Land Resource Unit

Brandon Research Centre

Agriculture and Agri-Food Canada

Rural Municipality of Cameron

Information Bulletin 97-7

Soils and Terrain

An introduction to the land resource

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Rural Municipality of Cameron

Information Bulletin 97-7

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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.

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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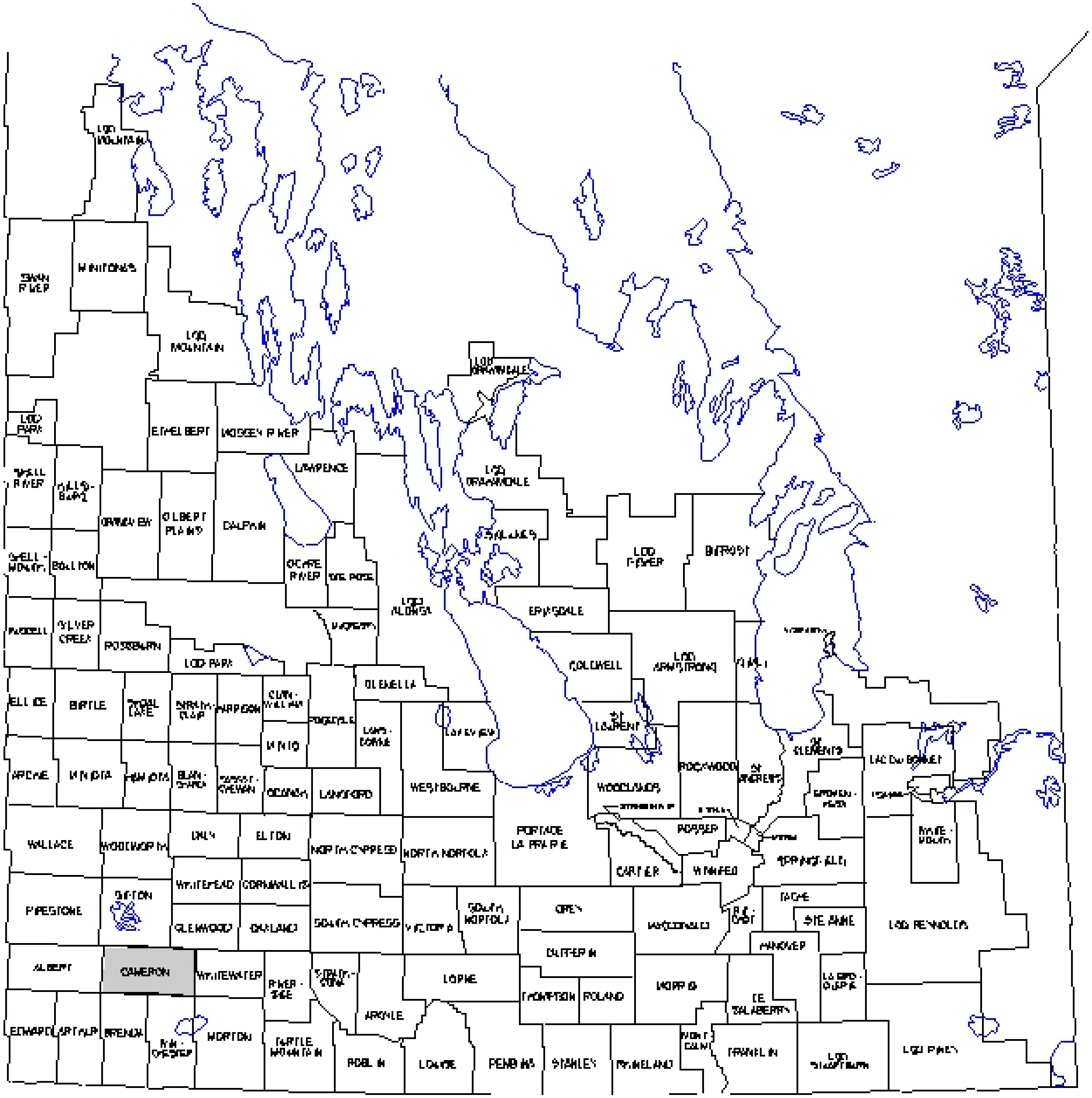


Figure 1. Rural municipalities of southern Manitoba.

INTRODUCTION

The location of the Rural Municipality of Cameron 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 Manitoba 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.

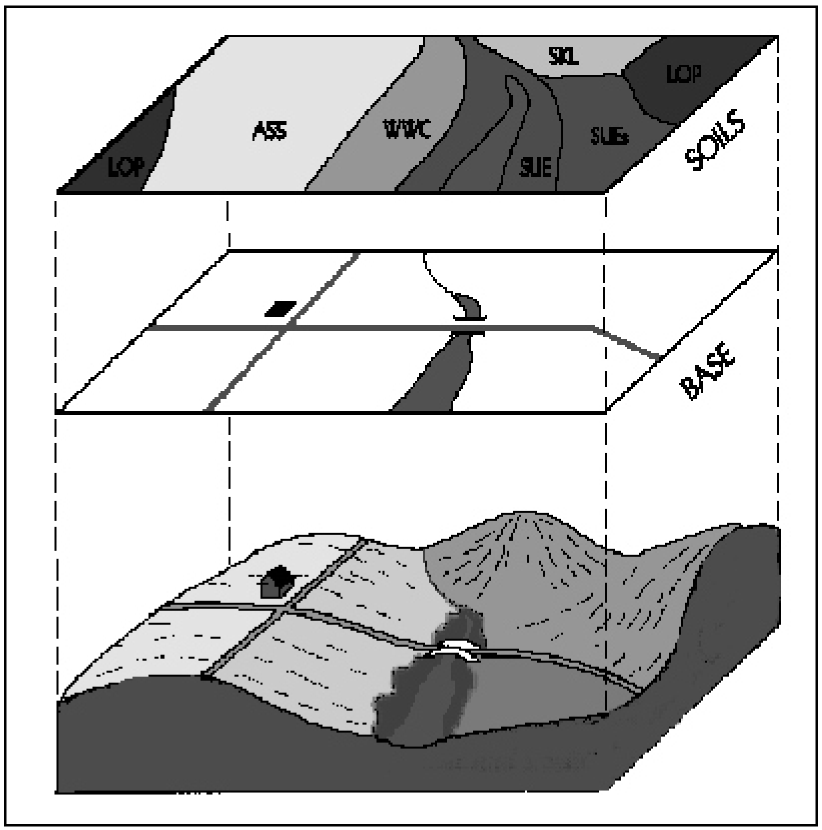


Figure 2. Soil and Base Map data.

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 air 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 gradient and length classes were also added, based on air photo-interpretation.

LAND RESOURCE OVERVIEW

The Rural Municipality (RM) of Cameron covers an area of 8 townships (approximately 77 600 hectares) of land in southwestern Manitoba (page 3). The town of Hartney is the main population and agriculture service centre in the municipality. The majority of the population is rural farm-based.

The climate in the municipality can be described by weather data from Melita. The mean annual temperature is 2.4˚C and the mean annual precipitation is 494 mm (Environment Canada, 1982). The degree-days above 5^0C average 1627 and the average frost-free period is 103 days (Ash, 1991). The calculated seasonal moisture deficit for the period between May and September ranges from 250 to nearly 300 mm. The estimated effective growing degree days (EGDD) above 5˚C accumulated from date of seeding to date of the first fall frost is approximately 1500 (Agronomic Interpretations Working Group, 1995). These parameters provide an indication of moisture and heat energy available for crop growth.

