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Rural Municipality of South Cypress


Information Bulletin 96-5

Soils and Terrain

An introduction
to the land resource

Land Resource Unit
Brandon Research Centre



Canada 

Rural Municipality of South Cypress

Information Bulletin 96-5

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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 soils 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 soils and terrain maps at larger scales, may be obtained by contacting:

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CITATION

Manitoba Land Resource Unit, 1996. Soils and Terrain. An introduction to the land resource. Rural Municipality of South Cypress, Information Bulletin 96-5, Ellis Bldg, University of Manitoba. Winnipeg.

ACKNOWLEDGEMENTS

This project was supported under the Canada-Manitoba Agreement of Agricultural Sustainability.

The following individuals and agencies contributed significantly to the compilation, interpretation, and derivation of the information contained in this report.

Managerial and administrative support was provided by:

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K.S. McGill, Chief, Land Utilization and Soil Survey, Soils and Crops Branch, Manitoba Agriculture.

Technical support was provided by:

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J. Fitzmaurice, N. Lindberg, K. Gehman, A. Waddell, and M. Fitzgerald, Dept. of Soil Science, University of Manitoba.
R. Lewis, PFRA, Agriculture and Agri-Food Canada.

Professional expertise for data conversion, correlation, and interpretation was provided by:

W.R. Fraser and W. Michalyna of the Manitoba Land Resource Unit, CLBRR, Agriculture and Agri-Food Canada.
P. Haluschak and G. Podolsky, Manitoba Soil Survey Unit, Soils and Crops Branch, Manitoba Agriculture.

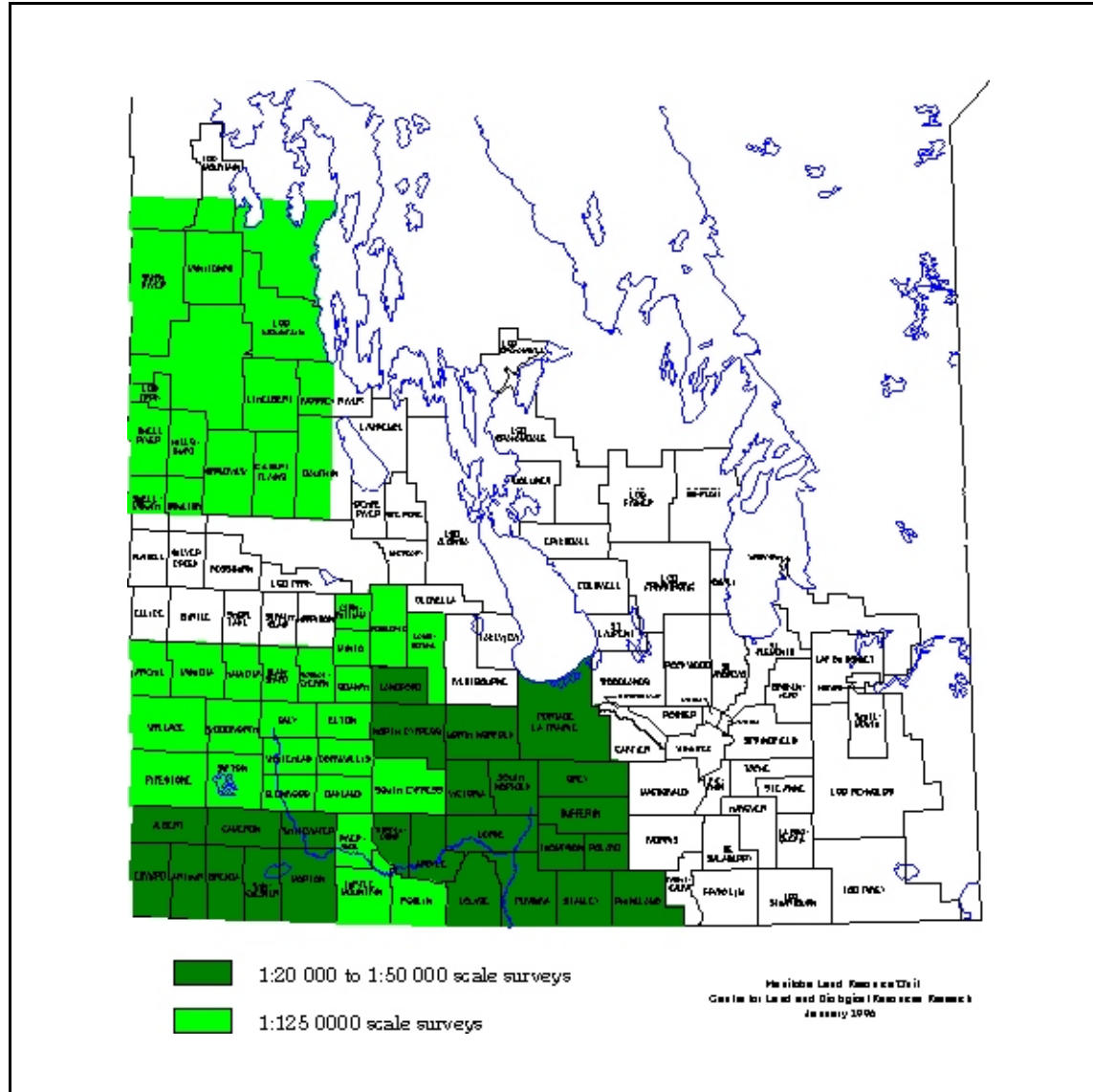


Figure 3. Rural municipalities in southern Manitoba with digital soil and terrain map information (1996).

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.

