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Rural Municipality of Oakland

Information Bulletin 96-8

Soils and Terrain

An introduction to the land resource

Land Resource Unit
Brandon Research Centre

Canada

Rural Municipality of Oakland

Information Bulletin 96-8

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PREFACE

This is one of a new series of information bulletins for individual rural municipalities of Manitoba. They serve to introduce the newly developed digital soil and terrain databases, and illustrate several typical derived map products for agricultural land use planning applications. The bulletins will also be available in diskette format for selected rural municipalities.

Information contained in this bulletin may be quoted and utilized with appropriate reference to the originating agencies. The authors and originating agencies assume no responsibility for the misuse, alteration, re-packaging, or re-interpretation of the information.

This information bulletin serves as an introduction to the land resource information available for the municipality. More detailed information, including copies of the primary soil and terrain maps at larger scales, may be obtained by contacting:

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CITATION

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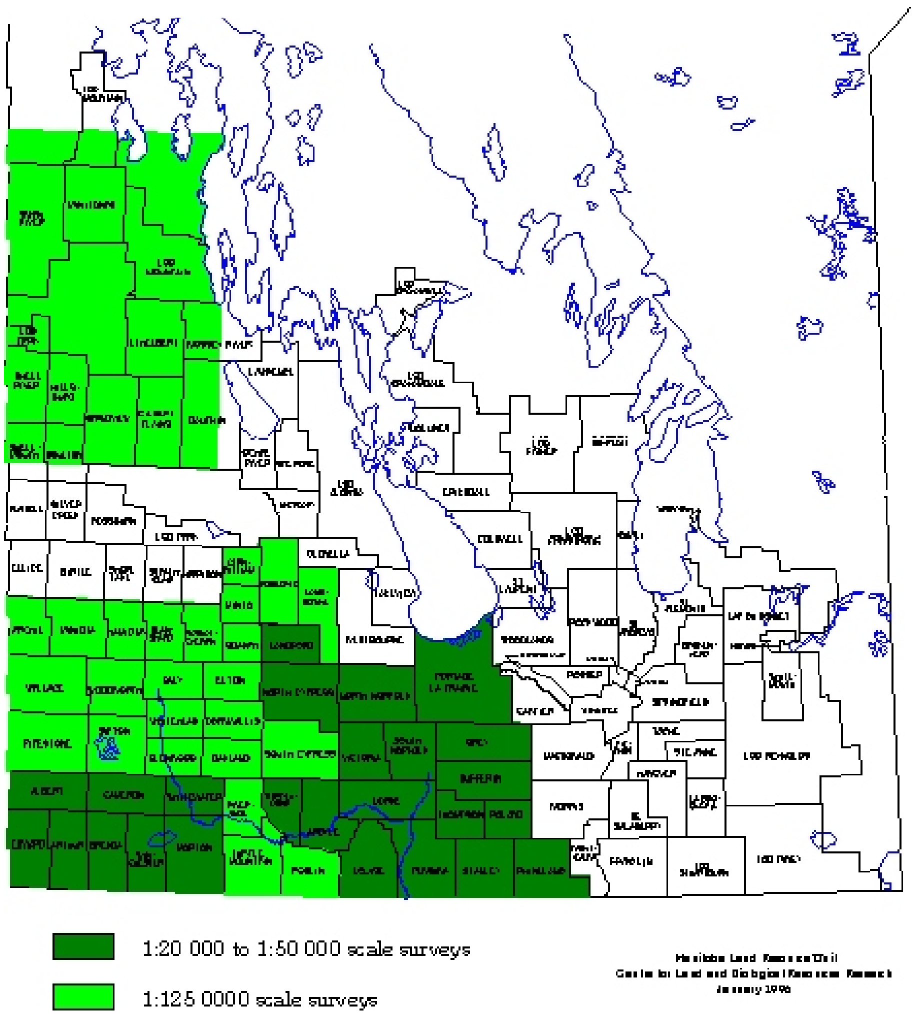


Figure 3. Rural municipalities in southern Manitoba with digital soil and terrain map information (1996).

INTRODUCTION

This information bulletin is one of a new series prepared for selected rural municipalities in southern Manitoba (Figure 1). A brief overview of the soil and terrain database information assembled for each municipality is presented, as well as a set of maps derived from the data for typical agricultural land use and planning applications.

The soil and terrain maps and databases were compiled and registered using the computerized Geographic Information System (GIS) facilities of the Manitoba Land Resource Unit. These GIS databases were used to create the generalized interpretive maps and statistics contained in this report.

LAND RESOURCE DATA

The soil and terrain (landscape) information were obtained as part of a larger project to provide a uniform level of land resource information for agricultural and regional planning purposes throughout Agro-Manitoba. This information was compiled and analyzed in digital form, using Geographic Information System (GIS) techniques. Three distinct layers of information were used, as shown in Figure 2.

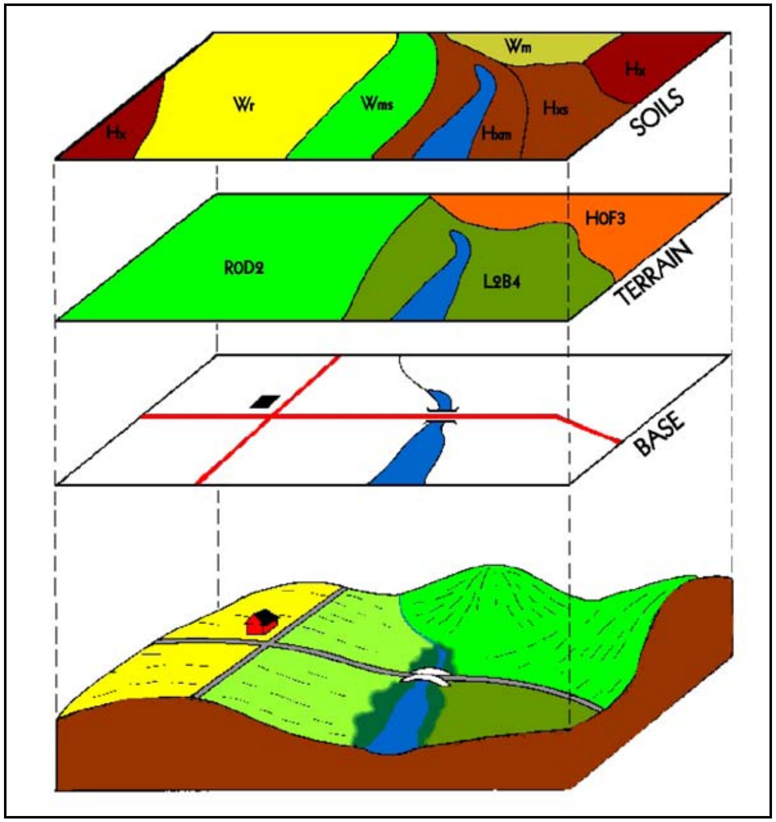


Figure 2. Soil, Terrain, and Base Map data.

Base Layer

Digital base map information includes the municipality and Township boundaries, and major streams, roads and highways. The soil and terrain layers were added and aligned ("georeferenced") to the digital base map. Major rivers and lakes from the base layer were also used as common boundaries for the soil and terrain map layers. Water bodies larger than 25 ha in size were digitized as separate polygons.

Terrain Layer

A separate terrain layer was produced for municipalities for which only reconnaissance scale soil map coverage was available. This was compiled by aerial photo-interpretation techniques, using recent 1:50 000 scale stereo air photo coverage. The terrain information was transferred from the photographs onto the standard RM base and digitized in the GIS. Where the soil and terrain boundaries coincided, such as along prominent escarpments and eroded stream channels, the new terrain line was used for both layers. The terrain line, delineated from modern airphoto interpretation, was considered more positionally accurate than the same boundary portrayed on the historical reconnaissance soil map. Each digital terrain polygon was assigned the following legend characteristics:

- Surface form (Landform)
- Slope class
- Slope length class
- Percent wetlands
- Wetland size
- Erosional modifiers
- Extent of eroded knolls
- Polygon number

The first four legend fields are considered differentiating, that is, a change in any of these classes defines a new polygon.