Physiographically, the RM of Cameron is located in the Antler River-Lake Souris Plain and the Boissevain Plain subsections of the Saskatchewan Plain (Canada-Manitoba Soil Survey, 1980). The Antler River-Lake Souris Plain comprising the majority of the area ranges in elevation from 428 in the north to about 450 metres above sea level (m asl) in the south. It is characterized by a generally level land surface with low relief (less than 3 m) and slopes usually less than 2 percent (page 9). Greatest local relief occurs along the Souris River flowing northeasterly within a channel entrenched some 20 to 30 meters below the land surface. The Lauder Sand Hills, north of the Souris River, consists of sand dunes characterized by sharply hummocky topography and very steep slopes exceeding 30 percent in some areas. The Boissevain Plain in the southeast portion of the RM gradually increases in elevation from 450 m to about 488 m asl in the south. This area is characterized by gently rolling to undulating topography with slopes of 5 to 9 percent. Local areas of more steeply sloping terrain occur along the Dand Channel and slopes adjacent to tributary gullies and ravines may exceed 30 percent.

The soil materials of the RM are primarily loam textured in the eastern portion while sandy soils are most common in the western half of the municipality (page 11). Local areas of coarse loamy lacustrine materials occur in the Antler River-Lake Souris Plain and minor areas of stratified loam to clay textured alluvial deposits occur on the floodplain of the Souris River. Soils in the Boissevain Plain are developed mainly on loamy textured glacial till. Shallow sediments underlain by shale bedrock occur along portions of the Dand Channel in the southeastern part of the municipality.

Soils in the municipality have been mapped at a detailed 1:20 000 scale and a semi-detailed 1:40 000 scale and published in Soils of the Boissevain-Melita Area, Soil Report No. 20, (Eilers et al., 1978). According to the Canadian System of Soil Classification (Expert Committee on Soil Survey, 1987), the soils are dominantly Black Chernozems with local areas of Humic Gleysols in depressional areas. Soils with minimal horizon developement (regosols) are common in the sand dune areas and on stratified alluvial deposits associated with the Souris River. The crests of knolls and ridges affected by severe water and wind erosion are also characterized by Regosolic soils. A more detailed and complete description of the type, distribution and textural variability of soils in the municipality is provided in the published soil report.

Surface drainage of the RM is facilitated mainly by the Souris River and its tributary creeks and channels. Imperfectly drained soils with seasonally high water tables are dominant and together with well and rapidly drained soils account for about 90 percent of the land area. Steeply sloping areas adjacent to the Dand Channel and in the sand dune areas are rapidly drained. Poorly drained soils occur mainly to the north of the Souris River and are most extensive adjacent to Marshy Lake (Page 13).

Areas of weak soil salinity (page 15) occur mainly in the area between the Souris River and the Boissevain Plain to the southeast, usually in association with imperfectly or poorly drained soils affected by high water tables. Subsoil salinity caused by upward seepage of salt-affected groundwater affects vegetative growth in drier periods of the growing season on soils in the vicinity of

Hartney. In addition to salinity, other management considerations are primarily related to coarse texture, topography and wetness (page 17). Slightly to moderately stony soil conditions are locally important in the southeastern portion of the RM. Shale bedrock occurs close to the surface along portions of the Dand Channel.

The majority of the soils in the RM (64 %) are rated in **Class 2** and **3** for agriculture capability (page 19). Low water holding capacity (droughtiness), topography and wetness are the main limitations for agriculture. About 70 percent of the soils are classified as **Good** to **Fair** for irrigation suitability and small areas of level, well drained loamy soils (nearly 11 percent of the RM) are rated as **Excellent** (page 21). Sandy soils are rated in **Class 3 or 4,** depending on drainage, water holding capacity and topography, and **Good** to **Fair** for irrigation. Steeply sloping soils, very coarse textured and very poorly drained soils are rated in **Class 5, 6** or **7** for agriculture and **Poor** for irrigation. Saline affected soils in the municipality are rated in **Class 3** for agriculture capability and **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 23). As shown, slightly over 36 percent of the soils in the RM are at **Low** risk of degradation. Soils with slopes in excess of 5 percent present a **Moderate** risk of environmental impact and steeply sloping soils are rated as having a **High** risk under irrigation. These conditions increase the risk or potential for rapid runoff from the soil surface and the transport of potential contaminants into adjacent wetlands or water bodies. The extensive areas of sandy soils in the western part of the RM have an increased risk for deep leaching of potential contaminants on the soil surface and are also rated as having a **High** risk of impact on the environment. This EI map is intended to be used in association with the irrigation suitability map.

Another issue of concern to producers and soil conservation 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 25). The risk of water erosion is **Negligible** for 46 percent of the soils in the RM and a further 42 percent of the area is at **Low** to **Moderate** risk. Areas of gently undulating loamy soils are at **High** risk of water erosion and knolls and ridges in these areas are also susceptible to erosion by wind. The more steeply sloping soils in the Boissevain Plain are at a **Severe** risk of degradation. Management practices focus primarily on maintaining adequate crop residues to provide sufficient surface cover during the early spring period. Sandy soils require careful management to keep soil erosion to a minimum; these practices include shelter belts, minimum tillage and suitable crop rotations. To provide adequate protection for the steeper sloping lands most at risk to water erosion and the coarser textured soils most at risk from wind erosion, a shift in land use away from annual cultivation to production of perennial forages and pasture may be required.

Land use in the RM of Cameron is primarily agriculture. An assessment of the status of land use in 1993 was obtained through an analysis of satellite imagery. It showed that annual crops occupied about 52 percent of the land in the RM, while the remaining areas were in grassland (27.7%), tree cover (12.6%) and forage production (2.9%). Most of the grassland and treed area occurs on the sandy textured soils most susceptible to degradation through wind erosion. Wetlands cover 1.1 percent of the area and small water bodies occupy less than 1 percent. The grassland areas provide native and improved pasture and forage for livestock. Various non-agricultural uses such as recreation and infrastructure for urban areas and transportation occupy about 2.7 percent of the RM (page 27).

While most of the soils in the RM of Cameron have moderate to moderately severe limitations for arable agriculture, management of lands with severe to very severe limitations requires careful choice of crops and maintenance of adequate surface cover to reduce the risk of degradation and maintain productivity. Implementation of conservation practices on all soils on a site-by-site basis will help to 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, soil salinity, 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
Surface Texture
Drainage
Salinity
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 Manitoba Land Resource Unit.

Slope Map.