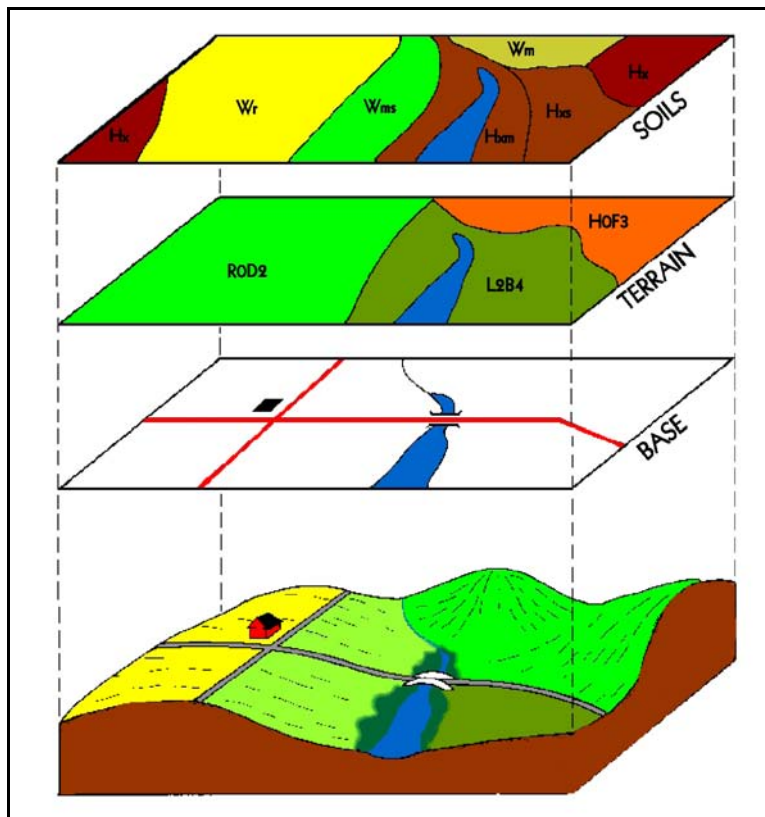


Figure 2. Soil, Terrain, and Base Map data.

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
- 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 provided 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 of South Cypress covers 11.5 Townships (approximately 183 000 ha) in south-central Manitoba. The town of Glenboro is the largest population centre in the municipality. Land use within the RM includes agriculture in the southern portion and recreation use in Spruce Woods Provincial Park. The Spruce Woods Forest Reserve also serves as a military reserve and training area.

Soils in the municipality of South Cypress have been mapped previously in the Reconnaissance Soil Survey of South-Central Manitoba (Ellis and Shafer, 1943) and the Reconnaissance Soil Survey of Carberry Map Sheet Area (Ehrlich et al., 1957). An area around the Town of Glenboro has been mapped in detail (1:20 000 scale) (Michalyna, 1979).

Based on climatic data from Glenboro (Environment Canada, 1982), mean annual temperature is 2.4°C; mean annual precipitation is 523 mm; mean growing season precipitation during May to September is 310 mm; frost-free period is 117 days and growing degree days above 5°C is 1757. The seasonal moisture deficit for the period May to September is 250 to 300 mm, and effective growing degree days (EGDD) above 5°C for the same period range from 1500 to 1600 (Agronomic Interpretations Working Group, 1995). This is suitable for growing cereals, oilseed and forages where soil conditions are favourable.

The RM is situated within the Brandon Lakes Plain and the Upper Assiniboine Delta. Elevation in the municipality ranges from 570 masl in the southwest corner decreasing to approximately 358 m in the northeast; elevations in the central portion of the RM are around 366 m. Relief in the municipality varies from level to very gently sloping to gently sloping and strongly sloping terrain. The Brandon Lakes Plain in the southwestern portion of the RM is characterized by level terrain and sandy to loamy textured lacustrine sediments deposited in former Glacial Lake Brandon and a subsequent extension of Glacial Lake Agassiz. The Upper Assiniboine Delta is characterized by level terrain and sandy textured fluvial outwash deposits and loamy textured deltaic and lacustrine sediments

associated with Lake Agassiz. Most of the coarse sandy deposits have been modified by wind and are in the form of stabilized dunes (36% of the RM) with relief up to 20 m and slopes up to 30%. The dominant soils in the RM of South Cypress are Black Chernozems on well to imperfectly drained sandy to loamy sediments and Orthic Regosols developed on rapidly to well drained sandy materials.

Within the Upper Assiniboine Delta, soils have been mainly described as the Stockton loamy sands, duned phase and Miniota sands (sandy over coarse sand to gravelly). Agriculture capability is class 6 and 7 and the soils generally are unsuitable for irrigation due to low water retention and topography. These soils have a high potential for adverse environmental impact when irrigated. They are very susceptible to wind erosion if surface vegetation is disturbed. The duned areas are mainly used as park land for recreation and wildlife.

Within the Brandon Lakes Plain, the soils are mainly Stockton sandy loam and Glenboro fine sandy loam (loamy sediments underlain by sand). Local areas of Carroll (loam to clay loam textures) and Assiniboine (loam to clay alluvial sediments) occur. The Stockton soils developed on sandy textured sediments have a low water retention capacity and are somewhat droughty; agriculture capability is 4M. Irrigation suitability is fair due to the low water retention. They are very susceptible to erosion by wind if surface residue is not maintained. The Stockton soils are developed on fine sandy loam fluvial sediments grading to fine sands generally below 0.5 m. Agriculture capability is class 2 to 3 M; suitability for irrigation is good. They are also susceptible to erosion by wind if the surface is left unprotected.

The Glenboro soils are developed on loam to clay loam lacustrine sediments that grade to fine sand at depths below 0.7 m. Agriculture capability is class 2M; suitability for irrigation is excellent although potential for environmental impact is moderate. Risk of water erosion is low. The Carroll soils are similar to the Glenboro, except the underlying fine sand occurs at depths below 1 m. Agriculture capability is class 1; suitability for irrigation is excellent.

A small area of Hilton soils in the Tiger Hills in the southwest corner of the municipality is developed on very strongly calcareous loam to clay loam glacial till derived from limestone and granitic materials. Most of these soils are well drained but minor areas of imperfectly drained and poorly drained soils occur in lower slope and depressional positions. The Hilton soils are generally rated as class 2 or 3 for agriculture with topography being the most limiting factor. Localized areas of class 5 to 7 occur, mainly in landscapes affected by severe erosion or wetness. Due to the uneven terrain much of this area is not suitable for irrigation. Water erosion risk over the Hilton soils varies from moderate to severe depending upon slope gradients.

Near the western edge of the RM, the Souris River joins the Assiniboine River. Both the Souris and Assiniboine Rivers flow in large glacial meltwater channels eroded some 30 m into the land surface. The level to undulating land in the valley bottoms consists of alluvial deposits of the Assiniboine Association ranging from sandy loam to clay in texture. Agriculture capability is mainly 2 to 3 depending on the frequency of inundation; these soils are good to fair for irrigation suitability. Risk of water erosion is low. The valley sides mapped as Eroded Slopes Complex are steeply sloping with variable textures and extensive seepage. Agricultural capability is dominantly class 6 and 7T. These steep slopes remain mainly in native vegetation providing wildlife habitat and recreation use.

