Agriculture and Agri-Food Canada
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Rural Municipality of Swan River

Information Bulletin 99-46

Soils and Terrain

An introduction to the land resource

Land Resource Unit
Brandon Research Centre

Canada

Rural Municipality of Swan River

Information Bulletin 99-46

Prepared by:

Land Resource Unit,
Brandon Research Centre, Research Branch,
Agriculture and Agri-Food Canada.

Department of Soil Science, University of Manitoba.

Manitoba Soil Resource Section,
Soils and Crops Branch, Manitoba Agriculture.

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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 databases and illustrate several typical derived and interpretive map products for agricultural land use planning applications. The bulletins will also be available in diskette format for each rural municipality.

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

Land Resource Unit
Room 360 Ellis Bldg, University of Manitoba
Winnipeg, Manitoba R3T 2N2
Phone: 204-474-6118 FAX: 204-474-7633

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Managerial and administrative support was provided by:

R.G. Eilers, Head, Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada.
G.J. Racz, Head, Department of Soil Science, University of Manitoba.

Technical support was provided by:

G.W. Lelyk, and P. Cyr, Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada.
J. Fitzmaurice, and A. Waddell, Department of Soil Science, University of Manitoba.
G.F. Mills, P. Ag, Winnipeg, Manitoba
J. Griffiths, and C. Aglugub, Soil Resource Section, Soils and Crops Branch, Manitoba Agriculture.
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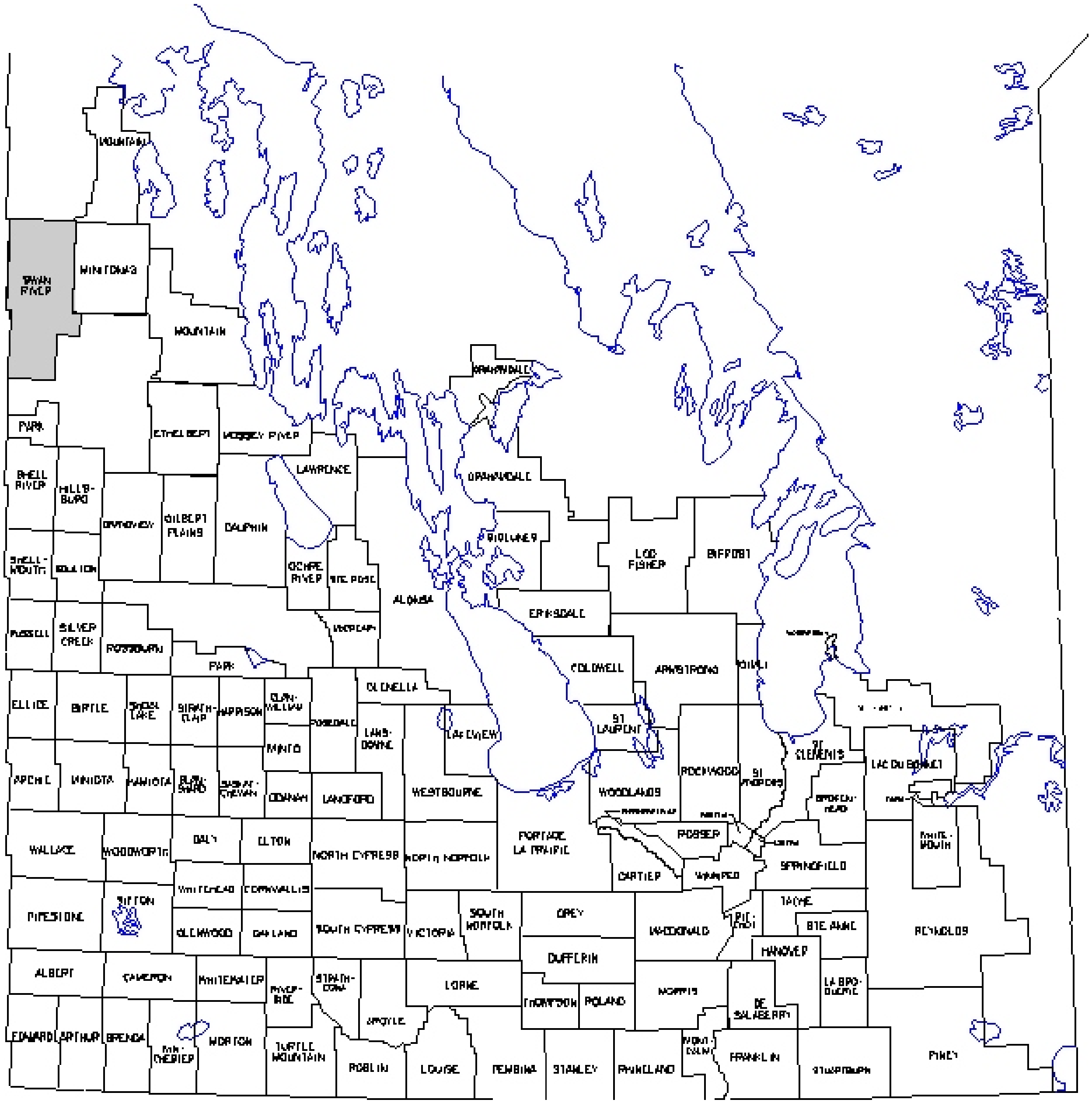


Figure 1. Rural municipalities of southern Manitoba.

INTRODUCTION

The location of the Rural Municipality of Swan River is shown in Figure 1. A brief overview of the database information, and general environmental conditions for the municipality are presented. A set of maps derived from the data for typical agricultural land use and planning applications are also included.

The soil map and database were compiled and registered using the Geographic Information System (PAMAP GIS) facilities of the Land Resource Unit. These databases were used in the GIS to create the generalized, derived and interpretive maps and statistics in this report. The final maps were compiled and printed using Coreldraw.

This bulletin is available in printed or digital format. The digital bulletin is a Windows based executable file which offers additional display options, including the capability to print any portion of the bulletin.

LAND RESOURCE DATA

The soil and terrain information presented in this bulletin was compiled 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 analysed in two distinct layers as shown in Figure 2.

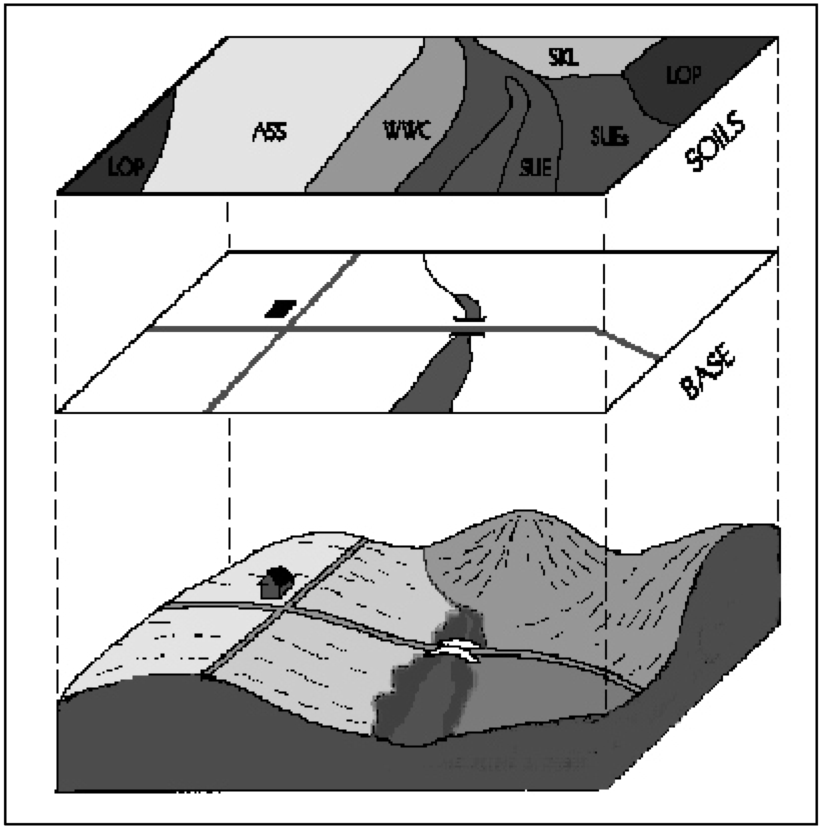


Figure 2. Soil and Base Map data.

