).

Apart from the 1.3 percent or 1,000 acres in Class 7, the soils in the area are suitable for some type of agriculture production.

A P P E N D I X I

Some Chemical and Physical Data of Representative Soil Series

List of Abbreviations for Chemical and Physical Data

Horizon Boundary

Distinctness: a - abrupt, c - clear, g - gradual, d - diffuse

Form: s - smooth, w - wavy, i - irregular, b - broken

Texture: S - sand, Si - silt, C - clay, L - loam, Co - coarse, M - medium, F - fine, VF - very fine

Soil Structure

Grade:		
	structureless or amorphous	0
	weak	1
	moderate	2
	strong	3

Fiber Size Class:			
	very fine	vf	(0.15-1.0 mm)
	fine	f	(1.0-2.0 mm)
	medium	m	(2.0-5.0 mm)
	coarse	co	(5.0-10.0 mm)
	very coarse	vco	(10.0-20.0 mm)

Kind:		
	platy	pl
	granular	gr

Consistence

Wet:		
	non-sticky	wso
	slightly sticky	wss
	sticky	ws
	very sticky	wvs

Moist:		
	friable	mfr
	very friable	mvfr

Wood Content Class (by volume)

non-woody	<2%
low wood	2-10%
mod. wood	10-30%
high wood	30-60%
very high wood	60+%

Fiber Content[1] (Degree of Fibrosity)

Fi: fibered
Undist: undisturbed
Of: A fibric layer has a rubbed fiber content of more than 4/10 of the organic volume and an unrubbed fiber content of more than 2/3 the organic volume.

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[1] The System of Soil Classification for Canada, 1970. Canada Dept. of Agric.

Om: A mesic layer has a rubbed fiber content of more than 1/10 if the unrubbed fiber content is between 1/3 and 2/3 of the organic volume.

Oh: A humic layer has a rubbed fiber content of less than 1/10 of the organic volume.

ANALYTICAL SOIL DATA

pH	Hydrogen ion concentration
Org. C.	Organic Carbon
N	Total N
C/N Ratio	Carbon to Nitrogen ratio
m.e./100 gm	Milliequivalent per 100 grams
Ca	Calcium
Mg	Magnesium
K	Potassium
Na	Sodium
H	Hydrogen
C.E.C.	Cation exchange capacity
Pyrophos. %	[1]Sodium pyrophosphate solubility, percent absorbance

[1] The System of Soil Classification for Cnada, Publ. 1455, Canada Dept. of Agric., 1974-Revised.

SOIL SERIES: Baynham
SUBGROUP: Typic Mesisol

PARENT MATERIAL: Forest peat and some fen peat overlying medium textured lacustrine deposits.

MORPHOLOGICAL DESCRIPTION

Horizon	Depth (cm)	Boundary	Kind of Fiber	Fiber Content %		Colour, wet			Structure	Consistence
				Undist.	Rubbed	Natural	Pressed	Rubbed		
Of_1	0-25	aw	sphagnum	100	62	10YR 3/3	10YR 3/3 + 4/3	10YR 4/3 + 7/2	f-vf Fi fibrous	wso
Om_1	25-100	cs	forest	58	14	5YR 2/2	5YR 2/2	5YR 3/2	vf-f Fi mod. wood	wss
Om_2	100-160		forest	46	2	10YR 2/2	10YR 2/2	10YR 3/2	vf Fi & o, mod. wood	wss
IIAhg	160-200					moist 2.5Y2.5/0			o	wvs

PHYSICAL AND CHEMICAL ANALYSIS

Horizon	Depth (cm)	Texture	$CaCO_3$ %	pH	Org. C %	N %	C/N Ratio	Exchange Analysis, m.e./100 gm						Pyrophos. %	Ash %	Bulk Density g/cc
								Ca	Mg	K	Na	H	C.E.C.			
Of_1	0-25			4.5	52.3	1.0	50.3	112.9	27.0	1.1	0.4	16.5	157.9	4.7	20.0	0.06
Om_1	25-100			6.5	47.9	1.4	35.2	163.2	28.9	0.2	0.2	8.3	200.7	57.4	24.0	0.17
Om_2	100-160			7.0	47.0	1.8	26.4	137.0	34.5	0.1	0.2	2.1	173.9	77.2	27.7	0.17
IIAhg	160-200	SiL		8.1	5.2	0.4	14.0								89.7	0.70

SOIL SERIES: Cayer
SUBGROUP: Terric Mesic Humisol

PARENT MATERIAL: Moderately well decomposed herbaceous fen peat underlain by fine textured lacustrine sediments.