Soil Layer

The most detailed soil information currently available was selected as the data source for the digital soil layer for each rural municipality.

Comprehensive detailed soil maps (1:20 000 to 1:50 000 scale) have been published for many rural municipalities. Where they were available, the individual soil map sheets were digitized and compiled as a single georeferenced layer to match the digital RM base. Map polygons have one or more soil series components, as well as slope and stoniness classes. Soil database information was produced for each polygon, to meet national standards (MacDonald and Valentine, 1992). Slope length classes were also added, based on photo-interpretation.

Older, reconnaissance scale soil maps (1:126 720 scale) represented the only available soil data source for many rural municipalities. These maps were compiled on a **soil association** basis, in which soil landscape patterns were identified with unique surficial geological deposits and textures. Each soil association consists of a range of different soils ("associates") each of which occurs in a repetitive position in the landscape. Each polygon digitized from the reconnaissance soil map was assigned the following legend characteristics:

Map symbol and modifier (overprinted symbol)
Soil Association or Complex name
Soil series and modifier codes
Polygon number

A modern soil series that best represents the soil association was identified for each soil polygon. The soil and modifier codes provide a link to additional databases of soil properties. In this way, both detailed and reconnaissance soil map polygons were related to soil drainage, surface texture, and other soil properties to produce various interpretive maps.

SOIL AND TERRAIN OVERVIEW

The Rural Municipality (RM) of Oakland covers 6 Townships (approximately 58 000 ha) in south-western Manitoba. The Town of Wawanesa is the largest population centre in the municipality. Land use is predominantly agriculture.

Portions of four reconnaissance soil maps (scale of 1:126 720) were compiled and digitized to provide the soil coverage for the municipality. These were the Reconnaissance Soil Surveys of South-Western Manitoba (Ellis and Shafer, 1940), South-Central Manitoba (Ellis and Shafer, 1943), the Rossburn and Virden Maps Sheet Areas (Ehrlich et al., 1956), and the Carberry Map Sheet Area (Ehrlich et al., 1957). More detaield information is provided at a scale of 1:20 000 for selected areas in Soils of the Brandon Region (Michalyna et al., 1976) and for the area around the Town of Wawanesa (Podolsky, 1985).

Climatic data from Souris (Environment Canada, 1982), indicates the mean annual temperature is 2.3°C; mean annual precipitation is 456 mm; frost-free period is 105 days and growing degree days above 5°C is 1697. The seasonal moisture deficit between May to September is 250 to 300 mm. Effective growing degree days (EGDD) above 5°C accumulated for the period from seeding to the first frost in fall is approximately 1500; this parameter provides an indication of heat energy available for crop growth (Agronomic Interpretations Working Group, 1995). These conditions are generally adequate for cereal crop production.

Terrain conditions in the municipality vary from level and gently undulating to hummocky. The Souris River Valley is a major topographic feature in the municipality, traversing the southeast portion of the area from southwest to northeast. The valley varies from one to two km in width, and has a depth of 20 to 50 metres. The Assiniboine River cuts across the extreme northeast corner of the municipality within a large valley similar in size to that of the Souris River. The west-central portions of the RM consist of a stony, glacial till upland area (approximately 40% of the total RM area), represented by portions of the Brandon Hills and the Tiger

Hills. Surface forms are hummocky to ridged, and slopes are generally from 5 to 15 percent, with some significantly steeper, higher relief areas occurring in the Brandon Hills (Tp 8, Rge 18W).

Dominant soil types in the municipality are Orthic and Calcareous Black Chernozems in the well drained upper and mid slope positions, Gleyed Black soils in lower slopes and Gleysolic soils in depressional positions. Regosolic soils occur in the bottom lands of the two major river valleys.

The Brandon Hills and Tiger Hills areas are represented by soils of the Tiger Hills and Hilton Associations. These soils range in agriculture capability from 2T to 6T, depending on the slope conditions. Steeper areas have a severe risk of water erosion. These areas are generally poor for irrigation (classes 3 and 4), mainly due to topography.

Medium to fine textured soils of the Carroll Association occur throughout extensive areas in the eastern half of the RM. These are dominantly imperfectly drained soils in association with some well drained areas, developed on stone free glacial lacustrine sediments. Topography is level to gently undulating. Carroll soils have a high capability for agriculture (mainly CLI class 2 and some class 1). They are well suited for annual crop production. They are considered suitable for irrigation (classes 1 and 2) with potential environmental impact under irrigation varying from minimal to low.

A small portion of the Assiniboine Delta, an extensive area of coarse textured glaciofluvial deposits, occurs in the north-eastern corner of the municipality. Areas with coarse sand and gravel deposits are mapped as the Marringhurst Association. Soils with a sandy surface and a gravelly subsurface are classified in the Miniota Association. Miniota and Marringhurst soils are very droughty, generally rated as agriculture capability class 4M and 5M, respectively. These soils are best suited for use as permanent pasture, and have a severe risk of wind erosion if disturbed. Irrigation suitability is poor to fair and the potential for adverse environmental impact is moderate to high. Where the glaciolacustrine sands are overlain by fine sandy loam textured deposits, they are recognized as the Stockton Association. The finer surface texture gives these soils a higher water retention capacity, resulting in an agricultural capability rating of class 2. Irrigation suitability of these soils is good to excellent and the potential for environmental impact is low to moderate.

Soil and terrain conditions associated with the Souris River Valley are quite variable. The valley bottom consists of loam textured alluvial deposits of recent origin. These are highly productive soils, although they have some restrictions due to annual flood hazard, variable textures and drainage, and field size restrictions due to the scrolled and terraced nature of the alluvial landforms. Similar soil and terrain conditions also occur in the Assiniboine valley.

The steeply sloping walls of the Souris River Valley are mapped as Eroded Slopes Complex, and are rated in agricultural capability class 5T to 7T. Most of these soils remain in native vegetation, providing wildlife habitat and recreation use. These soils have a severe risk of water erosion if the stabilizing vegetation is removed. Similar land use restrictions exist on the steep valley walls associated with the Assiniboine River valley.

DERIVED AND INTERPRETIVE MAPS

A large variety of computer derived and interpretive maps can be generated, once the soil and terrain data are stored in digital format. These maps are based on selected combinations of database values and assumptions.

Derived maps show information that is given in one or more columns in the computer map legend (such as soil texture, drainage, stoniness, or slope class).

Interpretive maps portray a more complex evaluation of information presented in the legend which is combined in a unique way to arrive at an entirely new map.

Several examples of derived and interpretive maps are included in this information bulletin. The maps have all been reduced in size and generalized (simplified), in order to portray conditions for an entire rural municipality on one page. Only interpretations based on the dominant soil and terrain conditions in each polygon are shown at such reduced scales. These generalized maps provide a useful overview of conditions within a municipality, but are not intended to apply to site specific land parcels.

The digital databases may also contain more detailed information concerning significant inclusions of differing soil and slope conditions in each map polygon, particularly where they have been derived from modern detailed soil maps. This information can be portrayed at larger map scales.

Information concerning particular interpretive maps, and the primary soil and terrain map data, can be obtained by contacting the Manitoba Land Resource Unit.

Slope Map.