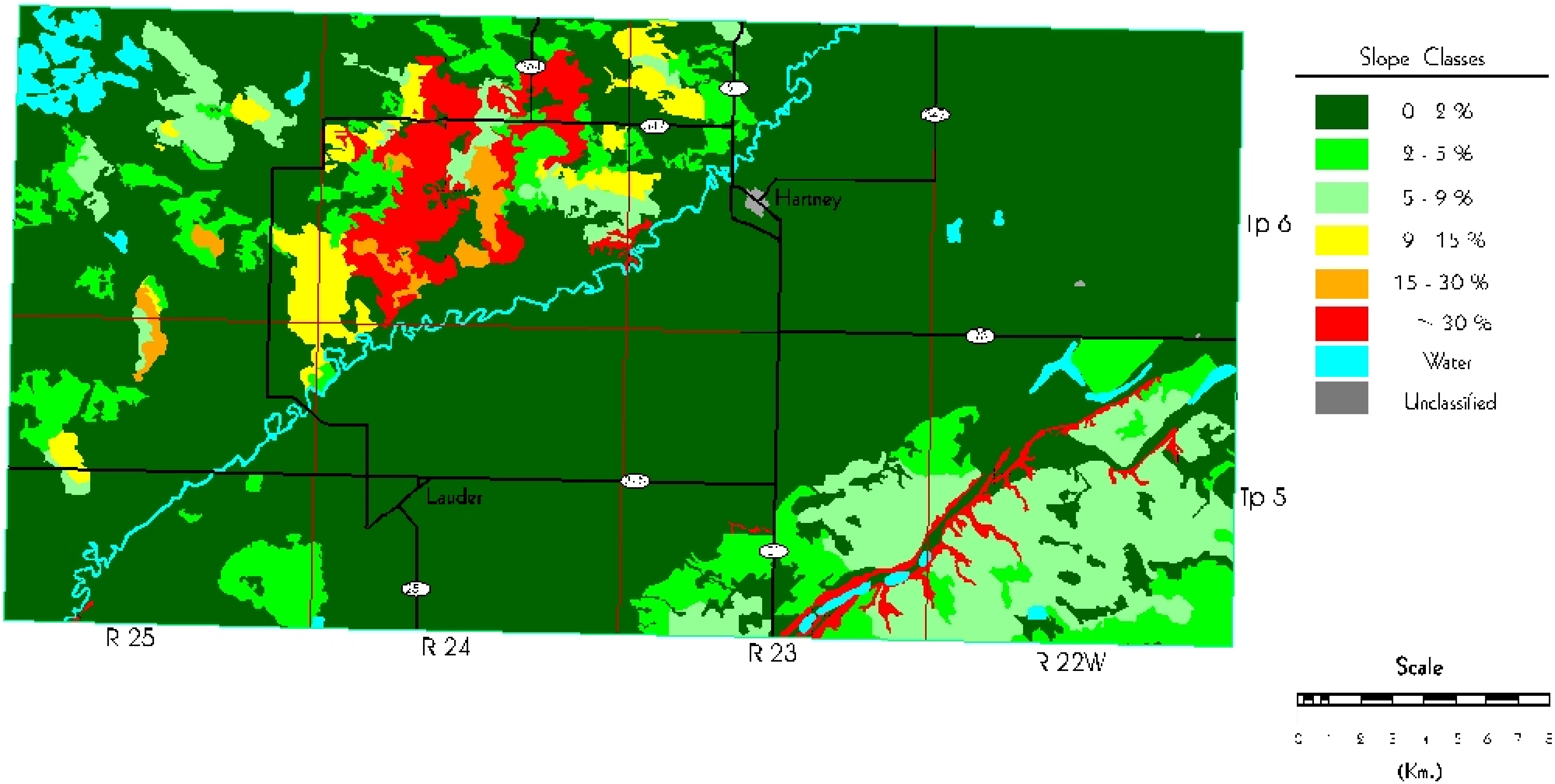
Slope describes the steepness of the landscape surface. The slope classes shown on this map are derived from the digital soil layer database. Specific colours are used to indicate the dominant slope class for each soil polygon in the RM. Additional slope classes may occur in each polygon area, but cannot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

Table 1. Slope Classes[1]

Slope Class	Area (ha)	Percent of RM
0 - 2 %	56577	72.9
2 - 5 %	6863	8.8
5 - 9 %	7290	9.4
9 - 15 %	1875	2.4
15 - 30 %	656	0.8
> 30 %	3043	3.9
Unclassified	56	0.1
Water	1245	1.6
Total	77604	100.0

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

Slope Map



Universal Transverse Mercator
(NAD27) Projection

Land Resource Unit
Brandon Research Centre
March 1998

Surface Texture Map.

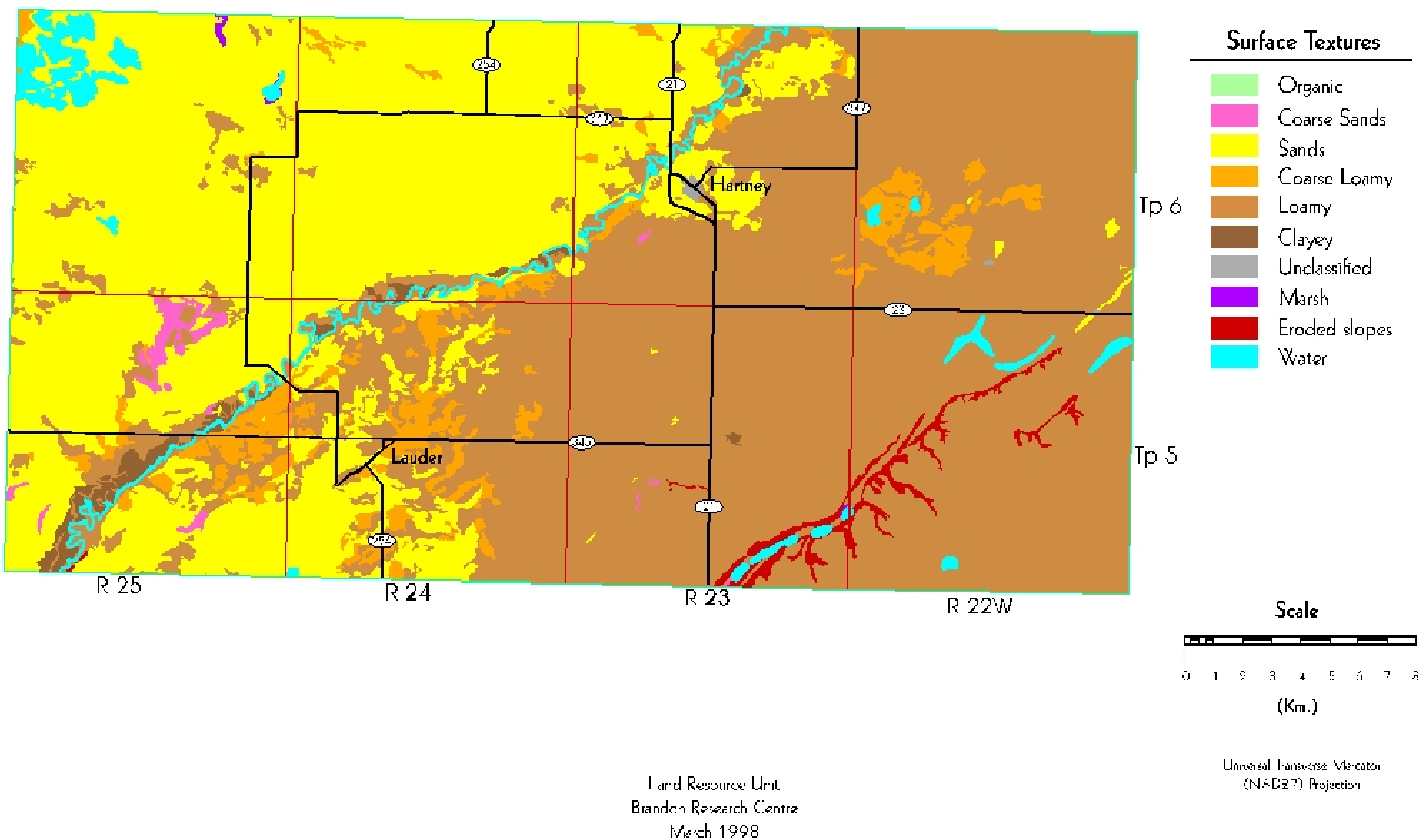
The soil textural class for the upper most soil horizon of the dominant soil series within a soil polygon was utilized for classification. Texture may vary from that shown with soil depth and location within the polygon.

Table 2. Surface Texture[1]

Surface Texture	Area (ha)	Percent of RM
Organics	0	0.0
Coarse Sands	419	0.5
Sands	30198	38.9
Coarse Loamy	3627	4.7
Loamy	40629	52.4
Clayey	623	0.8
Eroded Slopes	757	1.0
Marsh	50	0.1
Unclassified	56	0.1
Water	1245	1.6
Total	77604	100.0

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

Surface Texture Map



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. Six drainage classes plus four 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.