Base Layer

Digital base map information includes the municipality and township boundaries, along with major streams, roads and highways. Major rivers and lakes from the base layer were also used as common boundaries for the soil map layer. Water bodies larger than 25 ha in size were digitized as separate polygons.

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. Modern soil series that best represent the soil association were 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. Slope length classes were also added, based on photo-interpretation.

SOIL AND TERRAIN OVERVIEW

The Rural Municipality (RM) of Swan River covers 174 261 hectares of land (approximately 18.9 townships) in the Swan River Valley between the Duck Mountains and the Porcupine Hills in western Manitoba (page 3). The municipality includes 1.7 townships in the Duck Mountain Provincial Forest and 1.5 townships in the Porcupine Provincial Forest. Swan River is the main population and agriculture service centre with smaller concentrations of people in Benito, Bowsman, Kenville and Durban.

The climate in the municipality can be related to weather data from Swan River. The mean annual temperature is 1.4˚C and the mean annual precipitation is 499 mm (Environment Canada, 1993). The average frost-free period is 110 days and degree-days above 5^{0}C average 1486 (Ash, 1991) although the growing season is cooler and shorter at higher elevations in the Duck Mountains and the Porcupine Hills. The calculated seasonal moisture deficit for the period between May and September is slightly less than 200 mm at higher elevations and just above 200 mm in the rest of the municipality. The estimated effective growing degree days (EGDD) above 5˚C accumulated from date of seeding to the date of the first fall frost is about 1100 at higher elevations and slightly more than 1300 in the rest of the area (Agronomic Interpretations Working Group, 1995). These parameters provide an indication of length of growing season and the moisture and heat energy available for crop growth, and except for the higher elevations, are generally adequate to support a wide range of crops adapted to western Canada.

The Duck Mountain Upland in the southern part of the municipality at an elevation of 560 metres above sea level (m asl) and the Porcupine Hills in the north (elevation of 600 m asl) are the highest areas in the municipality. Each upland is bordered by a steep Escarpment sloping at a rate of 31 to 34 m/km (166 to 180 ft/mi) toward the level to gently undulating terrain of the Swan River Plain on the west and the Armit River-Swan lake Plain to the east. The prominent Kenville Escarpment separates the two areas. Elevations decrease from 412 m asl on the Saskatchewan boundary, sloping to the northeast at a rate of 3 m/km or 16 ft/mi (Canada-Manitoba Soil Survey, 1980). The dominant slopes are under 2 percent except for slightly higher relief and slopes of 2 to 5 percent adjacent to the river valleys and along the Kenville Escarpment. In contrast, the Duck Mountains and the Porcupine Hills are hilly with local relief exceeding 8 metres and slopes of 9 to 30 percent (page 9). Drainage of the municipality is facilitated by tributaries of the Woody and Swan Rivers flowing northeast toward Swan Lake. The soils are dominantly well drained with imperfect drainage being most common in the Armit River-Swan River Plain. Poorly drained and peaty soils occur in depressional areas throughout the municipality (page 13).

Soil materials were deposited during the last glaciation and during the time of glacial Lake Agassiz. Lacustrine sediments ranging from sand to loam and clay in texture are dominant. Stony, loam textured glacial till is most common in the Duck Mountains and Porcupine Hills, at higher elevations of the Swan River Plain and in local areas in the Armit River-Swan Lake Plain. Sand and gravel beach ridges and deltas occur in the Escarpment areas (page 11).

Soils in the municipality have been mapped at a reconnaissance level (1:126 720 scale) and published in the soil survey report for the Swan River Map Sheet Area (Ehrlich et al., 1962) and in Open Files for Soils of the Swan Lake Map Area and Soils of the Duck Mountain Forest Reserve (Open File, LRU, 2000b and 2000c). The area around the Swan River townsite is mapped at a detail 1:20 000 scale (Mills and Podolsky, 1987). According to the Canadian System of Soil Classification (Soil Classification Working Group, 1998), well and imperfectly drained Black Chernozem soils developed on sand (Gilbert and Lenswood series), loam (Vally, Dutton and Kenville series) and clay textured lacustrine sediments (Plainview series) are dominant. At higher elevation, Luvisolic and Dark Gray Chernozem soils have developed on clay textures (Blackstone and Duck Mountain series), loamy till (Waitville and Grifton series) and sandy deltaic materials (Pine Ridge and Berlo series). Local areas of poorly drained soils (Gleysols) occupy depressional sites in all landscapes. Regosolic soils occur on stratified stream deposits in the valleys and on steeply sloping areas of eroded slopes (page 11).

Management considerations are related to coarse and fine soil textures, topography and wetness (page 15). Topography is a concern in the hilly uplands, along the escarpments and adjacent to the deeply incised river valleys. Variably stony surface conditions occur on the till soils throughout the area, but very stony soils are of particular concern on the water worked till soils in the Armit River-Swan Lake Plain. All soils are non-saline.

Nearly 77 percent of the land in the municipality is rated in **Classes 1, 2** and **3** for agriculture capability (page 17). Limitations affecting agriculture use are droughtiness, stoniness, excess water and topography. About 30 percent of the area is rated **Good** for irrigation suitability (page 19). Very poorly drained (peaty) soils, and steeply sloping soils are rated in **Class 6** for agriculture. These soils and clayey textured soils are rated **Poor** for irrigation.

A major issue currently receiving considerable attention is the sustainability of agricultural practices and their potential impact on the soil and groundwater environment. To assist in highlighting this concern to land planners and agricultural producers, an assessment of potential environmental impact (EI) under irrigation has been included in this bulletin (page 21). As shown, the risk for impact varies from **Minimal** to **High**. Coarse textured soils and steeply sloping lands are rated as having a **High** potential for impact on the environment under irrigation. These conditions increase the risk for deep leaching of potential contaminants on the soil surface and the potential for rapid runoff from the soil surface into adjacent wetlands or water bodies. This EI map is intended to be used in association with the irrigation suitability map.

Another issue of concern to producers, soil conservationists and land use specialists is soil erosion caused by agricultural cropping and tillage practices. To highlight areas with potential for water erosion, a risk map has been included to show where special practices should be adopted to mitigate this risk (page 23). The risk of degradation is **Negligible** to **Low** (27 percent) in the mainly level terrain in the Armit River-Swan Lake Plain. The risk increases to **Moderate**, **High** and **Severe** as steepness and length of slope increase in the areas above the Kenville Escarpment. In addition, loamy and sandy textured lacustrine soils are at a greater risk of erosion by wind. Management practices for land in annual crop focus primarily on maintaining adequate crop residues to provide sufficient surface cover. Adequate protection of sloping lands and sandy soils most at risk from wind erosion may require a shift in land use away from annual cultivation to production of perennial forages and pasture or permanent tree cover.

Agriculture is the dominant land use in the RM of Swan River. An assessment of the status of land use in 1994 obtained through analysis of satellite imagery showed that 52 percent of the land is in annual cropland. Production of forage takes place on 3.4 percent of the area while grassland occupies 13 percent. Most of the treed land (24 percent) is in the forest reserves, but tree cover also occurs on steeply sloping soils adjacent to stream channels. Grasslands and the treed areas outside the forest reserves provide forage and grazing capacity as well as wildlife habitat. Wetlands and small water bodies occupy 5.3 percent of the area. Various non-agricultural uses such as recreation and infrastructure for urban areas and transportation occupy 2.5 percent of the area although land within the forest reserves provides wildlife habitat as well as recreation opportunities (page 25).

The majority of the soils in the RM of Swan River have moderate to moderately severe limitations for arable agriculture. Careful choice of crops and maintenance of adequate surface cover is essential for the management of sensitive lands with coarse texture or steeper slopes. Implementation of minimum tillage practices and crop rotations including forage on a site by site basis will help to reduce the risk of soil degradation, maintain productivity and insure that agriculture land-use is sustainable over the long-term.

DERIVED AND INTERPRETIVE MAPS

A large variety of computer derived and interpretive maps can be generated from the digital soil and landscape databases. 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 drainage or slope class).

Interpretive maps portray more complex land evaluations based on a combination of soil and landscape information. Interpretations are based on soil and landscape conditions in each polygon. Interpretative maps typically show land capabilities, suitabilities, or risks related to sustainability.