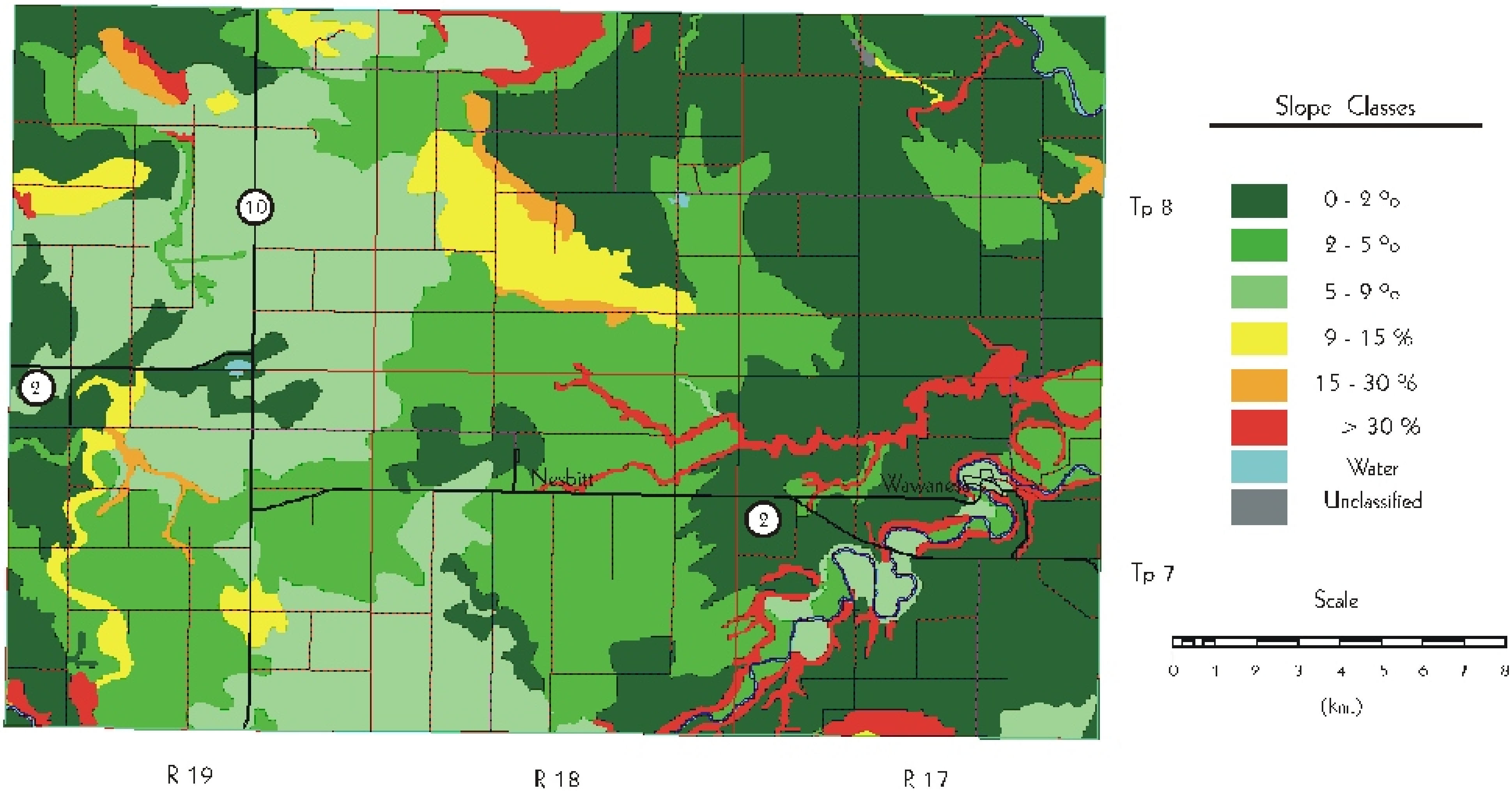
Slope describes the steepness of the landscape surface. The slope classes shown on this map are derived from the digital terrain layer database. Specific colours are used to indicate the most significant, limiting slope class for each terrain polygon in the RM. Additional slope classes can occur in each polygon area, but cannot be portrayed at this reduced map scale.

Table 1. Slope Classes[1]

Slope Class	Area (ha)	Percent of RM
0 - 2 %	22277	38.4
2 - 5 %	16576	28.6
5 - 9 %	12745	22.0
9 - 15 %	2661	4.6
15 - 30 %	733	1.3
> 30 %	2703	4.7
Water	226	0.4
Unclassified	22	0.0
Total	57943	100.0

[1] Area has been assigned to the most significant limiting slope for each terrain polygon. Significant areas of lesser slope, and smaller areas of greater slope may occur in each terrain polygon.

Rural Municipality of Oakland Slope Map



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Surface Form Map.

Surface forms describe the overall topography of the earth's surface. The various surface forms may exhibit a regular (or irregular) pattern of convexities and concavities, and are commonly associated with characteristic ranges of slope gradients and slope lengths. Surface forms may also imply particular modes of origin. For example, scrolled and terraced surface forms are created by river and stream deposits, while undulating and hummocky surface forms are frequently associated with glacial moraines. A description of the various surface form classes are contained in a separate Soil and Terrain Classification System Manual (Manitoba Land Resource Unit, 1996).

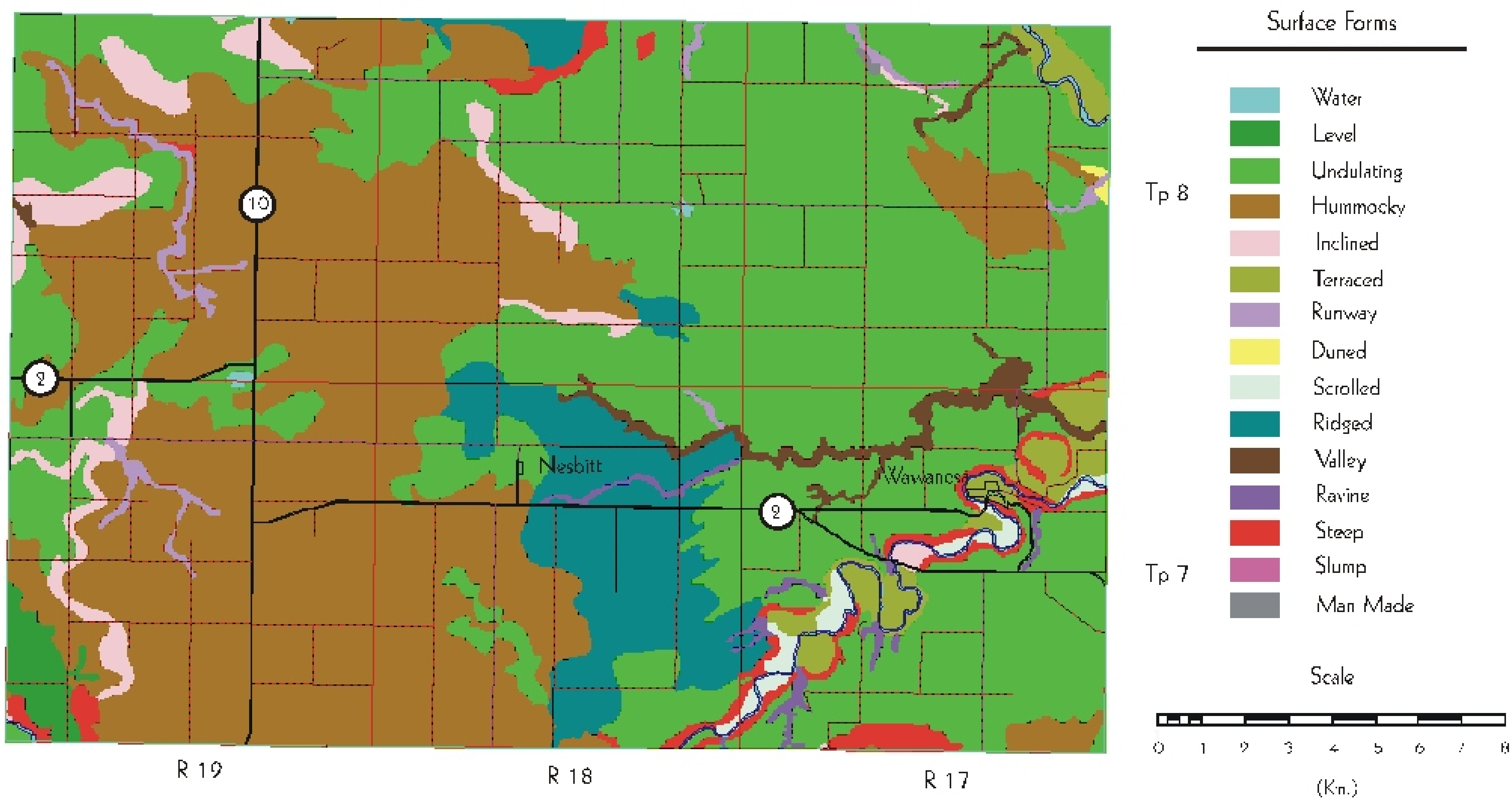
Surface form and slope class are two key features of the digital terrain map layer. Both of these characteristics are important as controlling and influencing factors to consider for sustainable land use planning and management.