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.

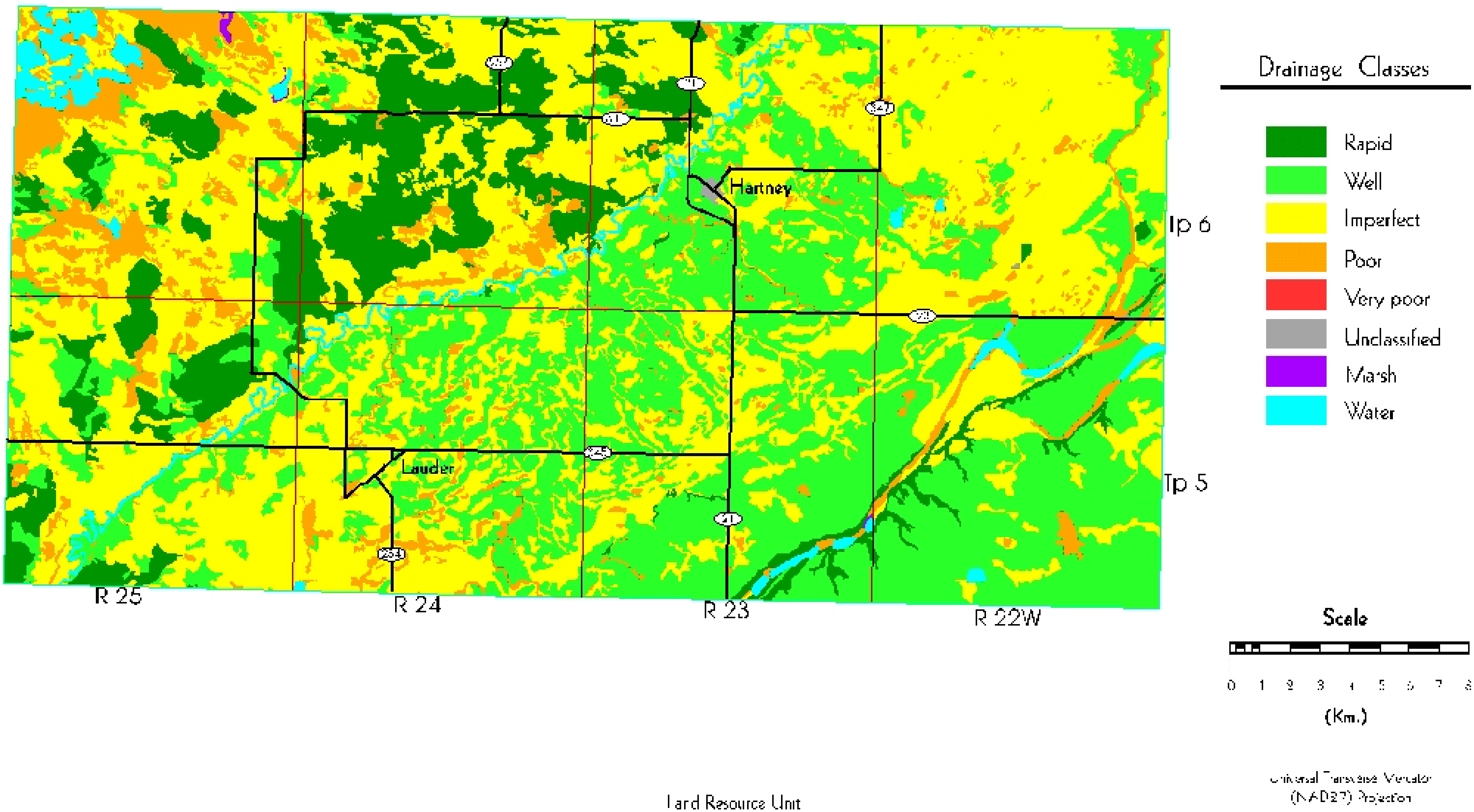
Drainage classification is based on the dominant soil series within each individual soil polygon.

Table 3. Drainage Classes[1]

Drainage Class	Area (ha)	Percent of RM
Very Poor	0	0.0
Poor	5783	7.5
Imperfect	35728	46.0
Well	25682	33.1
Rapid	9060	11.7
Marsh	50	0.1
Unclassified	56	0.1
Water	1245	1.6
Total	77604	100.0

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

Soil Drainage Map



Land Resource Unit
Brandon Research Centre
March 1998

Soil Salinity Map.

A saline soil contains soluble salts in such quantities that they interfere with the growth of most crops. Soil salinity is determined by the electrical conductivity of the saturation extract in decisiemens per metre (dS/m). Approximate limits of salinity classes are:

non-saline	< 4 dS/m
weakly saline	4 to 8 dS/m
moderately saline	8 to 15 dS/m
strongly saline	> 15 dS/m.

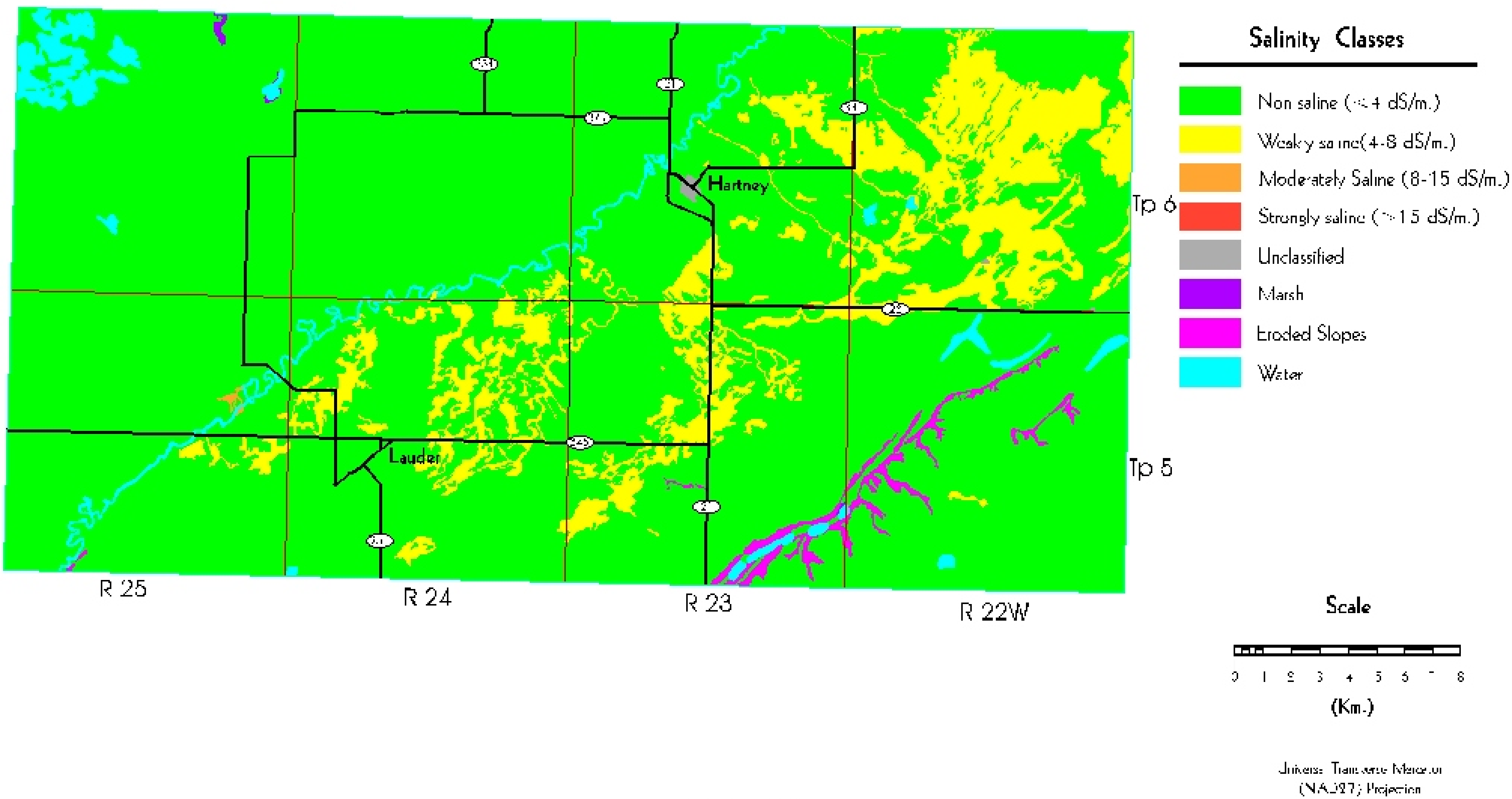
The salinity classification of each individual soil polygon was determined by the most severe salinity classification present within that polygon.