Several examples of derived and interpretive maps are included in this information bulletin:

Derived Maps
Slope
Generalized Soil
Drainage
Management Considerations

Interpretative Maps
Agricultural Capability
Irrigation Suitability
Potential Environmental Impact
Water Erosion Risk
Land Use

The maps have all been reduced in size and generalized (simplified) in order to portray conditions for an entire rural municipality on one page. These generalized maps provide a useful overview of conditions within a municipality, but are not intended to apply to site specific land parcels. On-site evaluations are recommended for localized site specific land use suitability requirements.

Digital databases derived from recent detailed soil inventories contain additional detailed information about significant inclusions of differing soil and slope conditions in each map polygon. This information can be portrayed at larger map scale than shown in this bulletin.

Information concerning particular interpretive maps, and the primary soil and terrain map data, can be obtained by contacting the Manitoba Soil Resource Section of Manitoba Agriculture, the local PFRA office, or the Land Resource Unit.

Slope Map.

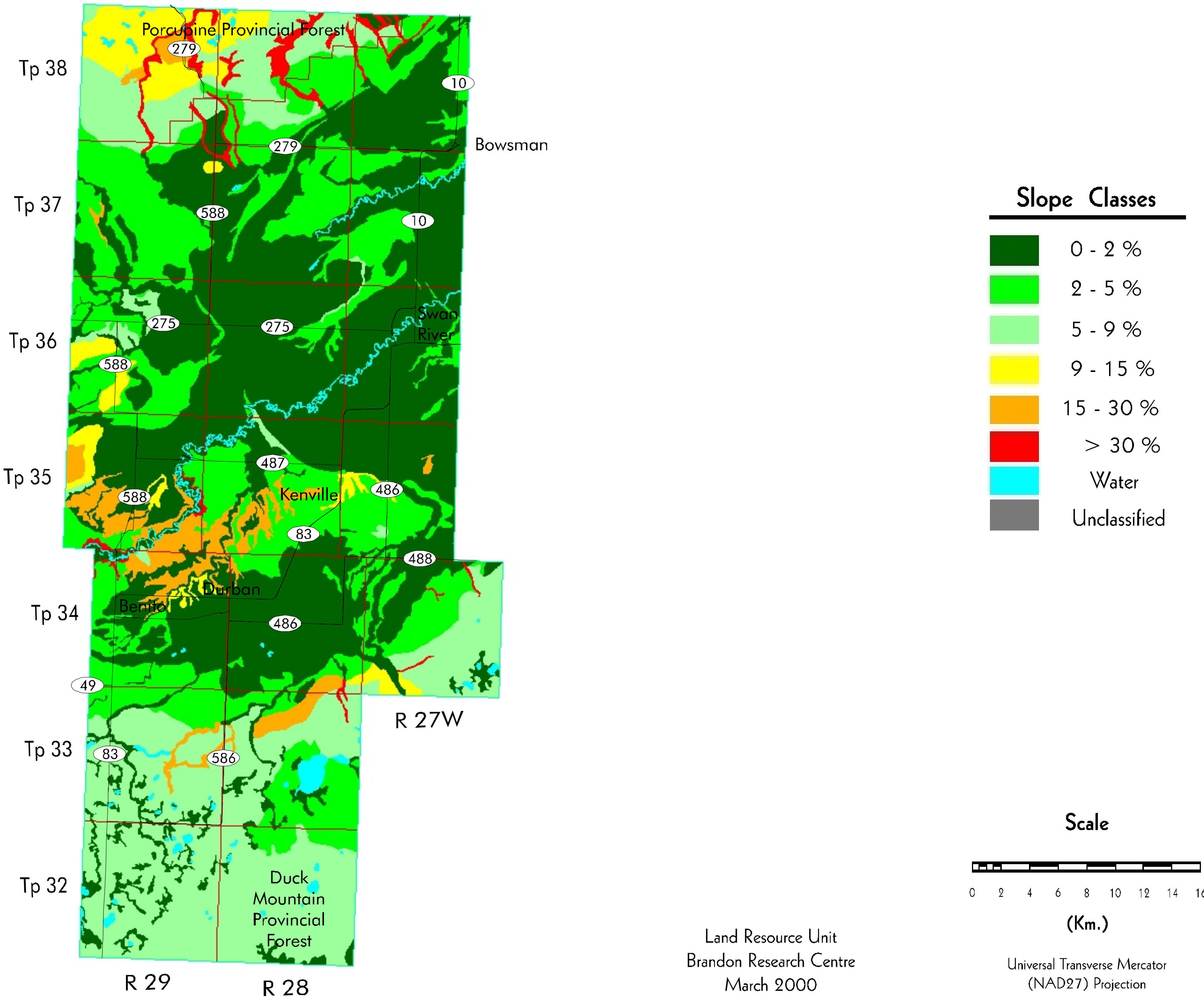
Slope describes the steepness of the landscape surface. The slope classes shown on this map are derived from the digital soil and terrain layer database. Specific colours are used to indicate the dominant slope class for each polygon in the RM. Additional slope classes may occur in each polygon area,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

Table 1. Slope Classes[1]

Slope Class	Area (ha)	Percent of RM
0 - 2 %	72712	41.7
2 - 5 %	44088	25.3
5 - 9 %	39199	22.5
9 - 15 %	7251	4.2
15 - 30 %	6793	3.9
> 30 %	2697	1.5
Unclassified	1	0.0
Water	1519	0.9
Total	174261	100.0

[1] Area has been assigned to the dominant slope in each soil polygon.

Slope Map



Land Resource Unit
Brandon Research Centre
March 2000

Generalized Soil Map.

The most recently available soil maps were digitized to produce the new digital soil map. For older reconnaissance soil maps, areas of overprinted symbols or significant differences in topography have been delineated as new polygons. All soil polygons have been digitized and translated into modern soil series equivalents.

The general soil groups provide a very simplified overview of the soil information contained in the digital soil map. The hundreds of individual soil polygons have been simplified into broad groups of soils with similar parent material origins, textures, and drainage classes. The dominant soil in each polygon determines the soil group, area, and colour for the generalized soil map. Gleysolic soils groups have poor to very poor drainage, while other mineral soil groups typically have a range of rapid, well, or imperfectly drained soils.