Table 2. Surface Form and Slope Classes[1]

Surface Form Slope Class	Area (ha)	Percent of RM
Water	**226**	**0.4**
Scrolled	**383**	**0.7**
C (2.0 to 5.0%)	383	0.7
Duned	**35**	**0.1**
F (16.0 to 30.0%) 35	0.1	
Hummocky	**20467**	**35.3**
C (2.0 to 5.0%)	6792	11.7
D (6.0 to 9.0%)	12016	20.7
E (10.0 to 15.0%)	1659	2.9
Inclined	**1824**	**3.1**
C (2.0 to 5.0%)	266	0.5
D (6.0 to 9.0%)	126	0.2
E (10.0 to 15.0%) 847	1.5	
F (16.0 to 30.0%) 502	0.9	
H (31.0 to 70.0%) 83	0.1	
Level	**503**	**0.9**
B (0.5 to 2.0%)	503	0.9
Ravine	**345**	**0.6**
H (31.0 to 70.0%) 92	0.2	
J (> 70.0%)	253	0.4
Ridged	**4041**	**7.0**
C (2.0 to 5.0%)	3639	6.3
E (10.0 to 15.0%) 154	0.3	
H (31.0 to 70.0%) 235	0.4	
J (> 70.0%)	13	0.0
Steep	**1199**	**2.1**
J (> 70.0%)	1199	2.1
Terraced	**1310**	**2.3**
B (0.5 to 2.0%)	53	0.1
C (2.0 to 5.0%)	678	1.2
D (6.0 to 9.0%)	580	1.0
Undulating	**26165**	**45.2**
B (0.5 to 2.0%)	21722	37.5
C (2.0 to 5.0%)	4443	7.7
Runway	**595**	**1.0**
C (2.0 to 5.0%)	376	0.6
D (6.0 to 9.0%)	23	0.0
F (16.0 to 30.0%) 197	0.3	
Valley	**829**	**1.4**
H (31.0 to 70.0%) 93	0.2	
J (> 70.0%)	736	1.3
Man Made	**22**	**0.0**
Total	**57943**	**100.0**

[1] Area has been assigned to the most significant limiting slope for each terrain polygon. Significant areas of lesser slope, and smaller areas of greater slope may occur in each terrain polygon.

Rural Municipality of Oakland Surface Form Map



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Generalized Soil Map.

All soil polygons on the original published reconnaissance maps were digitized to create the soil layer. In some cases, areas of overprinted symbols on the original maps were delineated as additional new soil polygons.

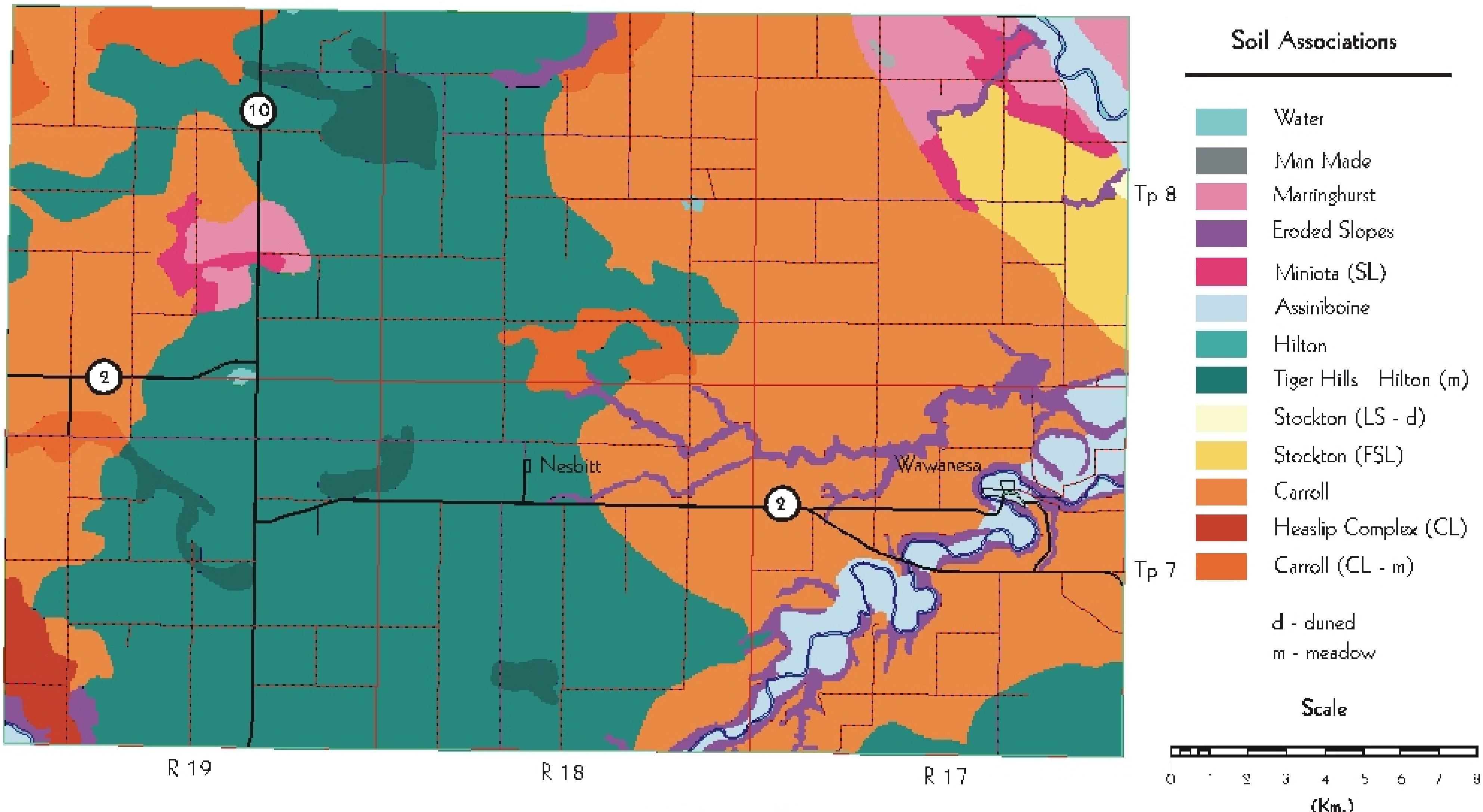
This generalized soil map has been reduced in size and simplified by grouping the original soil association polygons. The groups have been colour themed according to similar modes of origin, texture, and soil drainage. Soils derived from glacial till deposits (typically loam to clay loam in texture) have been assigned blue and green colours. Soils developed from glacial lake deposits are coloured yellow (sandy), orange (loam), or brown (clay). Sand and gravel deposits are coloured in pink.