Table 4. Salinity Classes[1]

Salinity Class	Area (ha)	Percent of RM
Non Saline	66540	85.7
Weakly Saline	8926	11.5
Moderately Saline	30	0.0
Strongly Saline	0	0.0
Eroded Slopes	757	1.0
Marsh	50	0.1
Unclassified	56	0.1
Water	1245	1.6
Total	77604	100.0

[1] Area has been assigned to the most severe salinity class for each soil polygon.

Soil Salinity Map



Land Resource Unit
Brandon Research Centre
March 1998

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)**, have 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.

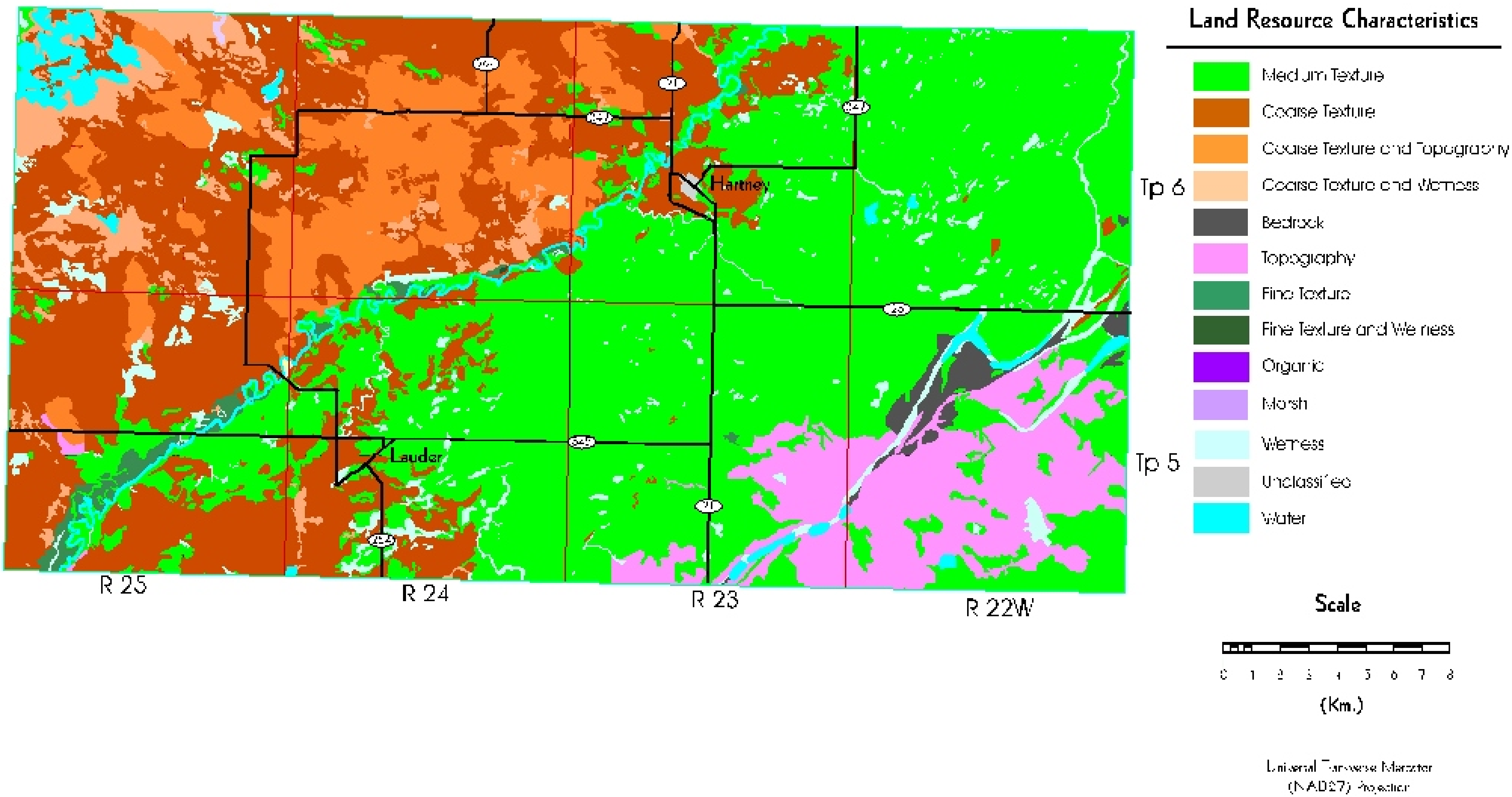
R = Bedrock - soil landscapes that have shallow depth to bedrock (< 50 cm) and/or exposed bedrock which may prevent the use of some or all tillage practices as well as the range of potential crops. They require special cropping and management practices to sustain agricultural production.

Table 5. Management Considerations[1]

Land Resource Characteristics	Area (ha)	Percent of RM
Fine Texture	648	0.8
Fine Texture and Wetness	6	0.0
Fine Texture and Topography	0	0.0
Medium Texture	35105	45.2
Coarse Texture	21084	27.2
Coarse Texture and Wetness	2980	3.8
Coarse Texture and Topography	6548	8.4
Topography	6316	8.1
Topography and Bedrock	0	0.0
Wetness	2785	3.6
Wetness and Topography	0	0.0
Bedrock	0	0.0
Organic	0	0.0
Marsh	50	0.1
Unclassified	56	0.1
Water	1245	1.6
Total	77604	100.0

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

Management Considerations Map



Land Resource Unit
Brandon Research Centre
March 1998

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 6. Agricultural Capability[1]