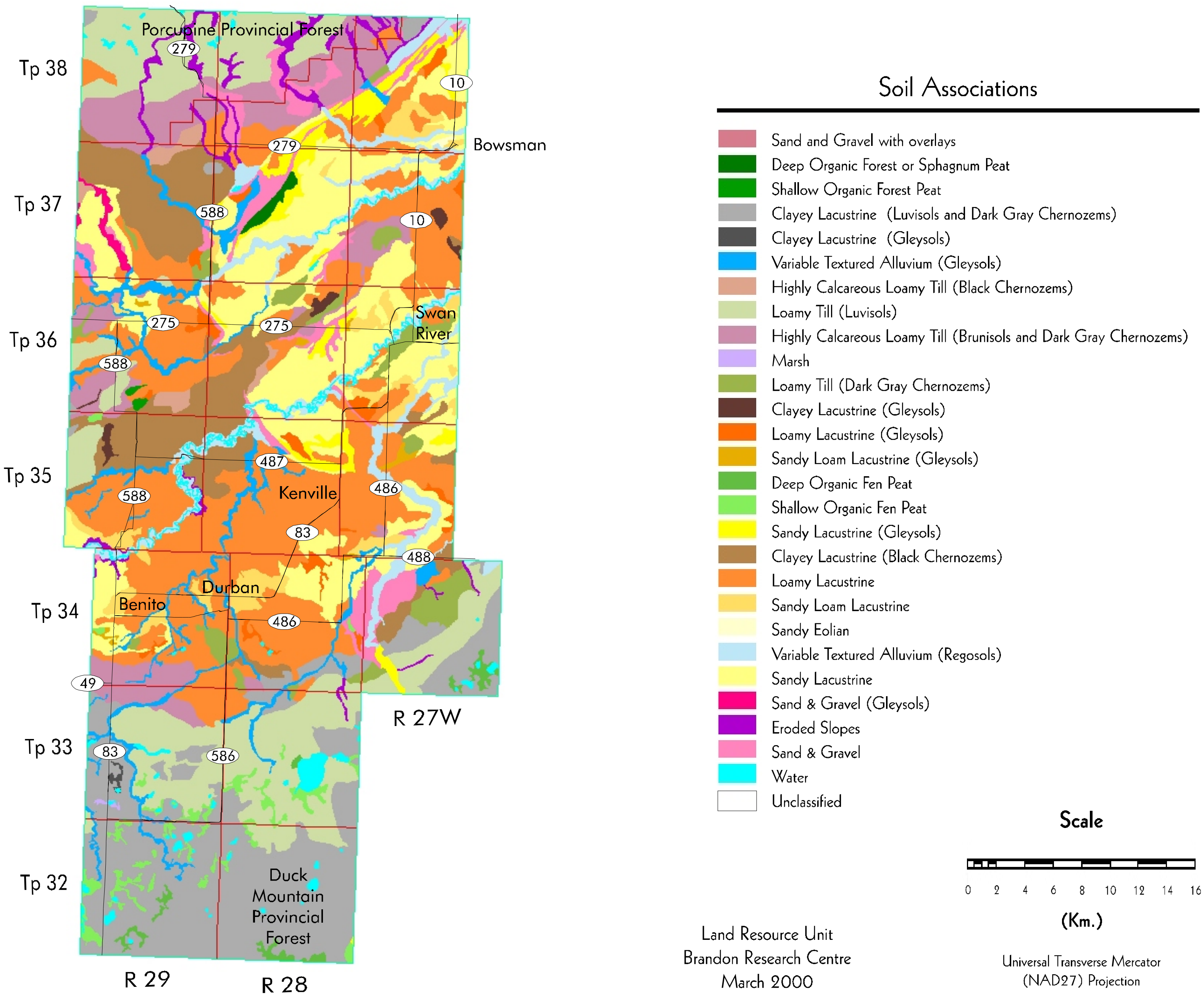
More detailed maps showing the dominant and subdominant soils in each polygon can also be produced at larger map scales.

Table 2. Generalized Soil Groups[1]

Soil Groups	Area (ha)	Percent of RM
Sand and Gravel with overlays	56	0.0
Deep Organic Forest or Sphagnum Peat	362	0.2
Shallow Organic Forest Peat	121	0.1
Clayey Lacustrine (Luvisols and Dark Gray Chernozems)	24713	14.2
Clayey Lacustrine (Gleysols)	94	0.1
Variable Textured Alluvium (Gleysols)	5513	3.2
Highly Calcareous Loamy Till (Black Chernozems)	1051	0.6
Loamy Till (Luvisols)	22510	12.9
Highly Calcareous Loamy Till (Brunisols and Dark Gray Chernozems)	11279	6.5
Marsh	53	0.0
Loamy Till (Dark Gray Chernozem)	3874	2.2
Clayey Lacustrine (Gleysols)	536	0.3
Loamy Lacustrine (Gleysols)	1651	0.9
Sandy Loam Lacustrine (Gleysols)	361	0.2
Deep Organic Fen Peat	836	0.5
Shallow Organic Fen Peat	2115	1.2
Sandy Lacustrine (Gleysols)	3538	2.0
Clayey Lacustrine (Black Chernozems)	13304	7.6
Loamy Lacustrine	37964	21.8
Sandy Loam Lacustrine	4184	2.4
Sandy Eolian	63	0.0
Variable Textured Alluvium (Regosols)	6859	3.9
Sandy Lacustrine	23279	13.4
Sand and Gravel (Gleysols)	436	0.3
Eroded Slopes	2534	1.5
Sand and Gravel	5454	3.1
Water	1519	0.9
Unclassified	1	0.0
Total	174261	100.0

[1] Based on the **dominant** soil series for each soil polygon.

Generalized Soil Map



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March 2000

Soil Drainage Map.

Drainage is described on the basis of actual moisture content in excess of field capacity, and the length of the saturation period within the plant root zone. Five drainage classes plus three land classes are shown on this map.

Very Poor - Water is removed from the soil so slowly that the water table remains at or on the soil surface for the greater part of the time the soil is not frozen. Excess water is present in the soil throughout most of the year.

Poor - Water is removed so slowly in relation to supply that the soil remains wet for a large part of the time the soil is not frozen. Excess water is available within the soil for a large part of the time.

Poor, drained - Water is removed slowly in relation to supply and the soil remains wet for a significant portion of the growing season. Although these soils may retain characteristics of poor internal drainage, extensive surface drainage improvements enable these soils to be used for annual crop production.

Imperfect - Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. Excess water moves slowly down the profile if precipitation is the major source.

Well - Water is removed from the soil readily but not rapidly. Excess water flows downward readily into underlying materials or laterally as subsurface flow.

Rapid - Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep slopes during heavy rainfall.

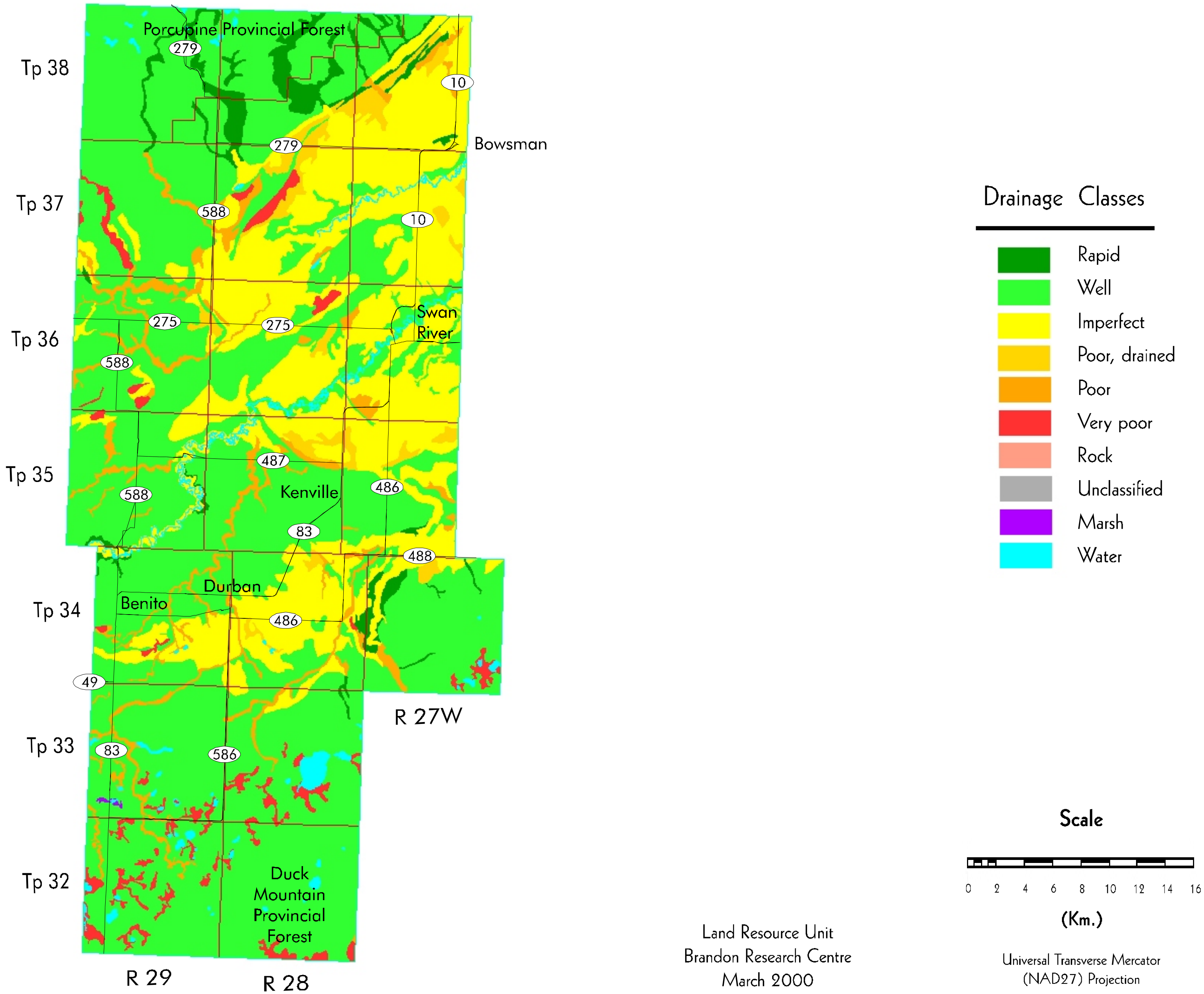
Drainage classification is based on the dominant soil series within each individual soil polygon.