The groups have been named after the dominant soil association, and the statistics for each the of the groups have been summarized (in bold). The original reconnaissance map symbol types and their areal extent in the municipality are shown within each group.

Table 3. Generalized Soil Association Groups

Association Group Associate	Area (ha)	Percent of RM
Water	**226**	**0.4**
Man Made	**20**	**0.0**
Marringhurst	**1554**	**2.7**
M	692	1.2
Ma	712	1.2
Ms	150	0.3
Eroded Slopes	**2280**	**3.9**
Er	2280	3.9
Miniota (SL)	**738**	**1.3**
M (meadow)	459	0.8
Ma (meadow)	278	0.5
Assiniboine	**1854**	**3.2**
As	1623	2.8
As (meadow)	204	0.4
Co	27	0.0
Hilton	**23824**	**41.1**
Hn	15156	26.2
T	1134	2.0
T-H	92	0.2
T-Hn	6965	12.0
Tc (meadow)	316	0.5
Th	161	0.3
Tiger Hills - Hilton (m)	**1469**	**2.5**
Hn (meadow)	371	0.6
Hnc (meadow)	283	0.5
T-H (meadow)	815	1.4
Stockton (LS - d)	**19**	**0.0**
Snls (duned)	19	0.0
Stockton (FSL)	**1681**	**2.9**
Snfsl	1681	2.9
Carroll	**21990**	**38.0**
Bd	3724	6.4
C	7020	12.1
Cc	669	1.2
Ccl	10248	17.7
Ccs	328	0.6
Heaslip Complex (CL)	**518**	**0.9**
Hx(Cl)	182	0.3
Hx(Cl) (meadow)	336	0.6
Carroll (CL-m)	**1771**	**3.1**
Cc (meadow)	261	0.5
Ccl (meadow)	1038	1.8
Ccl (saline)	472	0.8
Total	**57943**	**100.0**

Rural Municipality of Oakland Generalized Soil Map



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Agricultural Capability Map.

This evaluation utilizes the 7 class Canada Land Inventory system (CLI, 1965). Classes 1 to 3 represent the prime agricultural land, classes 4 and 5 represent marginal lands, and classes 6 and 7 are considered unsuitable for dryland agriculture.

This generalized interpretive map is based on the dominant modern soil type for the soil polygon, in combination with the dominant slope class identified from the terrain polygon layer. The nature of the CLI subclass limitations and the classification of subdominant components cannot be portrayed at this generalized map scale.

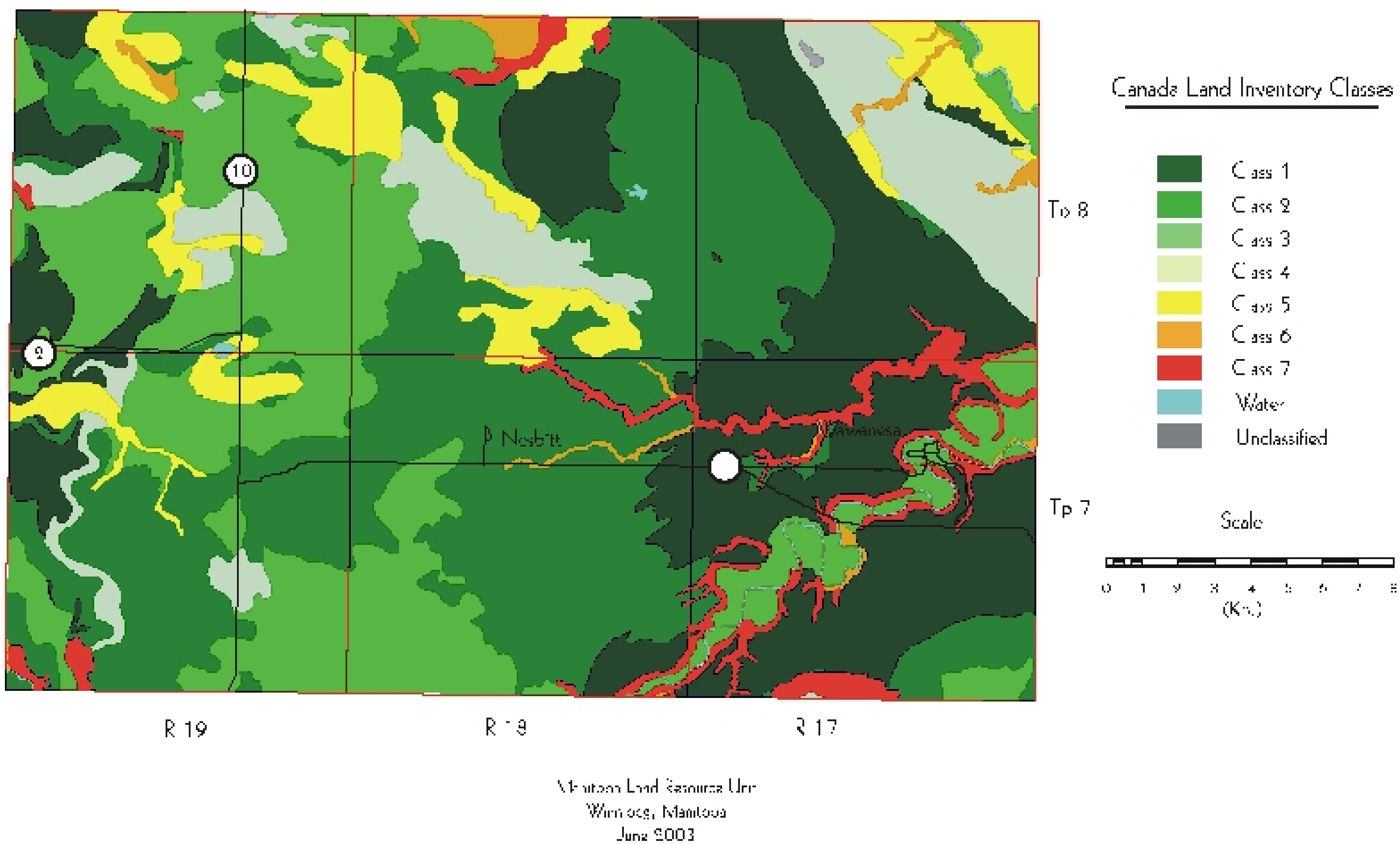
Table 4. Agricultural Capability[1]

Class Subclass	Area (ha)	Percent of RM
1	**12685**	**21.9**
2	**18777**	**32.4**
2IW	26	0.0
2P	514	0.9
2T	10965	18.9
2TP	935	1.6
2TW	1266	2.2
2W	2822	4.9
2X	2249	3.9
3	**13559**	**23.4**
3	595	1.0
3I	1033	1.8
3N	785	1.4
3T	11140	19.2
3TN	6	0.0
4	**5411**	**9.4**
4	42	0.1
4M	2815	4.9
4MT	32	0.1
4T	2523	4.4
5	**4300**	**7.4**
5	548	0.9
5M	381	0.7
5T	576	1.0
5W	2590	4.5
5WI	204	0.4
6	**687**	**1.2**
6	10	0.0
6M	18	0.0
6T	659	1.1
7	**2206**	**3.8**
7	115	0.2
7T	2090	3.6
Unclassified	**22**	**0.0**
Water	**225**	**0.4**
Total	**57872**	**100.0**

[1] Based on **dominant** soil and slope of the respective soil and terrain maps.

Rural Municipality of Oakland

Agriculture Capability Map



Irrigation Suitability Map.