MORPHOLOGICAL DESCRIPTION

Horizon	Depth (cm)	Boundary	Kind of Fiber	Fiber Content %		Colour, wet			Structure	Consistence
				Undist.	Rubbed	Natural	Pressed	Rubbed		
Om_1	0-30	cs	fen	48	8	5YR 2/2	5YR 3/4	5YR 2/2	m-f Fi med. wood	wso
Oh_1	30-75	cs	fen	46	2	5YR 2/2	5YR 3/3	5YR 2/1.5	vf Fi non-woody	wss
Oh_2	75-90	as	fen	38	2	5YR 3/3 + 2/1	5Y[illegible] 3/4	5YR 2.5/2	vf Fi low wood	wss
IICkg	90-100					10YR 2.5/1(m)			o	wss

PHYSICAL AND CHEMICAL ANALYSIS

Horizon	Depth (cm)	Texture	$CaCO_3$ %	pH	Org. C %	N %	C/N Ratio	Exchange Analysis, m.e./100 gm						Pyro-phos. %	Ash %	Bulk Density g/cc
								Ca	Mg	K	Na	H	C.E.C.			
Om_1	0-30			7.3	53.6	2.4	22.6	165.6	33.8	0.6	1.0	-	201.0	23.2	14.3	
Oh_1	30-75			6.7	57.9	2.5	23.5	146.5	39.9	0.2	0.6	13.0	200.1	15.2	11.4	
Oh_2	75-90			6.3	60.4	2.9	21.2	149.5	29.3	0.1	0.6	12.5	191.9	29.8	10.6	
IICkg	90-100	C		7.0	4.3	0.1	71.2	16.0	2.7	0.1	0.1		18.9		96.8	

SOIL SERIES: Katimik
SUBGROUP: Typic Mesisol (sphagnic phase)

PARENT MATERIAL: Discontinuous surface sphagnum peat overlying deep moderately well decomposed forest-fen and/or fen peat. Fine textured lacustrine deposits occur below 150 cm of the surface.

MORPHOLOGICAL DESCRIPTION

Horizon	Depth (cm)	Boundary	Kind of Fiber	Fiber Content %		Colour, wet			Structure	Consistence
				Undist.	Rubbed	Natural	Pressed	Rubbed		
Of_1	0-30	aw	sphagnum	100	92	10YR 6/3 + 5/6	10YR 8/2	10YR 7/3	m-co Fi low non-woody	wso
Om_1	30-100	cs	forest-fen	62	10	5Y 3/2	5YR 4/2 + 6/2	5YR 4/2	f-vf Fi	wss
Om_2	100-185	as	fen	84	24	7.5YR 3/2 moist	7.5YR 4/2	5YR 3/2	m-f Fi	wss
IICkg	185+					5Y 4/1				

PHYSICAL AND CHEMICAL ANALYSIS

Horizon	Depth (cm)	Texture	$CaCO_3$ %	pH	Org. C %	N %	C/N Ratio	Exchange Analysis, m.e./100 gm						Pyrophos. %	Ash %	Bulk Density g/cc
								Ca	Mg	K	Na	H	C.E.C.			
Of_1	0-30			3.8	55.2	0.9	65.0	24.0	28.5	3.5	0.4	37.0	93.4	5.4	3.9	
Om_1	30-100			5.2	59.0	1.8	33.1	40.1	32.3	0.5	0.5	34.5	107.9	5.4	4.9	0.09
Om_2	100-185			6.2	62.2	2.4	26.3	66.4	47.5	0.1	1.0	20.5	141.5	14.4	6.0	0.09
IICkg	185+	C		7.2	5.1	0.1	63.4	16.0	14.6	0.5	0.4	-	31.5		b...	