Table 3. Drainage Classes[1]

Drainage Class	Area (ha)	Percent of RM
Very Poor	**4204**	**2.4**
Poor	**7335**	**4.2**
Poor, drained	**4025**	**2.3**
Imperfect	**44176**	**25.4**
Well	**107950**	**61.9**
Rapid	**4998**	**2.9**
Rock	**0**	**0.0**
Marsh	**53**	**0.0**
Unclassified	**1**	**0.0**
Water	**1519**	**0.9**
Total	**174261**	**100.0**

[1] Area has been assigned to the dominant drainage class for each soil polygon.

Soil Drainage Map



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Brandon Research Centre
March 2000

Management Considerations Map.

Management consideration maps are provided to focus on awareness of land resource characteristics important to land use. This map does not presume a specific land use. Rather it portrays the most common and wide spread attributes that apply to most soil landscapes in the province.

These maps **highlight attributes** of soil-landscapes that the land manager must consider for any intended land use.

- **Fine texture**
- **Medium texture**
- **Coarse texture**
- **Topography**
- **Wetness**
- **Organic**
- **Bedrock**

F = Fine texture - soil landscapes with **fine textured soils (clays and silty clays)**, and thus low infiltration and internal permeability rates. These require special considerations to mitigate surface ponding (water logging), runoff, and trafficability. Timing and type of tillage practices used may be restricted.

M = Medium texture - soil landscapes with medium to moderately fine textures **(loams to clay loams)**, and good water and nutrient retention properties. Good management and cropping practices are required to minimize leaching and the risk of erosion.

C = Coarse texture - soil landscapes with **coarse to very coarse textured soils (loamy sands, sands and gravels)**, have a high permeability throughout the profile, and require special management practices related to application of agricultural chemicals, animal wastes, and municipal effluent to protect and sustain the long term quality of the soil and water resources. The risk of soil erosion can be minimized through the use of shelterbelts and maintenance of crop residues.

T = Topography - soil landscapes with **slopes greater than 5 %** are steep enough to require special management practices to minimize the risk of erosion.

W = Wetness - soil landscapes that have **poorly drained soils and/or >50 % wetlands** (due to seasonal and annual flooding, surface ponding, permanent water bodies (sloughs), and/or high water tables), require special management practices to mitigate adverse impact on water quality, protect subsurface aquifers, and sustain crop production during periods of high risk of water logging.

O = Organic - soil landscapes with organic soils, requiring special management considerations of drainage, tillage, and cropping to sustain productivity and minimize subsidence and erosion.

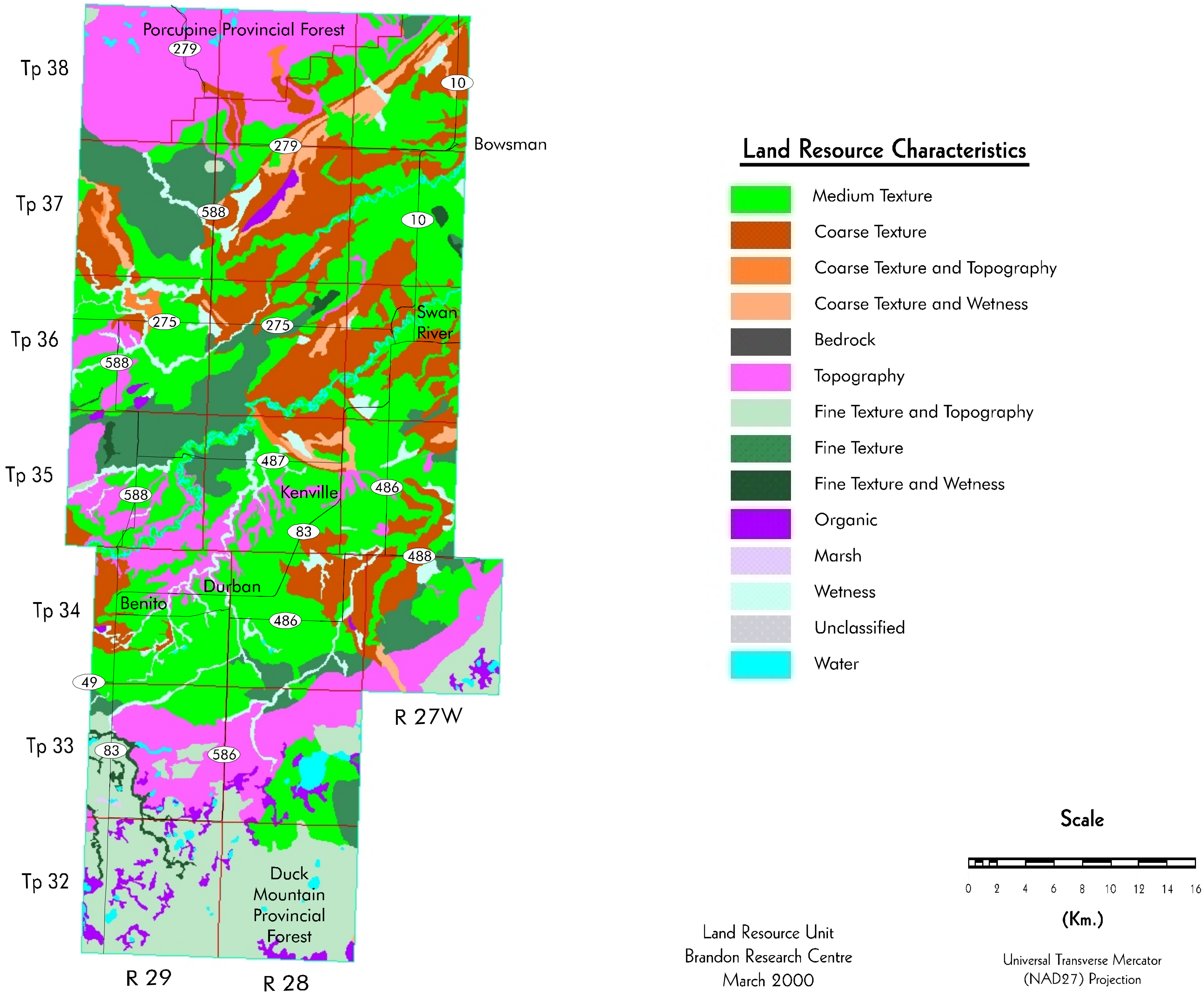
R = Bedrock - soil landscapes that have shallow depth to bedrock (< 50 cm) and/or exposed bedrock which may prevent the use of some or all tillage practices as well as the range of potential crops. They require special cropping and management practices to sustain agricultural production.

Table 4. Management Considerations[1]

Land Resource Characteristics	Area (ha)	Percent of RM
Fine Texture	16350	9.4
Fine Texture and Wetness	1308	0.8
Fine Texture and Topography	21667	12.4
Medium Texture	56806	32.6
Coarse Texture	28028	16.1
Coarse Texture and Wetness	3974	2.3
Coarse Texture and Topography	824	0.5
Topography	33450	19.2
Bedrock	0	0.0
Wetness	6847	3.9
Organic	3435	2.0
Marsh	53	0.0
Unclassified	1	0.0
Water	1519	0.9
Total	174261	100.0

[1] Based on the **dominant** soil series and slope gradient within each polygon.

Management Considerations 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, class 4 land is marginal for sustained cultivation, class 5 land is capable of perennial forages and improvement is feasible, class 6 land is capable of producing native forages and pasture but improvement is not feasible, and class 7 land is considered unsuitable for dryland agriculture. Subclass modifers include structure and/or permeability (D), erosion (E), inundation (I), moisture limitation (M), salinity (N), stoniness (P), consolidated bedrock (R), topography (T), excess water (W) and cumulative minor adverse characteristics (X).

This generalized interpretive map is based on the dominant soil series and phases for each soil polygon. The CLI subclass limitations cannot be portrayed at this generalized map scale.