Irrigation suitability is a four class rating system. Classes are **Excellent, Good, Fair, and Poor**. Irrigation ratings are based on an assessment of the most limiting combination of soil and landscape conditions. Soils in the same class have a similar relative suitability or degree of limitation for irrigation use, although the specific limiting factors may differ. These limiting factors are described by subclass symbols at detailed map scales. The irrigation rating system does not consider water availability, method of application, water quality, or economics of irrigated land use.

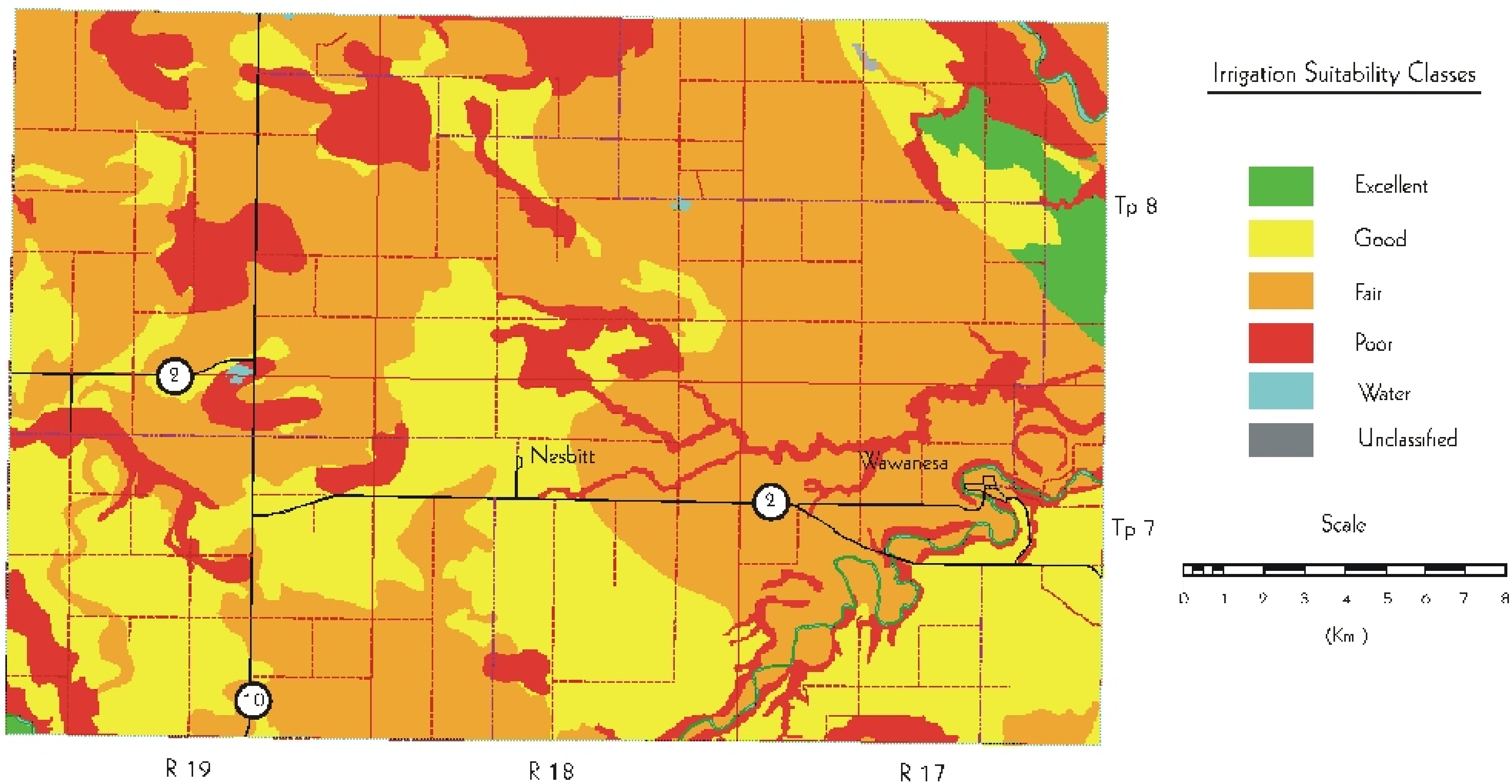
This generalized interpretive map is based on the dominant soil series for each soil polygon, in combination with the dominant slope class from the terrain layer database. The nature of the subclass limitations, and the classification of subdominant components is not shown at this generalized map scale.

Table 5. Irrigation Suitability[1]

Class	Area (ha)	Percent of RM
Excellent	1077	1.9
Good	17613	30.4
Fair	30561	52.7
Poor	8444	14.6
Organic	0	0.0
Water	226	0.4
Unclassified	22	0.0
Total	57943	100.0

[1] Based on **dominant** soil and slope of the respective soil and terrain maps.

Rural Municipality of Oakland Irrigation Suitability Map



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Potential Environmental Impact Under Irrigation.

A major concern for land under irrigated crop production is the possibility that surface and/or groundwater may be impacted. The potential environmental impact assessment provides a relative rating of land into 4 classes (minimal, low, moderate and high) based on an evaluation of specific soil factors and landscape conditions that determine the impact potential.

Soil factors considered are those properties that determine water retention and movement through the soil; topographic features are those that affect runoff and redistribution of moisture in the landscape. Specifically considered are: soil texture, hydraulic conductivity, salinity, geological uniformity, depth to watertable and topography. The risk of altering surface and subsurface soil drainage regimes, soil salinity or the potential for runoff, erosion or flooding is determined by specific criteria for each property.

Use of this rating is intended to serve as a warning of potential environmental concern. It may be possible to design and/or give special consideration to soil-water-crop management practices that will mitigate any adverse impact.

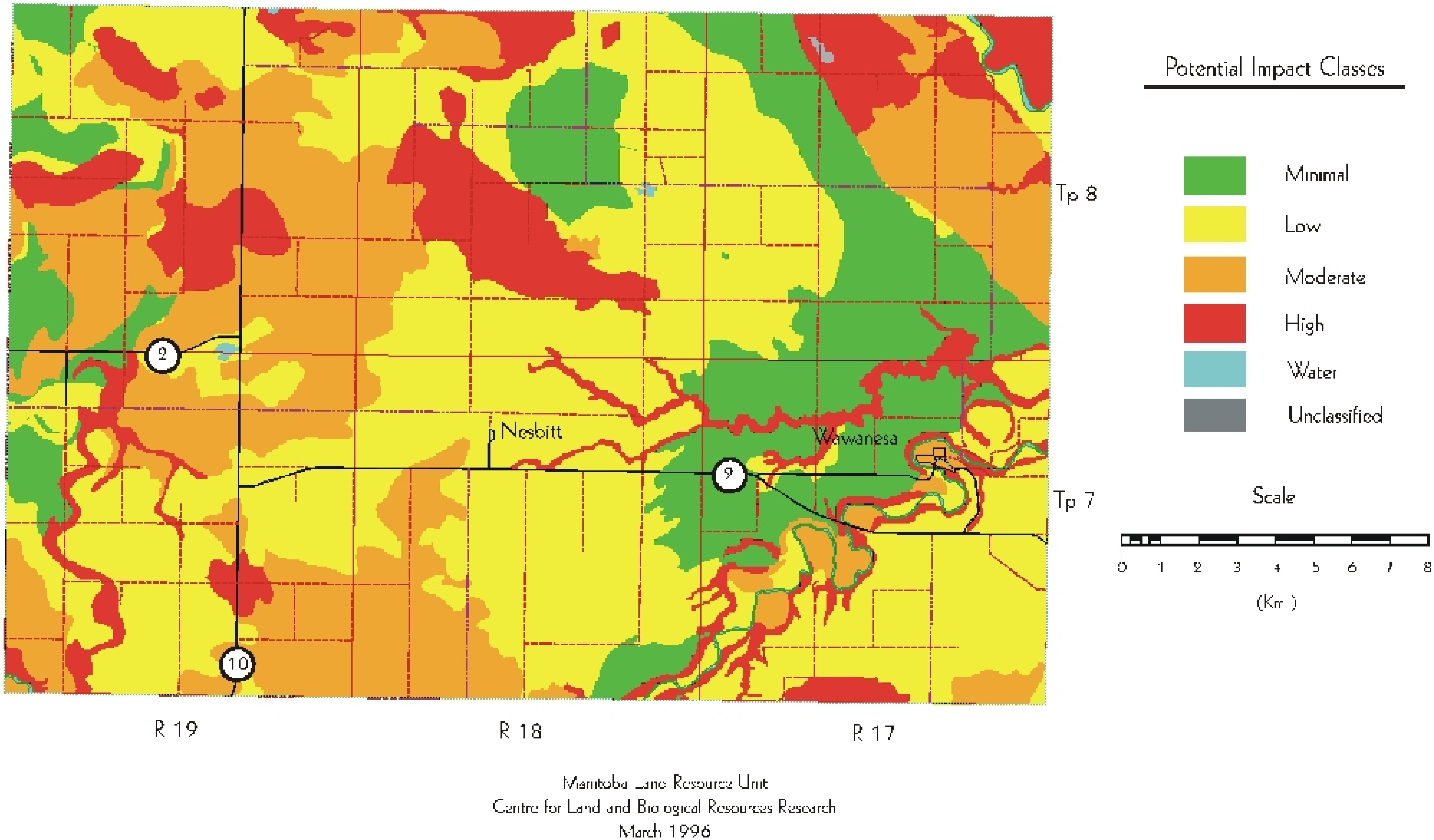
This generalized interpretive map is based on the dominant soil series for each soil polygon, in combination with the dominant slope class from the terrain layer database. The nature of the subclass limitations, and the classification of subdominant components is not shown at this generalized map scale.