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 interpretative 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.

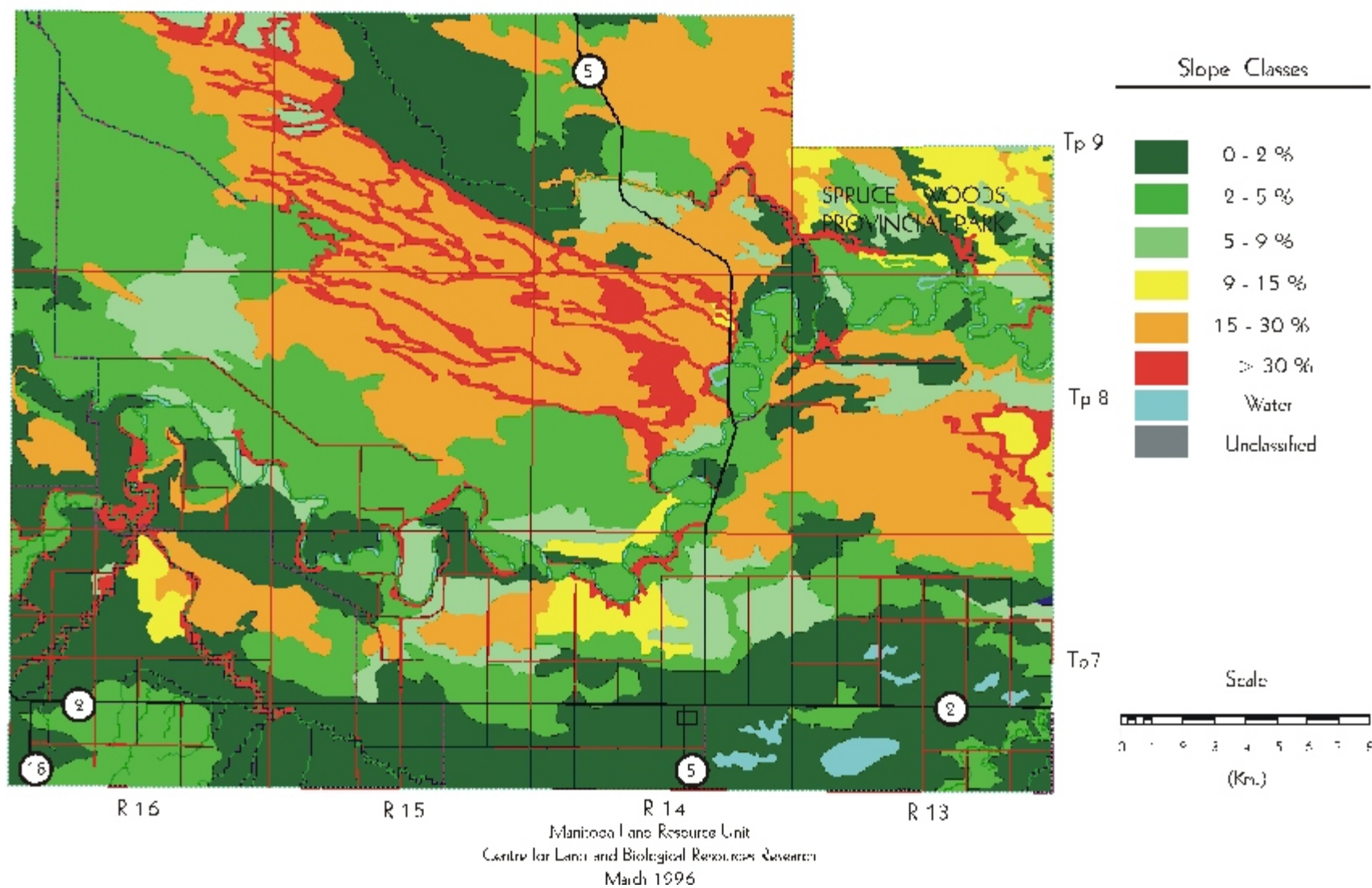
Table 1. Slope Classes¹

Slope Class	Area (ha)	Percent of RM
0 - 2 %	30752	27.7
2 - 5 %	31768	28.6
5 - 9 %	8725	7.8
9 - 15 %	3791	3.4
15 - 30 %	27500	24.7
> 30 %	6968	6.3
Water	1660	1.5
Unclassified	0	0.0
Total	111163	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 South Cypress

Slope Map



Surface Form Map.

Surface forms describe the overall shape 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. They 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 controlling and influencing factors to consider for sustainable land use planning and management.