Table 5. Agricultural Capability[1]

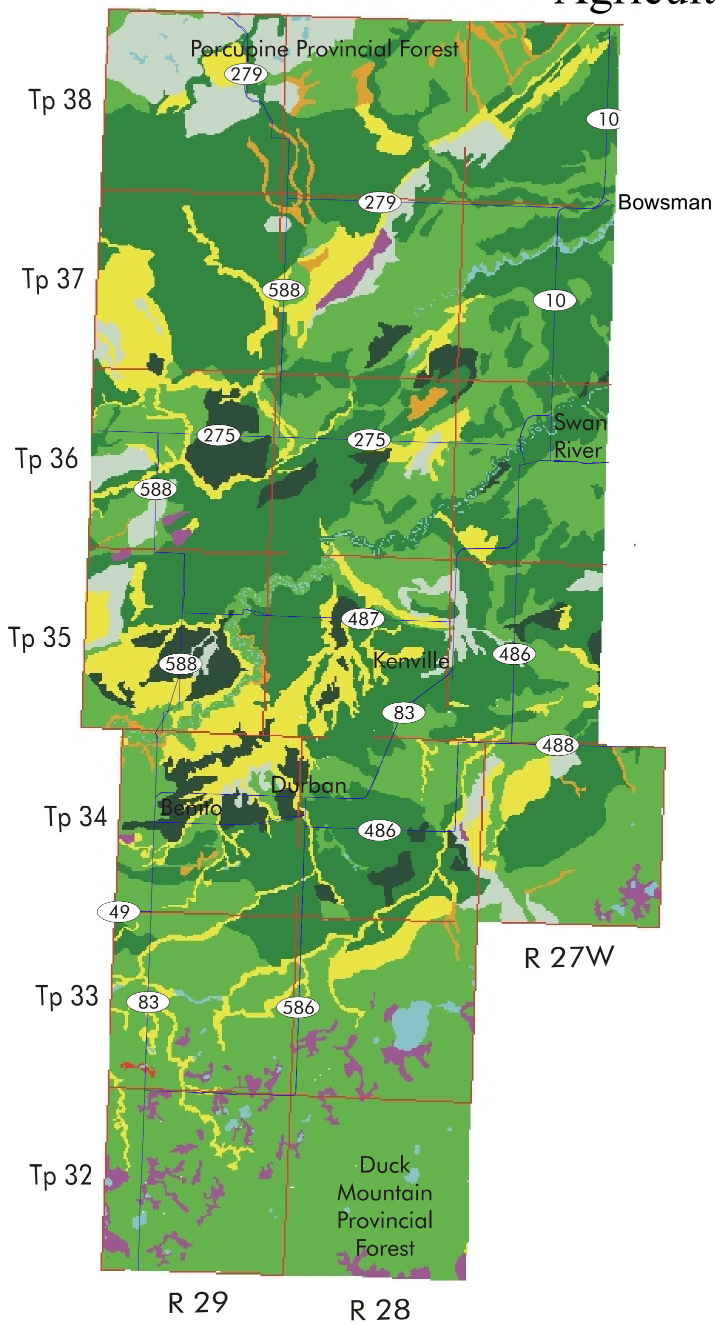
Class Subclass	Area (ha)	Percent of RM
1	**7899**	**4.5**
2	**49863**	**28.6**
2D	5539	3.2
2I	965	0.6
2M	4252	2.4
2MT	1511	0.9
2P	183	0.1
2T	9598	5.5
2TD	6960	4.0
2TP	866	0.5
2TW	908	0.5
2W	16819	9.7
2WP	2210	1.3
2X	53	0.0
3	**76053**	**43.7**
3I	5905	3.4
3M	20711	11.9

Table 5. Agricultural Capability[1] (cont.)

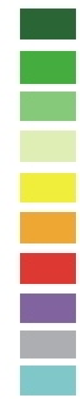
Class Subclass	Area (ha)	Percent of RM
3ME	180	0.1
3MT	470	0.3
3T	37563	21.6
3W	1263	0.7
3X	9961	5.7
4	**12006**	**6.9**
4IW	183	0.1
4M	814	0.5
4P	1190	0.7
4T	7234	4.2
4W	2585	1.5
5	**20231**	**11.6**
5M	5910	3.4
5MT	91	0.1
5T	6687	3.8
5W	2223	1.3
5WI	5322	3.1
6	**3091**	**1.8**
6M	63	0.0
6T	2696	1.5
6W	332	0.2
7	**53**	**0.0**
7W	53	0.0
Unclassified	**1**	**0.0**
Water	**1516**	**0.9**
Organic	**3434**	**2.0**
Total	**174147**	**100.0**

[1] Based on the **dominant** soil series and slope gradient within each polygon.

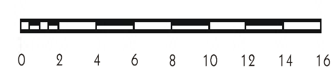
Agriculture Capability Map



Canada Land Inventory Classes



Scale



(Km.)

Land Resource Unit
Winnipeg Manitoba
June 2003

Universal Transverse Mercator
(NAD27) Projection

Irrigation Suitability Map.

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.

Irrigation suitability is a four class rating system. Areas with no or slight soil and/or landscape limitations are rated **Excellent** to **Good** and can be considered irrigable. Areas with moderate soil and/or landscape limitations are rated as **Fair** and considered marginal for irrigation providing adequate management exists so that the soil and adjacent areas are not adversely affected by water application. Soil and landscape areas rated as **Poor** have severe limitations for irrigation.

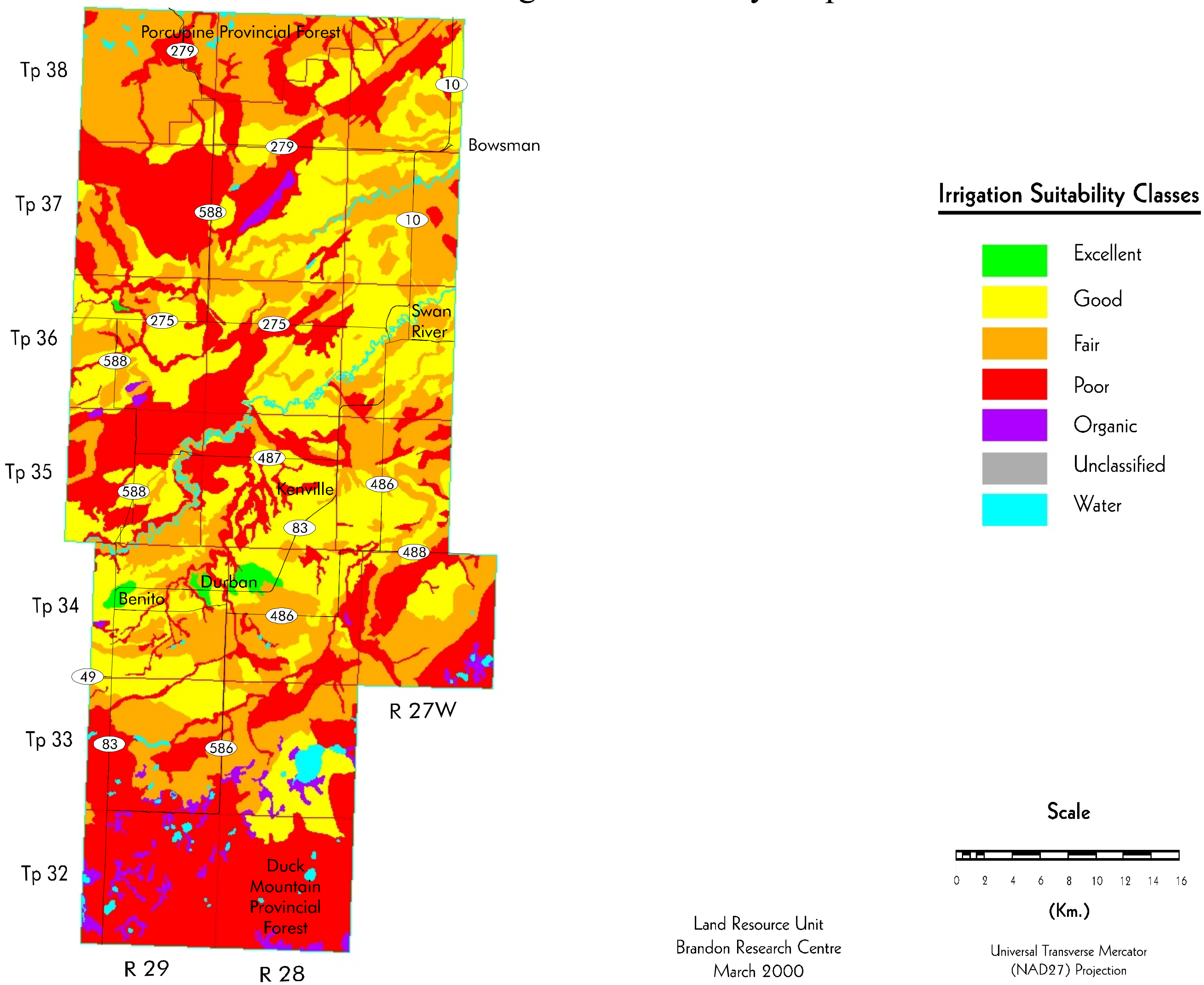
This generalized interpretive map is based on the dominant soil series for each soil polygon, in combination with the dominant slope class. The nature of the subclass limitations and the classification of subdominant components is not shown at this generalized map scale.