Table 6. Potential Environmental Impact Under Irrigation[1]

Class	Area (ha)	Percent of RM
Minimal	9689	16.7
Low	25090	43.3
Moderate	14753	25.5
High	8163	14.1
Organic	0	0.0
Water	226	0.4
Unclassified	22	0.0
Total	57943	100.0

[1] Based on **dominant** soil, slope gradient, and slope length of the respective soil and terrain maps.

Rural Municipality of Oakland **Potential Environmental Impact Under Irrigation**



Water Erosion Risk Map.

The risk of water erosion was estimated using the universal soil loss equation (USLE) developed by Wischmeier and Smith (1965). The map shows 5 classes of soil erosion risk based on bare unprotected soil:

negligible
low
moderate
high
severe

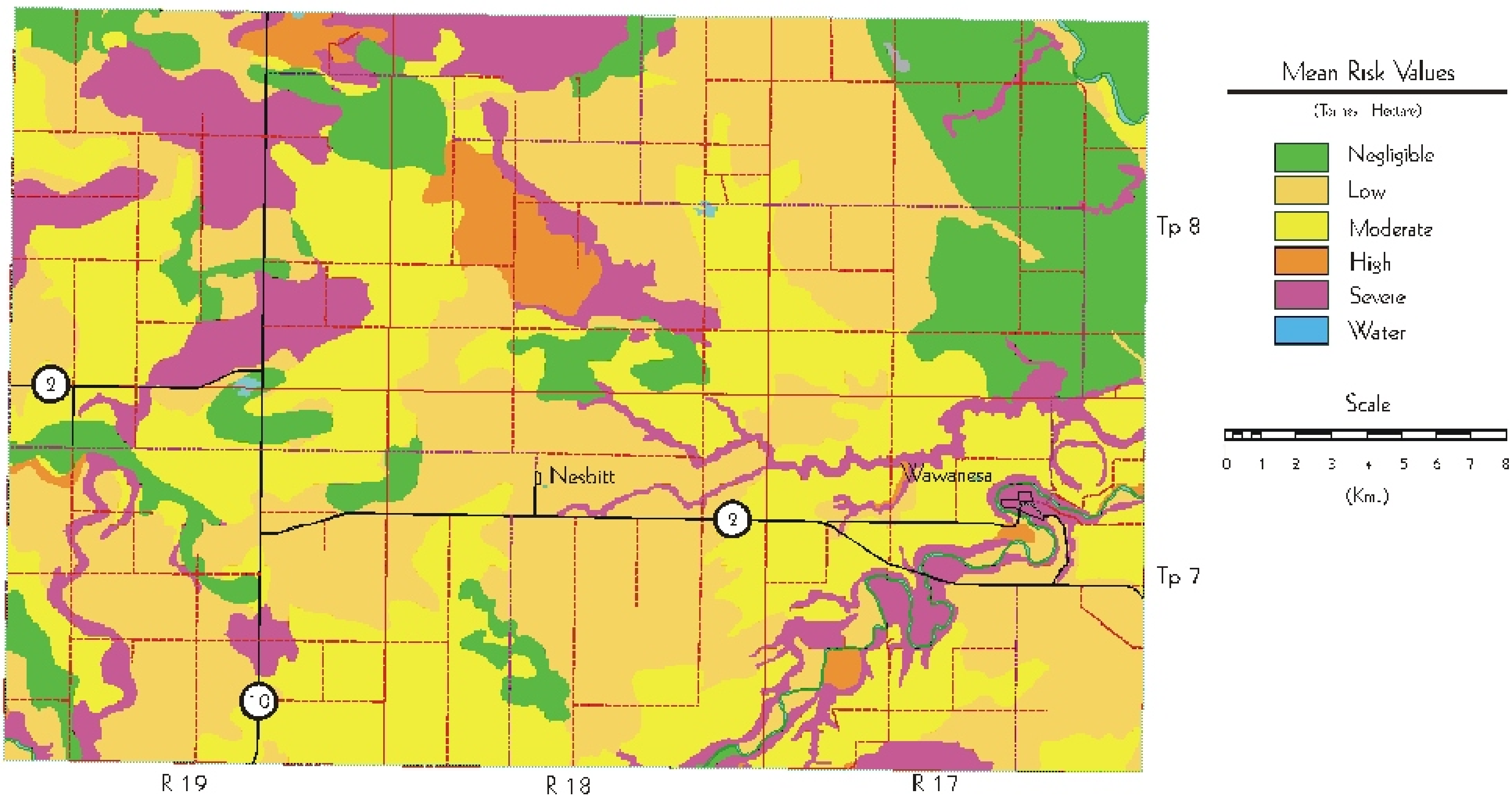
Cropping and management practices will significantly reduce this risk depending on crop rotation program, soil type, and landscape features.

Table 7. Water Erosion Risk[1]

Class	Area (ha)	Percent of RM
Negligible	**9057**	**15.6**
Low	**20847**	**36.0**
Moderate	**18205**	**31.4**
High	**1521**	**2.6**
Severe	**8066**	**13.9**
Water	**226**	**0.4**
Unclassified	**22**	**0.0**
Total	**57943**	**100.0**

[1] Based on **dominant** soil, slope gradient, and slope length of the respective soil and terrain maps.

Rural Municipality of Oakland Water Erosion Risk Map



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March 1996

REFERENCES

Agronomic Interpretations Working Group. 1995. Land Suitability Rating System for Agricultural Crops: 1. Spring-seeded Small Grains. Edited by W.W. Pettapiece. Tech. Bull. 1995-6E. Centre for Land and Biological Resources Research, Agriculture and Agri-Food Canada, Ottawa. 90 pages, 2 maps.

Canada Land Inventory. 1965. Soil Capability Classification for Agriculture. Canada Land Inventory Report No. 2. ARDA, Dept. of Forestry, Canada, Ottawa.

Ellis, J.H., and Shafer, W.H. 1940. Reconnaissance Soil Survey of South-Western Manitoba. Soils Report No. 3. Manitoba Soil Survey. Published by Manitoba Dept. of Agriculture. 104pp and map.