Table 2. Surface Form and Slope Classes¹

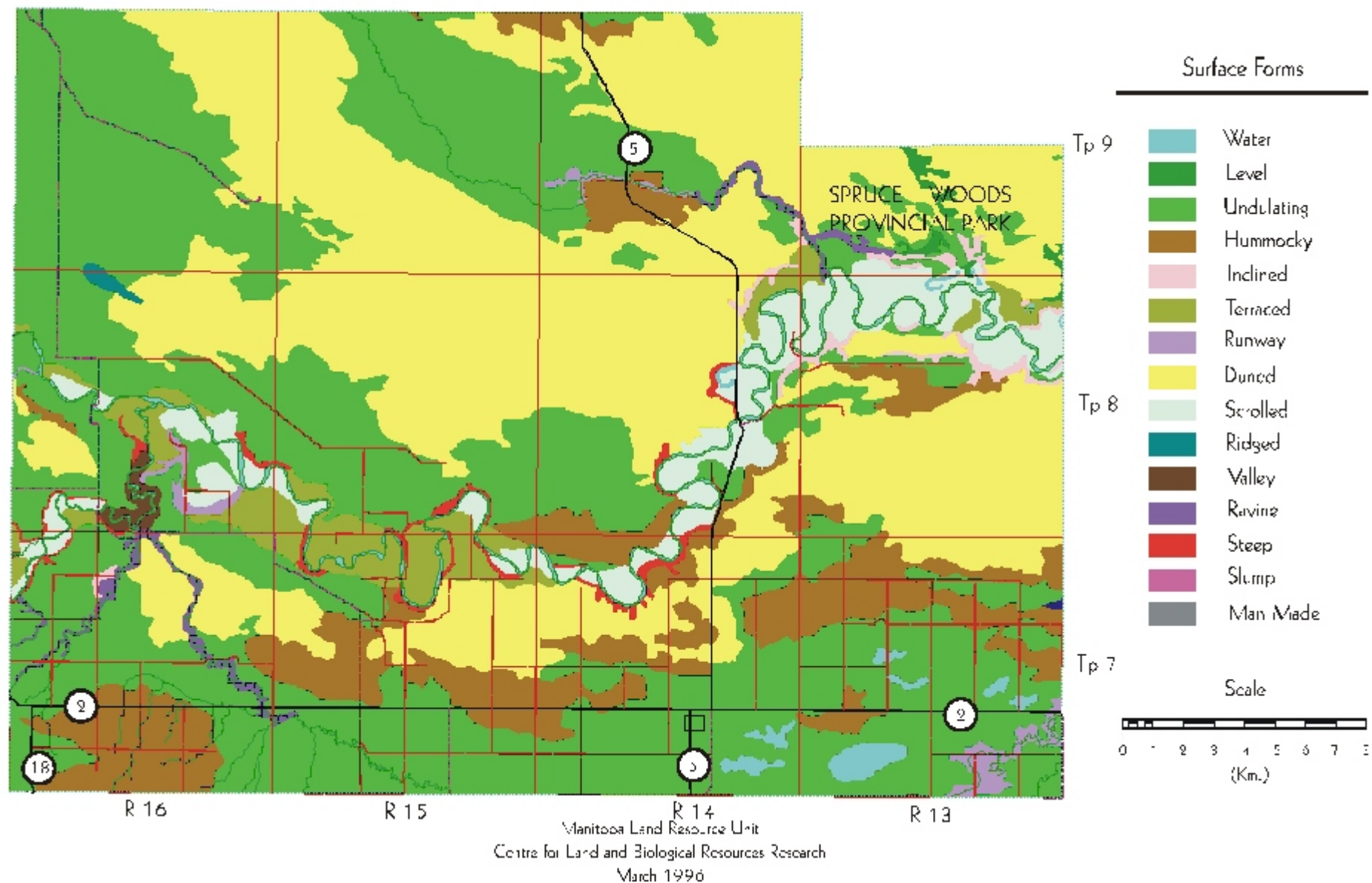
Surface Form Slope Class	Area (ha)	Percent of RM
Scrolled	5281	4.8
B (0.5 to 2.0%)	321	0.3
C (2.0 to 5.0%)	4372	3.9
D (6.0 to 9.0%)	587	0.5
Duned	39960	35.9
C (2.0 to 5.0%)	280	0.3
D (6.0 to 9.0%)	4874	4.4
E (10.0 to 15.0%)	3369	3.0
F (16.0 to 30.0%)	26629	24.0
H (31.0 to 70.0%)	703	0.6
J (> 70.0%)	4105	3.7
Hummocky	11081	10.0
C (2.0 to 5.0%)	8007	7.2
D (6.0 to 9.0%)	2760	2.5
E (10.0 to 15.0%)	315	0.3

Surface Form Slope Class	Area (ha)	Percent of RM
Inclined	749	0.7
D (6.0 to 9.0%)	52	0.0
E (10.0 to 15.0%)	107	0.1
F (16.0 to 30.0%)	371	0.3
H (31.0 to 70.0%)	219	0.2
Level	322	0.3
A (0.0 to 0.5%)	322	0.3
Ravine	881	0.8
H (31.0 to 70.0%)	275	0.2
J (> 70.0%)	606	0.5
Ridged	117	0.1
F (16.0 to 30.0%)	117	0.1
Steep	760	0.7
J (> 70.0%)	760	0.7
Terraced	3536	3.2
B (0.5 to 2.0%)	1979	1.8
C (2.0 to 5.0%)	1105	1.0
D (6.0 to 9.0%)	453	0.4
Undulating	45673	41.1
B (0.5 to 2.0%)	28131	25.3
C (2.0 to 5.0%)	17543	15.8
Runway	844	0.8
C (2.0 to 5.0%)	462	0.4
F (16.0 to 30.0%)	383	0.3
Valley	300	0.3
J (> 70.0%)	300	0.3
Water	1660	1.5
Total	111163	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 South Cypress

Surface Form Map



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 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.

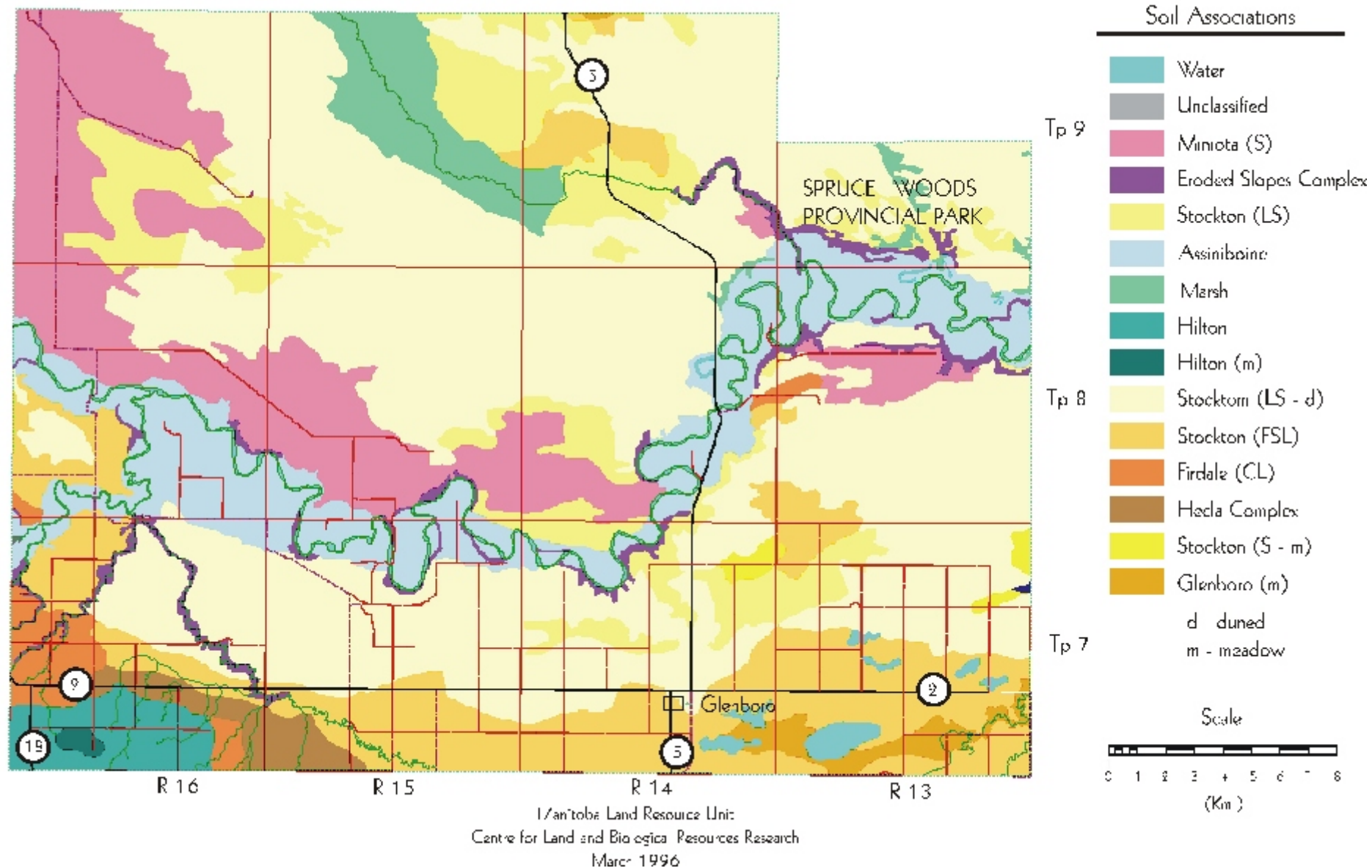
Table 3. Generalized Soil Association Groups