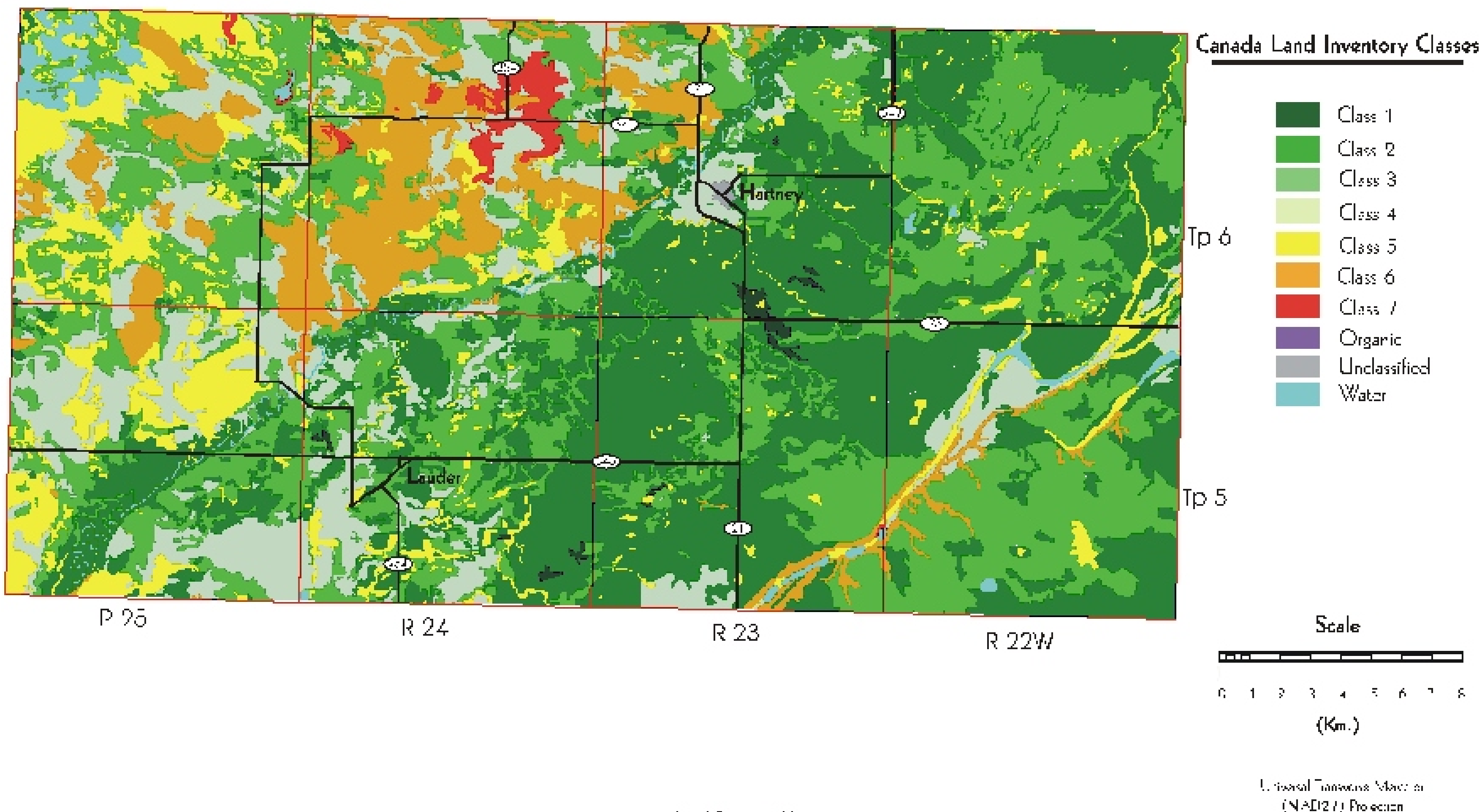
Class Subclass	Area (ha)	Percent of RM
1	**254**	**0.3**
2	**24719**	**31.8**
2I	192	0.2
2IW	600	0.8
2M	1395	1.8
2ME	22	0.0
2T	2683	3.5
2TE	36	0.0
2TP	334	0.4
2W	9185	11.8
2WP	275	0.4
2X	9999	12.9
3	**25152**	**32.4**
3I	182	0.2
3M	11542	14.9
3ME	25	0.0

Table 6. Agricultural Capability[1](cont)

Class Subclass	Area (ha)	Percent of RM
3MN	49	0.1
3N	8100	10.4
3T	3435	4.4
3TE	1820	2.3
4	**11164**	**14.4**
4	445	0.6
4EM	67	0.1
4ET	288	0.4
4M	9504	12.2
4R	767	1.0
4RD	88	0.1
4RM	4	0.0
5	**7533**	**9.7**
5	121	0.2
5M	1608	2.1
5W	5748	7.4
5WI	55	0.1
6	**6874**	**8.8**
6M	4471	5.8
6MT	1645	2.1
6T	758	1.0
7	**719**	**0.9**
7T	669	0.9
7W	50	0.1
Unclassified	**56**	**0.1**
Water	**1250**	**1.6**
Total	**77720**	**100.0**

[1] Based on **dominant** soil, slope gradient, and slope length of each soil polygon.

Agriculture Capability Map



Land Resource Unit
Winnipeg Manitoba
June 2003

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.

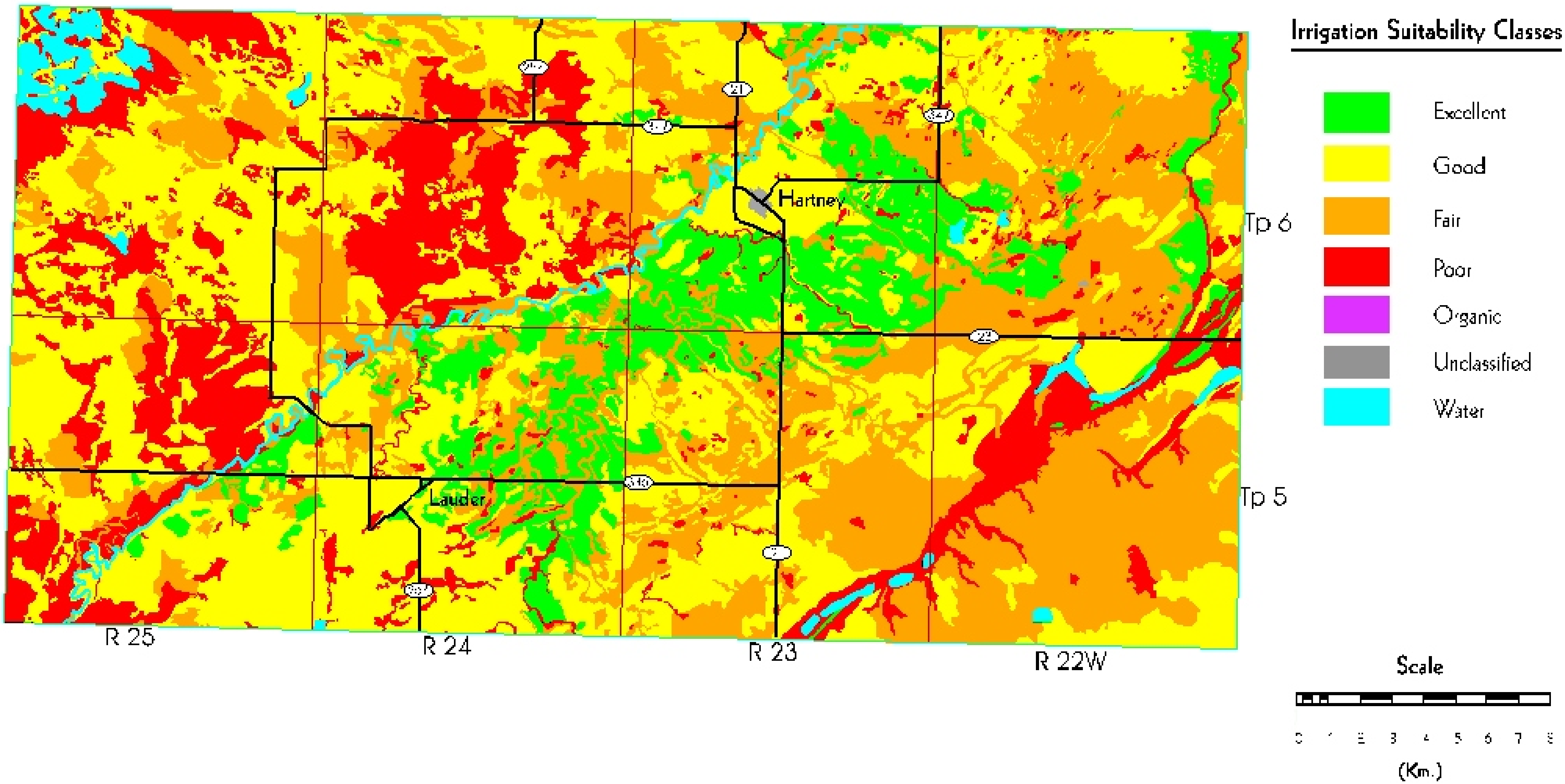
This generalized interpretive map is based on the dominant soil series for each soil polygon, in combination with the dominant slope class. The nature of the subclass limitations and the classification of subdominant components is not shown at this generalized map scale.