SOIL SERIES: Okno
SUBGROUP: Terric Mesisol

PARENT MATERIAL: Moderately well decomposed forest peat overlying mesic fen peat; moderately fine textured lacustrine sediments occur between 40 and 130 cm of the surface

MORPHOLOGICAL DESCRIPTION

Horizon	Depth (cm)	Boundary	Kind of Fiber	Fiber Content %		Colour, wet			Structure	Consistence
				Undist.	Rubbed	Natural	Pressed	Rubbed		
Of_1	0-10	aw	forest peat	84	44	10YR 6/4	10YR 8/2	10YR 6/4	co Fi	wso
Of_2	10-40	cs	forest peat			10YR 2/2	10YR 4/4	10YR 2/2	co Fi mod. wood	wso
Om_1	40-90	cs	forest	64	12	5YR 2/2	5YR 2/2+5YR 4/4	5YR 2/2	m-f Fi	wso
Om_2	90-120	as	fen	44	12	10YR 2/2	7.5YR 3/2	10YR 2/2	f Fi non-woody	wss
IICkg	120+								o	

PHYSICAL AND CHEMICAL ANALYSIS

Horizon	Depth (cm)	Texture	$CaCO_3$ %	pH	Org. C %	N %	C/N Ratio	Exchange Analysis, m.e./100 gm						Pyrophos. %	Ash %	Bulk Density g/cc
								Ca	Mg	K	Na	H	C.E.C.			
Of_2	0-40			3.9	58.0	1.6	35.6	83.1	33.3	1.4	0.4	33.5	151.7	5.8	8.1	
Om_1	40-90			5.8	55.6	1.6	34.5	102.0	42.9	0.1	0.4	17.0	162.5	9.4	7.0	.12
Om_2	90-120			5.7	60.3	2.0	30.1	117.4	44.4	0.1	0.5	17.5	180.0	13.0	10.6	.13
IICkg	120+	SCL-C		6.4	11.5	0.1	82.2	14.7	9.9	0.2	0.1	1.2	26.1		93.2	

SOIL SERIES: Overflowing
SUBGROUP: Hydric Mesisol

PARENT MATERIAL: Very deep, moderately well decomposed fen peat overlying fine textured lacustrine sediments.

MORPHOLOGICAL DESCRIPTION

Horizon	Depth (cm)	Boundary	Kind of Fiber	Fiber Content %		Colour, wet			Structure	Consistence
				Undist.	Rubbed	Natural	Pressed	Rubbed		
Of_1	0-10	aw	fen	54	28	7.5YR 2/0	10YR 3/3-2/2	10YR 2/2	co-f Fi	wso
Of_2	10-25		fen	40	20	10YR 3/3	10YR 5/4	10YR 3/3	co Fi felty	wso
Om_1+H_2O	25-45	gs	fen	62	22	10YR 3/2-4/3	10YR 4/3	10YR 3/2	f-vf Fi felty	wss
Om_2	45-95		fen	44	6	5YR 2/2	5YR 3/4	5YR 2/1.5	f-vf Fi felty	wss
Om_3	95-165		fen	48	8	10YR 3/2-3/3	10YR 3/4	10YR 2/2	f-vf Fi	wss
Oh_1	165-260		fen	66	4	10YR 3/2-3/3	10YR 3/2	10YR 2/2	vf-f Fi felty	wss
IIAhg	260-270		fen			5Y2/1(m)			o	
IICkg	270+		fen			N6/(m)			o	

PHYSICAL AND CHEMICAL ANALYSIS

Horizon	Depth (cm)	Texture	$CaCO_3$ %	pH	Org. C %	N %	C/N Ratio	Exchange Analysis, m.e./100 gm						Pyrophos. %	Ash %	Bulk Density g/cc
								Ca	Mg	K	Na	H	C.E.C.			
Of_1	0-10			7.5	45.1	1.8	25.8	96.0	20.7	1.0	0.9		118.6	14.1	22.6	
Of_2	10-25			7.3	52.3	2.3	23.2	87.9	21.7	0.6	0.9		111.1	12.8	12.8	
Om_1+H_2O	25-45			7.2	56.5	2.6	22.8	122.2	20.5	0.5	0.7		143.9	7.9	8.4	
Om_2	45-95			7.2	56.2	2.5	22.5	115.1	23.2	0.5	0.8		139.7	11.6	7.8	0.09
Om_3	96-165			6.7	62.1	2.4	26.2	84.3	20.5	0.2	0.6	5.5	109.1	14.5	8.2	0.10
Oh_1	165-260			6.6	58.0	2.4	23.9	80.8	19.7	0.2	0.6	18.5	119.8	23.5	15.7	0.11
IIAhg	260-270	L	21.5	7.7	12.6	0.2	74.4								65.6	
IICkg	270+	SCL	39.7	7.8	3.3	0.1	33.0								85.1	

SOIL SERIES: Rat River
SUBGROUP: Terric Mesisol

PARENT MATERIAL: Shallow to deep moderately well decomposed forest peat underlain by coarse textured lacustrine sediments.