Association Group Associate	Area (ha)	Percent of RM
Miniota (S)	13401	12.1
Ms	13401	12.1
Eroded Slopes Complex	2145	1.9
Er	2145	1.9
Stockton (LS)	10423	9.4
Snls	10423	9.4
Assiniboine	11045	9.9
As	7458	6.7
As (meadow)	2978	2.7
As (wooded)	609	0.5

Association Group Associate	Area (ha)	Percent of RM
Marsh	3561	3.2
Mh	3561	3.2
Hilton	1929	1.7
Hn	1929	1.7
Hilton (m)	1471	
Hn (meadow)	147	0.1
Stockton (LS - d)	48798	43.9
Ds	4299	3.9
Sn	8939	8.0
Snls (duned)	35560	32.0
Stockton (FSL)	13495	12.1
Gl	10846	9.8
Snfsl	2649	2.4
Firdale (CL)	1678	1.5
C	1428	1.3
Ccl	80	0.1
Fcl	170	0.2
Hecla Complex	1403	1.3
He.x	1403	1.3
Stockton (S - m)	453	0.4
Sn (meadow)	453	0.4
Glenboro (m)	1029	0.9
Gl (meadow)	1005	0.9
Snfsl (meadow)	24	0.0
Water	1660	1.5
Total	111163	100.0

Rural Municipality of South Cypress

Generalized Soil Map



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.