Table 6. Irrigation Suitability[1]

Class	Area (ha)	Percent of RM
Excellent	976	0.6
Good	51933	29.8
Fair	55229	31.7
Poor	61168	35.1
Organic	3435	2.0
Unclassified	1	0.0
Water	1519	0.9
Total	174261	100.0

[1] Based on the **dominant** soil series and slope gradient within each polygon.

Irrigation Suitability Map



Land Resource Unit
Brandon Research Centre
March 2000

Universal Transverse Mercator
(NAD27) Projection

Potential Environmental Impact Under Irrigation Map.

A major environmental concern for land under irrigated crop production is the possibility that surface and/or ground water 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. Several factors are specifically considered: soil texture, hydraulic conductivity, salinity, geological uniformity, depth to water table and topography. The risk of altering surface and subsurface soil drainage regimes, soil salinity, potential for runoff, erosion and 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.

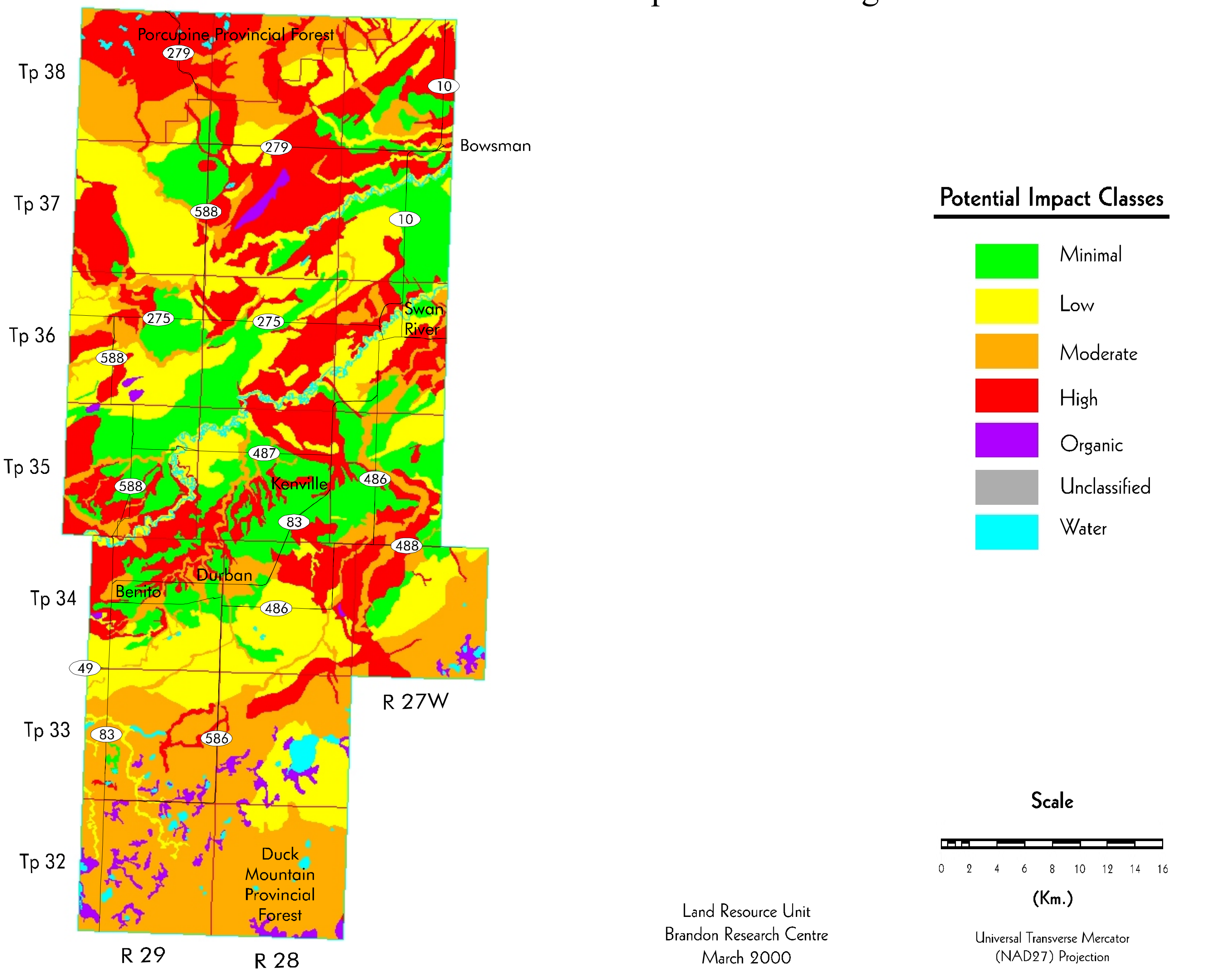
This generalized interpretive map is based on the dominant soil series and slope class for each soil polygon. The nature of the subclass limitations, and the classification of subdominant components is not shown at this generalized map scale.

Table 7. Potential Environmental Impact Under Irrigation[1]

Class	Area (ha)	Percent of RM
Minimal	**29588**	**17.0**
Low	**44449**	**25.5**
Moderate	**49277**	**28.3**
High	**45991**	**26.4**
Organic	**3435**	**2.0**
Unclassified	**1**	**0.0**
Water	**1519**	**0.9**
Total	**174261**	**100.0**

[1] Based on the **dominant** soil series and slope gradient within each polygon.

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 USLE predicted soil loss (tons/hectare/year) is calculated for each soil component in each soil map polygon. Erosion risk classes are assigned based on the weighted average soil loss for each map polygon. Water erosion risk factors include mean annual rainfall, average and maximum rainfall intensity, slope length, slope gradient, vegetation cover, management practices, and soil erodibility. The map shows 5 classes of soil erosion risk based on bare unprotected soil:

negligible
low
moderate
high
severe

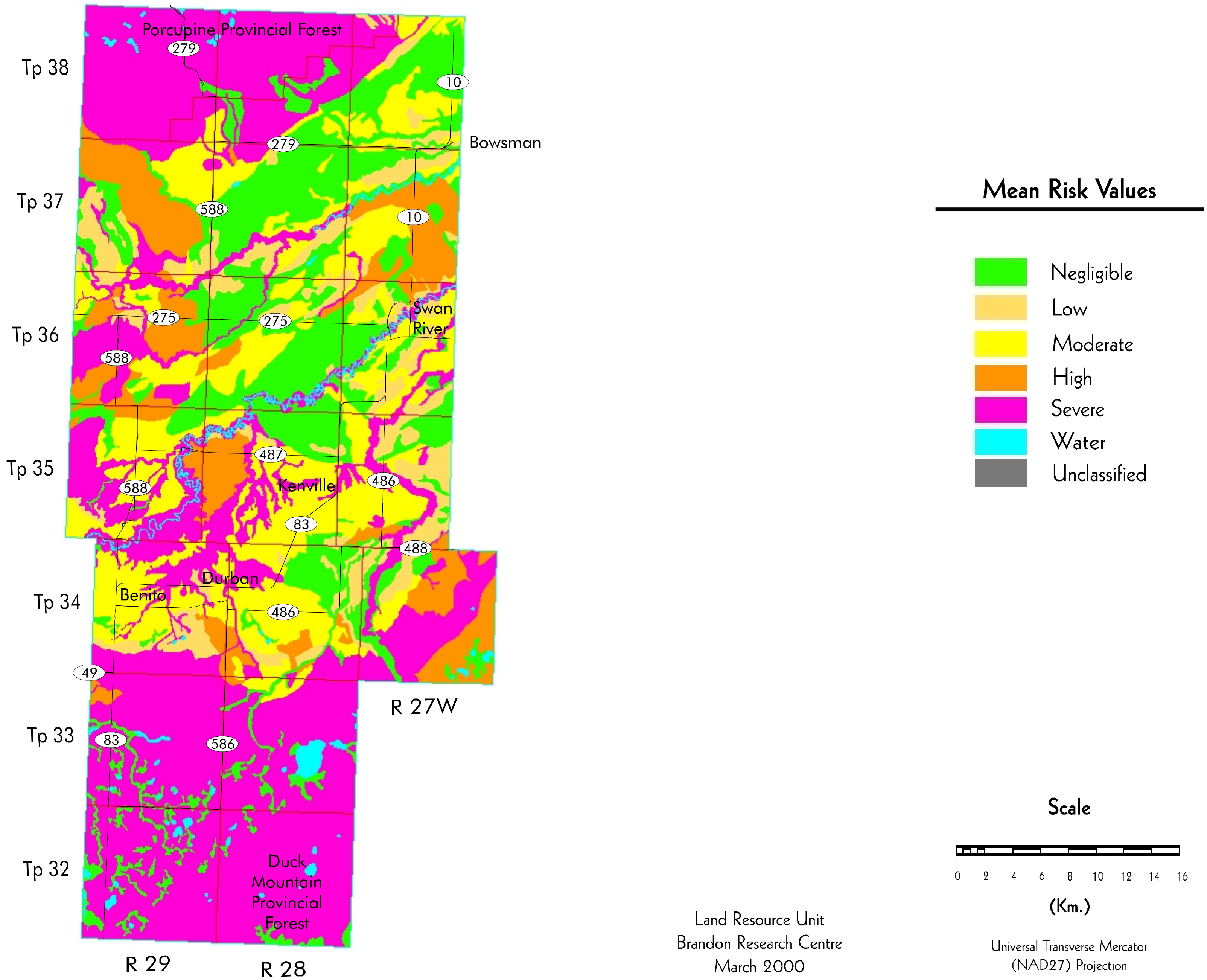
Cropping and residue management practices will significantly reduce this risk depending on crop rotation program, soil type, and landscape features.

Table 8. Water Erosion Risk[1]

Class	Area (ha)	Percent of RM
Negligible	**33505**	**19.2**
Low	**13462**	**7.7**
Moderate	**33906**	**19.5**
High	**17688**	**10.2**
Severe	**74179**	**42.6**
Unclassified	**1**	**0.0**
Water	**1519**	**0.9**
Total	**174261**	**100.0**

[1] Based on the **weighted average** USLE predicted soil loss within each polygon, assuming a bare unprotected soil.

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.

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.

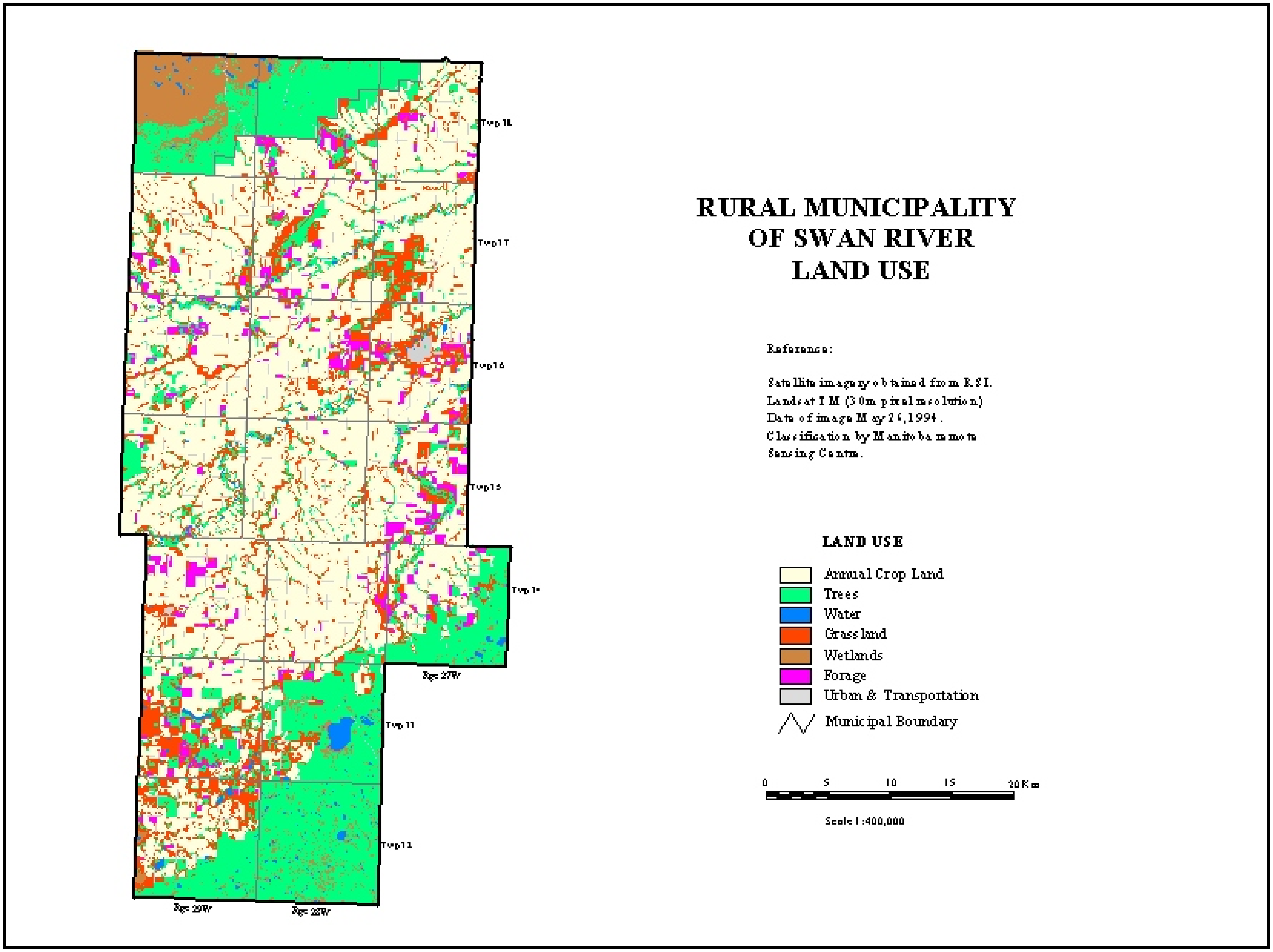
Water - open water - lakes, rivers streams, ponds, and lagoons.

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

Table 9. Land Use[1]

Class	Area (ha)	Percent of RM
Annual Crop Land	91582	52.3
Forage	6042	3.4
Grasslands	21855	12.5
Trees	42172	24.1
Wetlands	7354	4.2
Water	1944	1.1
Urban and transportation	4306	2.5
Undifferentiated	0	0.0
Total	175,255	100.0

[1] Land use information (1994) and map supplied by Prairie Farm Rehabilitation Administration. Areas may vary from previous maps due to differences in analytical procedures.


RURAL MUNICIPALITY
OF SWAN RIVER
LAND USE
Reference:
Satellite imagery obtained from RSI.
Landsat TM (30m pixel resolution)
Date of image May 26, 1994.
Classification by Manitoba Remote
Sensing Centre.
LAND USE
Annual Crop Land
Trees
Water
Grassland
Wetlands
Forage
Urban & Transportation
Municipal Boundary
0 5 10 15 20 Km
Scale 1:400,000
Twp 18
Twp 17
Twp 16
Twp 15
Twp 14
Twp 13
Twp 12
Rge 27W
Rge 29W
Rge 28W

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