MORPHOLOGICAL DESCRIPTION

Horizon	Depth (cm)	Boundary	Kind of Fiber	Fiber Content %		Colour, wet			Structure	Consistence
				Unrub.	Rubbed	Natural	Pressed	Rubbed		
Of_1	0-15	as	feathermoss	64	16				f Fi	loose
Om_1	15-40	cs	forest	44	nil	5YR 2/2	5YR 2/2	5YR 2.5/1	o vf Fi mod. wood	wss
Om_2	40-67	cs	forest	54	2	5YR 2/1	5YR 2/1	5YR 2/1	o vf Fi low wood	wss
Oh_1	67-98	as	moss and carex	34	4	5YR 2/1	5YR 2/1	5YR 2/1	weak fine layered o	wss
IICkg	98+									

PHYSICAL AND CHEMICAL ANALYSIS

Horizon	Depth (cm)	Texture	$CaCO_3$ %	pH	Org. C %	N %	C/N Ratio	Exchange Analysis, m.e./100 gm						Pyrophos. %	Ash %	Bulk Density g/cc
								Ca	Mg	K	Na	H	C.E.C.			
Of_1	0-15			NS												0.14
Om_1	15-40			6.8	46.6	1.2	38.5	216.5	35.4	0.2	0.3	2.1	255.5	82.4	23.8	0.18
Om_2	40-67			6.9	49.9	1.5	34.2	201.6	36.2	0.2	0.3	2.6	240.8	75.0	23.7	0.17
Oh_1	67-98			6.8	45.1	1.9	23.5	162.2	37.8	0.2	0.3	6.1	206.5	91.0	31.9	0.52
IICkg	98+	FS		7.6	0.7	0.1	9.43									

SOIL SERIES: Stead
SUBGROUP: Typic Mesisol

PARENT MATERIAL: Deep fen peat underlain by fine textured lacustrine sediments.

MORPHOLOGICAL DESCRIPTION

Horizon	Depth (cm)	Boundary	Kind of Fiber	Fiber Content %		Colour, wet			Structure	Consistence
				Undist.	Rubbed	Material	Pressed	Rubbed		
Of_1	0-50	cs	fen	56	14	5YR 3/3	5YR 3.5/2	10YR 3/4	vf FI non-woody, felty	wss
Om_1	50-95	ds	fen	48	14	10YR 2/2	10YR 3.5/2	10YR 2/2	vf FI low wood, felty	wss
Om_2	95-125	ds	fen	46	10	5YR 2/1	10YR 2/1	5YR 2/1	vf FI non-woody, felty	ws
Om_3	125-185	as	fen	60	12	5YR 2/2	10YR 3/2	5YR 2/2 dry	vf FI low-non woody, felty	wss
IICkg	185+							5Y 5/1-6/1	o	wvs

PHYSICAL AND CHEMICAL ANALYSIS

Horizon	Depth (cm)	Texture	$CaCO_3$ %	pH	Org. C %	N %	C/N Ratio	Exchange Analysis, m.e./100 gm						Pyrophos. %	Ash %	Bulk Density g/cc
								Ca	Mg	K	Na	H	C.E.C.			
Of_1	0-50			5.8	56.0	1.9	29.3	74.3	50.9	0.2	0.6	21.6	147.6	7.8	7.1	0.10
Om_1	50-95			5.6	57.5	1.9	30.6	67.7	56.3	0.1	0.5	25.8	150.4	7.0	10.9	0.13
Om_2	95-125			6.1	51.6	1.8	28.0	85.0	28.1	0.0	0.6	12.7	126.3	21.3	25.8	0.14
Om_3	125-185			6.0	50.7	2.0	25.7	82.4	62.4	0.1	0.6	17.6	163.2	31.0	39.7	0.12
IICkg	185+	C	28.0	7.6	1.3											