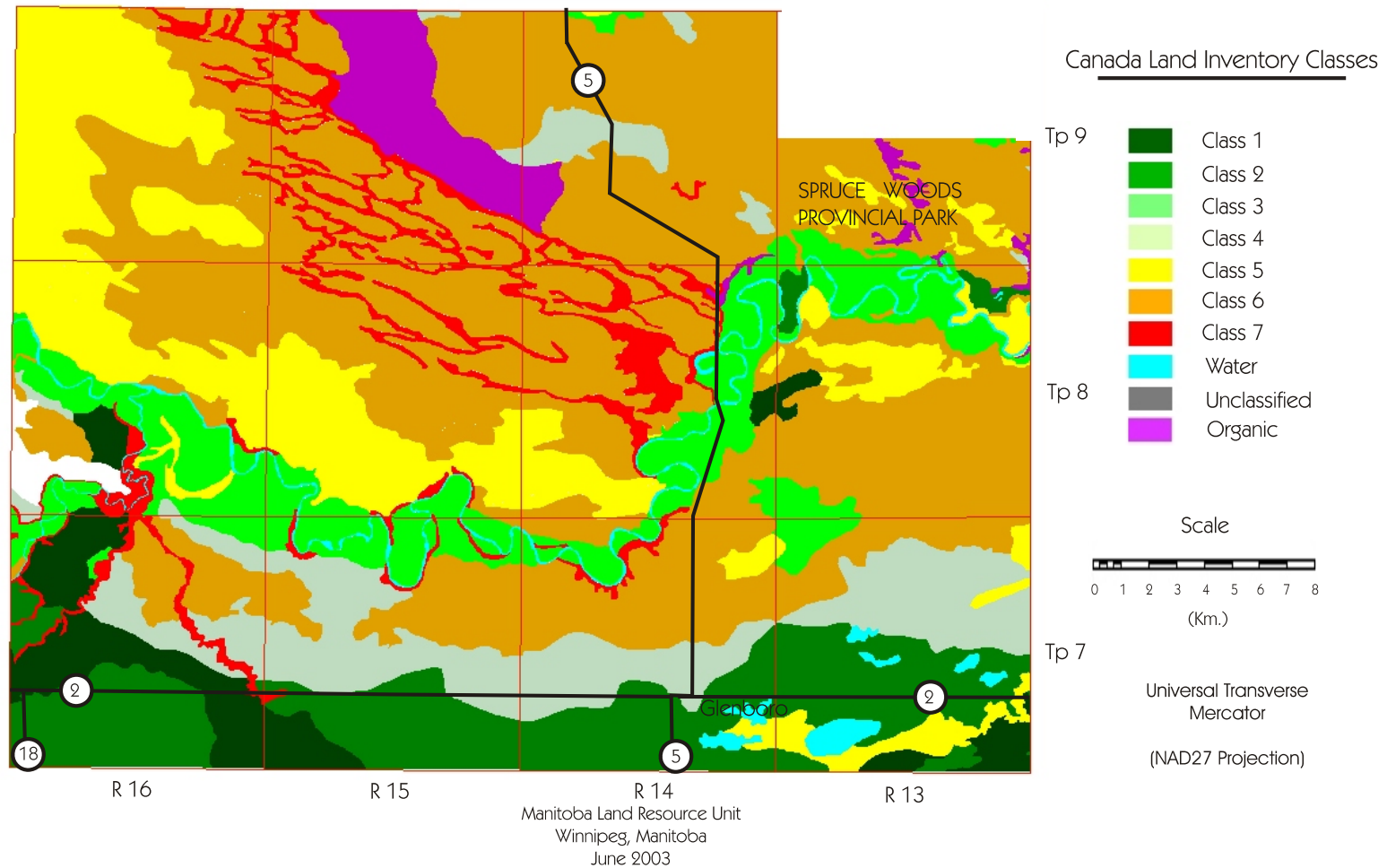
Table 4. Agricultural Capability¹

Class Subclass	Area (ha)	Percent of RM
1	5015	4.5
2	11333	10.2
2I	183	0.2
2T	2434	2.2
2TW	305	0.3
2W	7929	7.1
2X	482	0.4
3	10417	9.4
3	847	0.8
3I	7828	7.0
3M	1645	1.5
3MT	56	0.1
3T	42	0.0
4	10873	9.8
4M	10873	9.8
5	16000	14.4
5	316	0.3
5M	13752	12.4
5MT	119	0.1
5T	2	0.0
5W	1397	1.3
5WI	414	0.4
6	46661	42.0
6M	45042	40.0
6MT	675	0.6
6T	945	0.8
7	5756	5.2
7	955	0.9
7T	4801	4.3
Water	1653	1.5
Organic	3480	3.1
Total	111188	100.0

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

Rural Municipality of South Cypress

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.

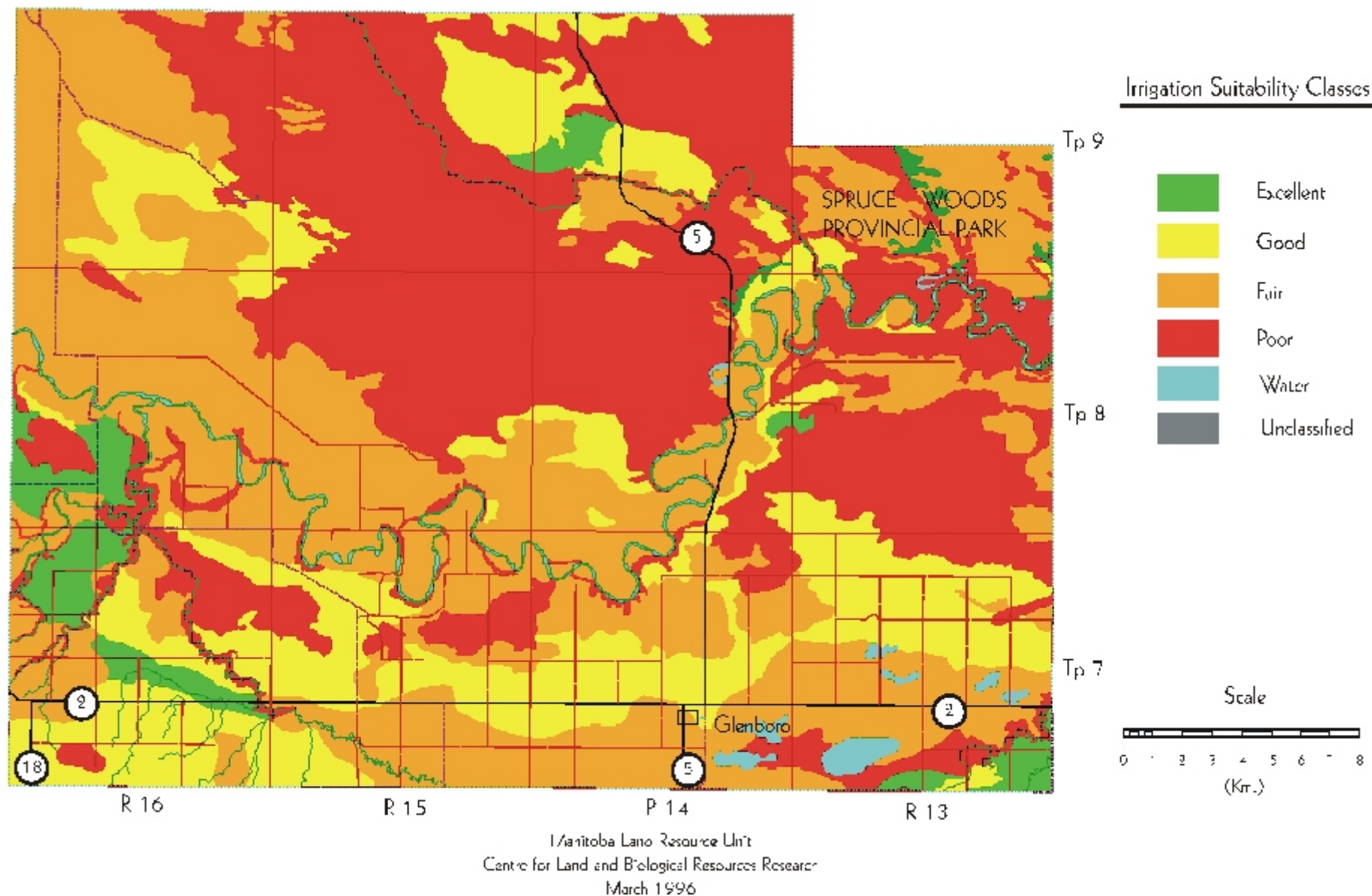
Table 5. Irrigation Suitability¹

Class	Area (ha)	Percent of RM
Excellent	3665	3.3
Good	22019	19.8
Fair	42404	38.1
Poor	40989	36.9
Organic	426	0.4
Water	1660	1.5
Unclassified	0	0.0
Total	111163	100.0

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

Rural Municipality of South Cypress

Irrigation Suitability Map



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.