Ellis, J.H., and Shafer, W.H. 1943. Reconnaissance Soil Survey of South-Central Manitoba. Soils Report No. 4. Manitoba Soil Survey. Published by Manitoba Dept. of Agriculture. 146pp and map.

Ehrlich, W.A., Poyser, E.A. and Pratt, L.E. 1957 Report of Reconnaissance Soil Survey of Carberry Map Sheet Areas. Soils Report No. 7. Manitoba Soil Survey. Published by Manitoba Dept. of Agriculture. 93pp and map.

Ehrlich, W.A., Pratt, L.E. and Poyser, E.A. 1956 Report of Reconnaissance Soil Survey of Rossburn and Virden Map Sheet Areas. Soils Report No. 6. Manitoba Soil Survey. Published by Manitoba Dept. of Agriculture. 121pp and 2 maps.

Expert Committee on Soil Survey. 1987. The Canadian System of Soil Classification. Second Edition. Publ. No. 1646. Research Branch, Agriculture Canada.

MacDonald, K.B., and Valentine, K.W.G. 1992. CanSIS Manual 1 CanSIS/NSDB: A General Description. Land Resource Division, Centre for Land and Biological Resources Research, Research Branch, Agriculture Canada, Ottawa.

Manitoba Land Resource Unit. 1996. Soil and Terrain Classification System Manual. In preparation. Ellis Bldg. University of Manitoba. Winnipeg.

PFRA. 1964. Handbook for the Classification of Irrigated Land on the Prairie Provinces. PFRA, Regina, Saskatchewan.

Podolsky, G. 1985. Soils of the Souris, Virden and Wawanesa Townsites. Report No. D56. Canada-Manitoba Soil Survey. Winnipeg.

Wishmeier, W.H. and Smith, D.D. 1965 Predicting Rainfall-erosion Loss from Cropland East of the Rocky Mountains. U.S. Department of Agriculture, Agriculture Handbook No. 282, U.S. Government Printing Office, Washington, D.C.

ADDENDUM

Land Use Map.

The land use classification of the RM has been interpreted from LANDSAT satellite imagery, using supervised computer classification techniques. Many individual spectral signatures were classified and grouped into the seven general land use classes shown here. Although land use changes over time, and some land use practices on individual parcels may occasionally result in similar spectral signatures, this map provides a general representation of the current land use in the RM.

The following is a brief description of the land use classes.

Annual Crop Land - land that is normally cultivated on an annual basis.

Forage - perennial forages, generally alfalfa or clover with blends of tame grasses.

Grasslands - areas of native or tame grasses, may contain scattered stands of shrubs.

Trees - lands that are primarily in tree cover.

Wetlands - areas that are wet, often with sedges, cattails, and rushes.

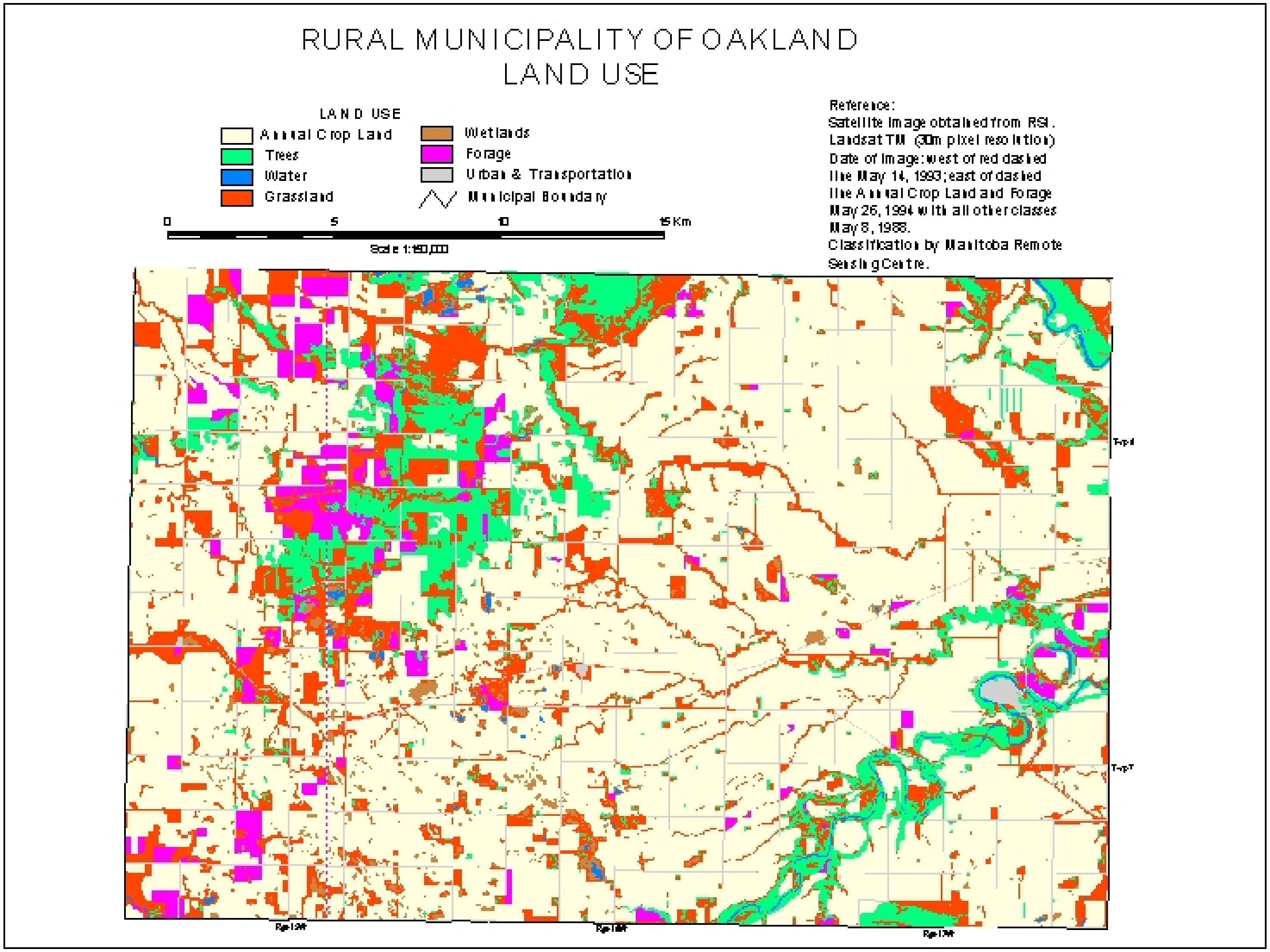
Water - open water - lakes, rivers streams, ponds, and lagoons.

Urban and Transportation - towns, roads, railways, quarries.

Table 10. Land Use[1]

Class	Area (ha)	Percent of RM
Annual Crop Land	38912	66.7
Forage	1983	3.4
Grasslands	8780	15.1
Trees	5462	9.4
Wetlands	994	1.7
Water	320	0.5
Urban and Transportation	1864	3.2
Total	58315	100.0

[1] Land use information (1995) and map supplied by Prairie Farm Rehabilitation Administration. Areas may vary from previous maps due to differences in analytical procedures.


RURAL MUNICIPALITY OF OAKLAND
LAND USE
LAND USE
Annual Crop Land
Trees
Water
Grassland
Wetlands
Forage
Urban & Transportation
Municipal Boundary
0
5
10
15 Km
Scale 1:150,000
Reference:
Satellite image obtained from RSI.
Landsat TM (30m pixel resolution)
Date of image: west of red dashed
line May 14, 1993; east of dashed
line Annual Crop Land and Forage
May 26, 1994 with all other classes
May 8, 1988.
Classification by Manitoba Remote
Sensing Centre.