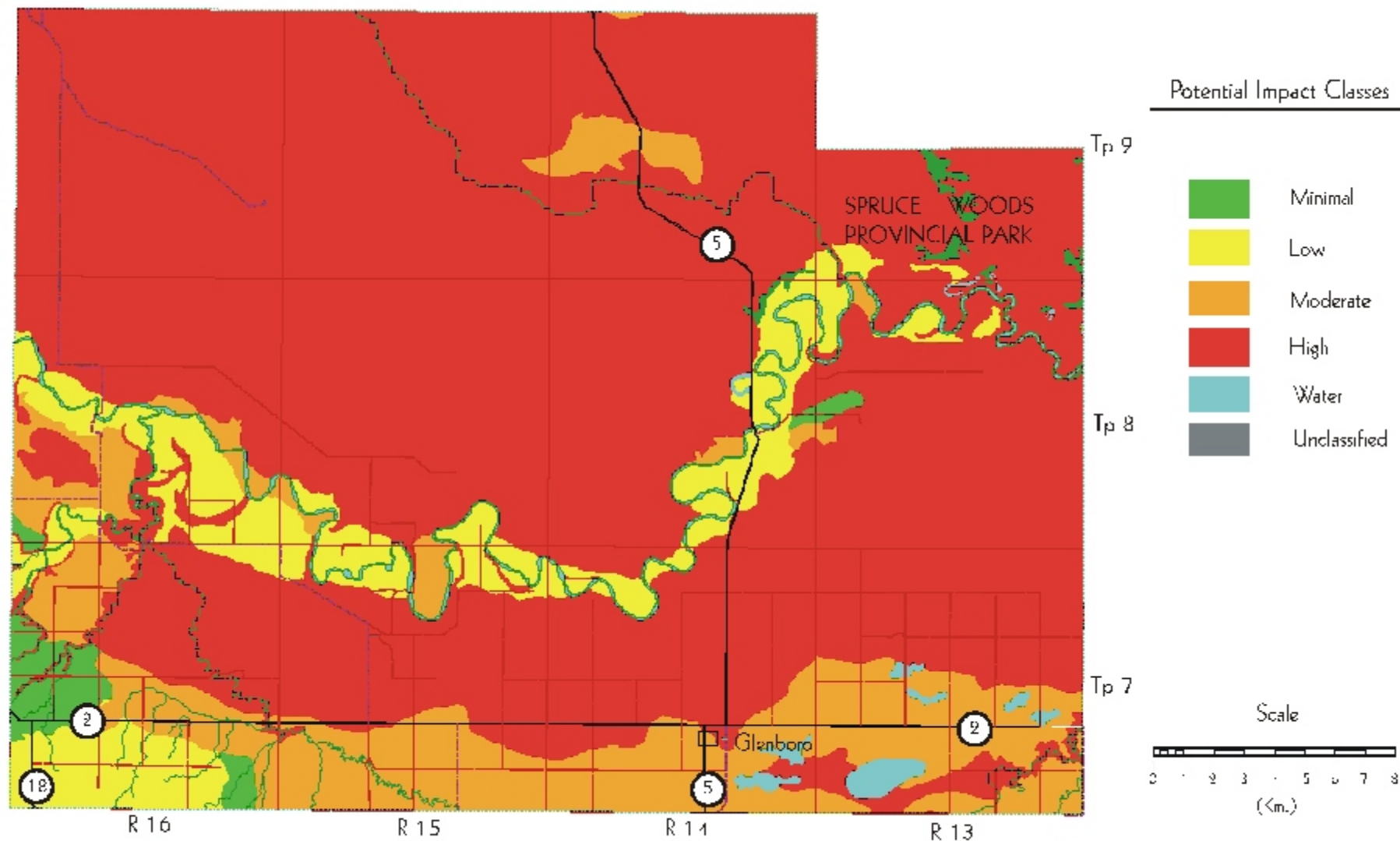
Use of this rating is intended to serve as a warning of potential environmental concern. It may be possible to design and/or give special consideration to soil-water-crop management practices that will mitigate any adverse impact.

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 Irrigation¹

Class	Area (ha)	Percent of RM
Minimal	1572	1.4
Low	9774	8.8
Moderate	15013	13.5
High	82719	74.4
Organic	426	0.4
Water	1660	1.5
Unclassified	0	0.0
Total	111163	100.0

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

Rural Municipality of South Cypress**Potential Environmental Impact Under Irrigation**

Manitoba Land Resource Unit
Centre for Land and Biological Resources Research
March 1996

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.

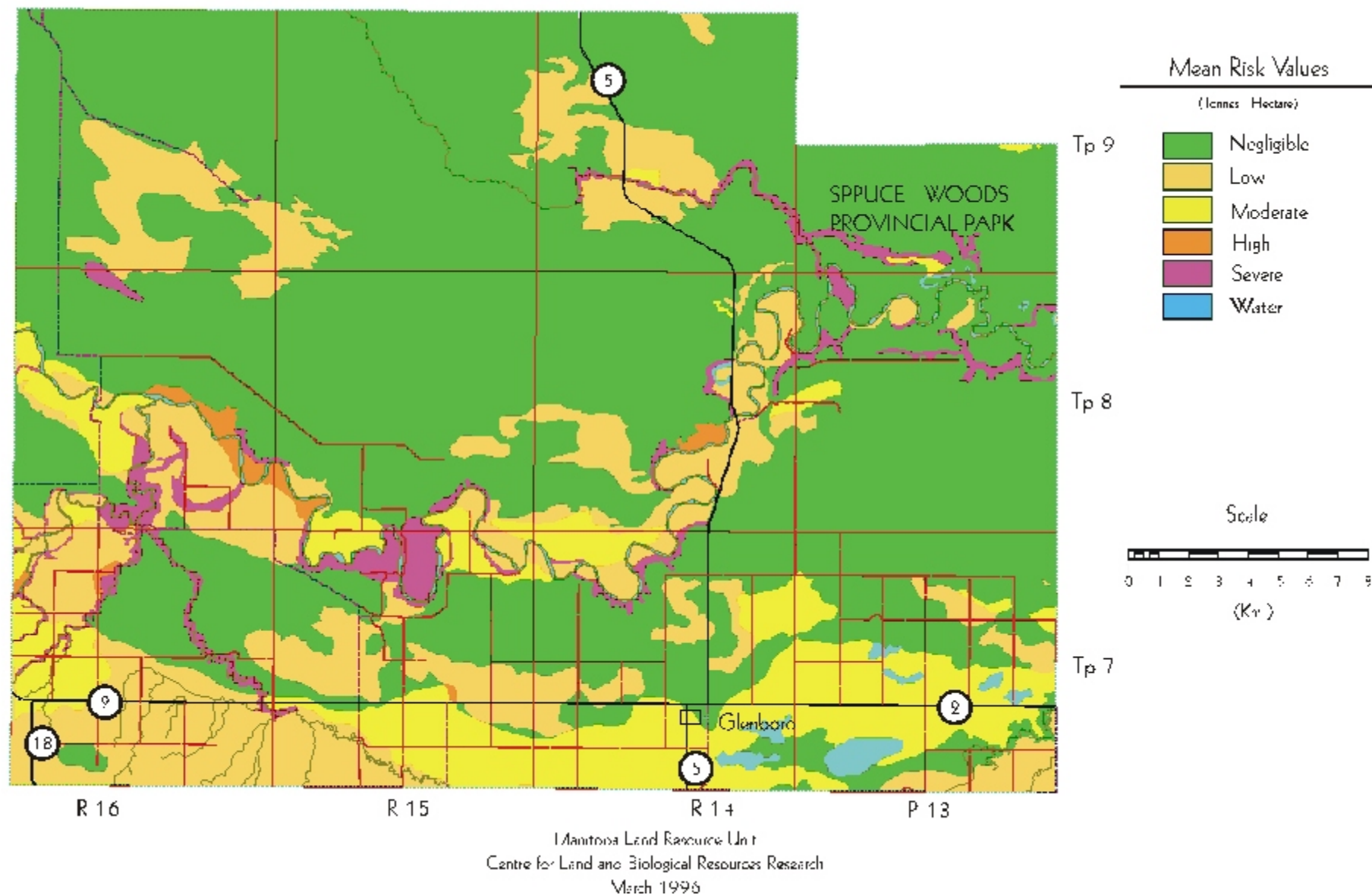
Table 7. Water Erosion Risk¹

Class	Area (ha)	Percent of RM
Negligible	71646	64.5
Low	21328	19.2
Moderate	12119	10.9
High	687	0.6
Severe	3724	3.4
Water	1660	1.5
Unclassified	0	0.0
Total	111163	100.0

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

Rural Municipality of South Cypress

Water Erosion Risk Map



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.

A brief description of the land use classes are:

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.

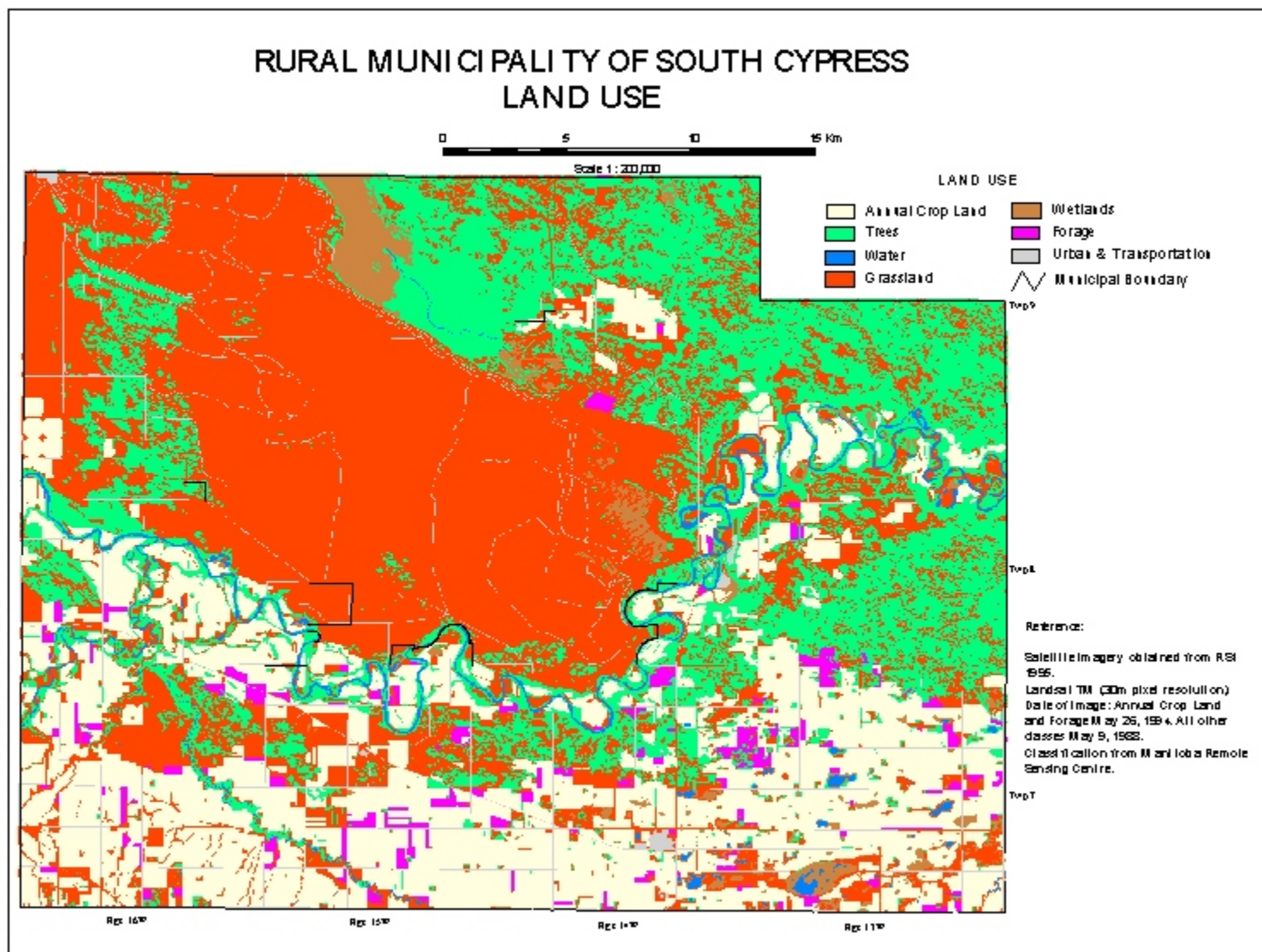
Water - open water-lakes, rivers streams, ponds, and lagoons

Urban and Transportation - towns, roads, railways, quarries

Table 8. Land Use¹

Class	Area (ha)	Percent of RM
Annual Crop Land	27795	25.0
Forage	2119	2.0
Grasslands	46659	42.0
Trees	28409	25.0
Wetlands	2648	2.0
Water	1573	1.0
Urban and Transportation	2644	2.0
Total	111163	100.0

¹ Land use information (1995) supplied by Prairie Farm Rehabilitation Administration.



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