Table 7. Irrigation Suitability[1]

Class	Area (ha)	Percent of RM
Excellent	**8404**	**10.8**
Good	**31176**	**40.2**
Fair	**23748**	**30.6**
Poor	**12974**	**16.7**
Organic	**0**	**0.0**
Unclassified	**56**	**0.1**
Water	**1245**	**1.6**
Total	**77604**	**100.0**

[1] Based on **dominant** soil, slope gradient, and slope length of each soil polygon.

Irrigation Suitability Map



Universal Transverse Mercator
(NAD27) Projection

Land Resource Unit
Brandon Research Centre
March 1998

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.

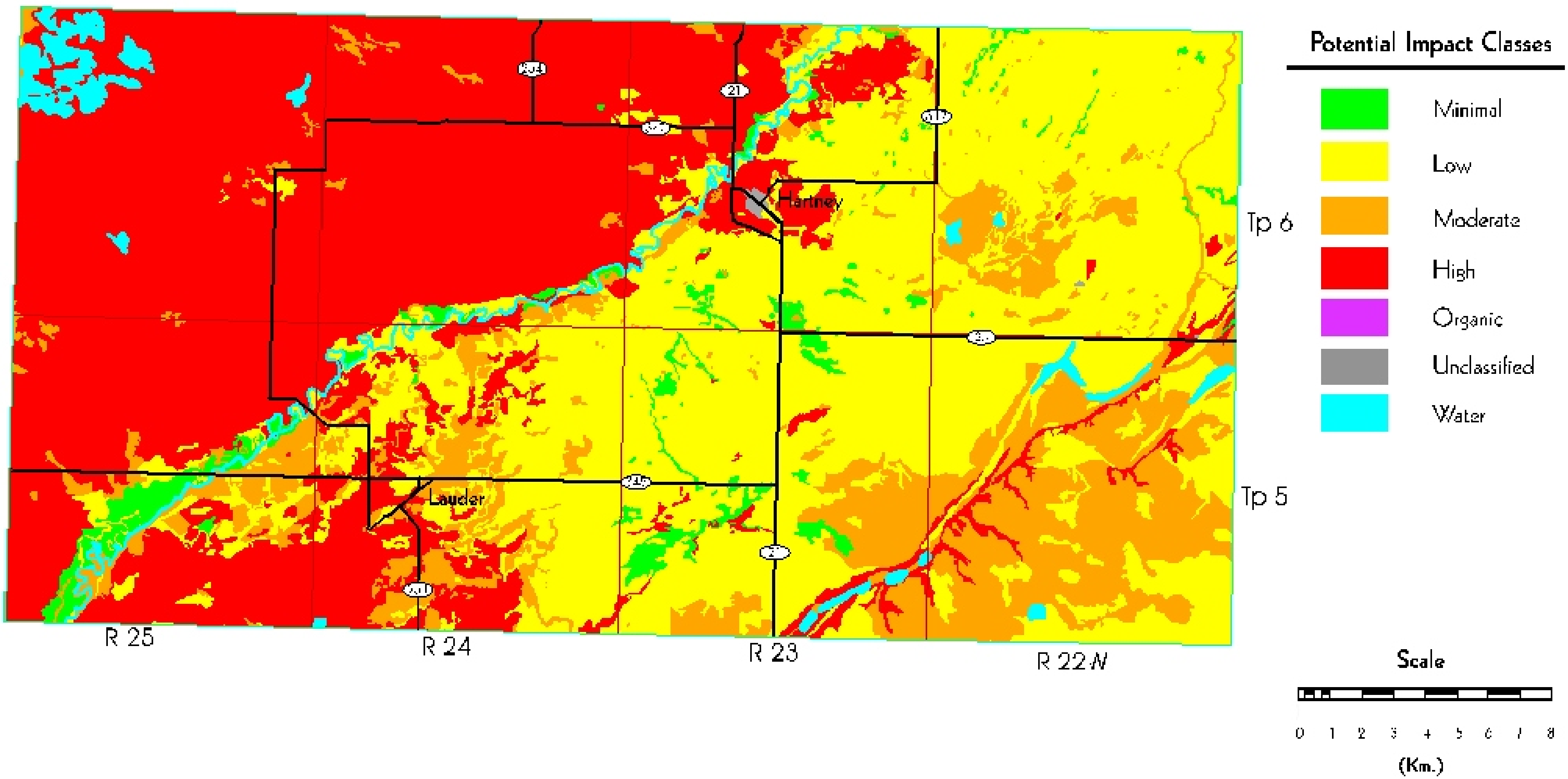
This generalized interpretive map is based on the dominant soil series and slope class for each soil polygon. The nature of the subclass limitations, and the classification of subdominant components is not shown at this generalized map scale.

Table 8. Potential Environmental Impact Under Irrigation[1]

Class	Area (ha)	Percent of RM
Minimal	**1854**	**2.4**
Low	**30318**	**39.1**
Moderate	**11761**	**15.2**
High	**32370**	**41.7**
Organic	**0**	**0.0**
Unclassified	**56**	**0.1**
Water	**1245**	**1.6**
Total	**77604**	**100.0**

[1] Based on **dominant** soil, slope gradient, and slope length of each soil polygon.

Potential Environmental Impact Under Irrigation



Universal Transverse Mercator (NAD27) Projection

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March 1998

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. The map shows 5 classes of soil erosion risk based on bare unprotected soil:

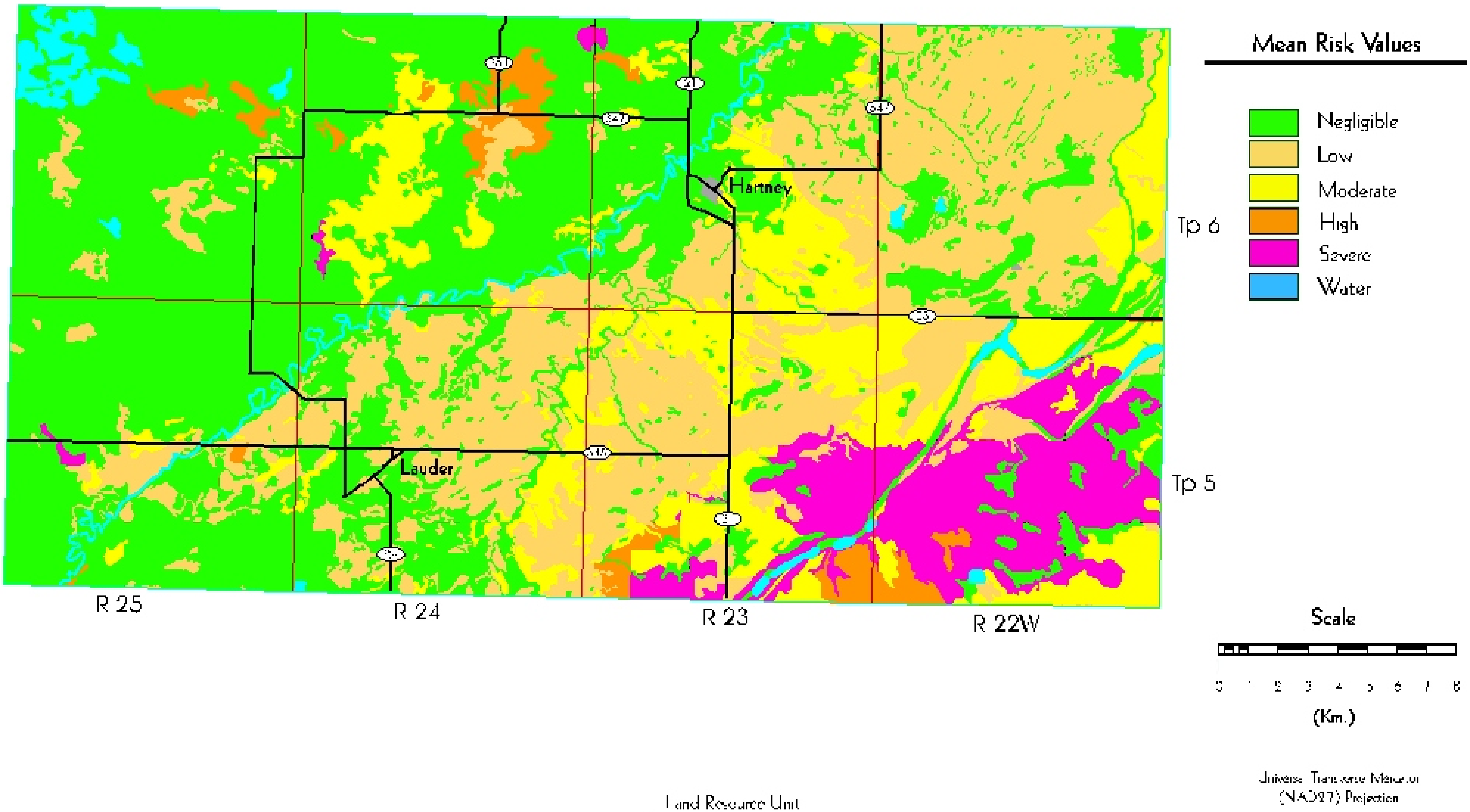
negligible
low
moderate
high
severe.

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

Table 9. Water Erosion Risk[1]

Class	Area (ha)	Percent of RM
Negligible	35569	45.8
Low	21832	28.1
Moderate	11163	14.4
High	1814	2.3
Severe	5926	7.6
Unclassified	56	0.1
Water	1245	1.6
Total	77604	100.0

Water Erosion Risk Map



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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.

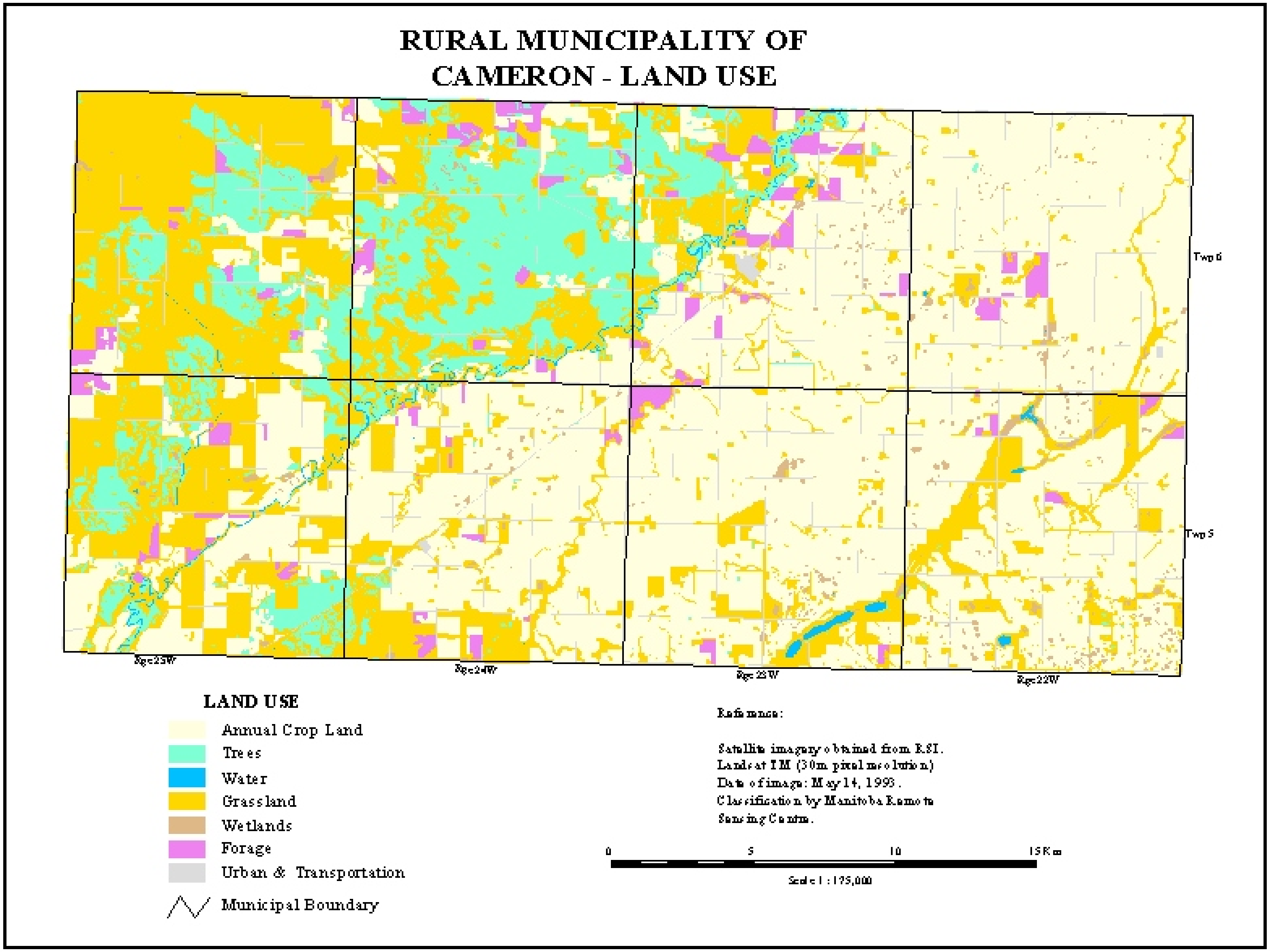
Water - open water - lakes, rivers streams, ponds, and lagoons.

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

Table 10. Land Use[1]

Class	Area (ha)	Percent of RM
Annual Crop Land	41000	52.4
Forage	2285	2.9
Grasslands	21728	27.7
Trees	9864	12.6
Wetlands	900	1.1
Water	418	0.5
Urban and Transportation	2113	2.7
Total	78308	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
CAMERON - LAND USE
Twp 6
Twp 5
Rge 25W
Rge 24W
Rge 23W
Rge 22W
LAND USE
Annual Crop Land
Trees
Water
Grassland
Wetlands
Forage
Urban & Transportation
Municipal Boundary
Reference:
Satellite imagery obtained from RSI.
Landsat TM (30m pixel resolution)
Date of image: May 14, 1993.
Classification by Manitoba Remote
Sensing Centre.
0
5
10
15 Km
Scale 1:175,000

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.

Ash, G.H.B. 1991. An Agroclimatic Risk Assessment of Southern Manitoba and Southeastern Saskatchewan. M.A. Thesis. Department of Geography, University of Manitoba, Winnipeg.

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

Canada-Manitoba Soil Survey. 1980. Physiographic Regions of Manitoba. Ellis Bldg., University of Manitoba, Winnipeg. Revised. Unpublished Report.

Canada-Manitoba Soil Survey. 1979. Ecological Regions and Subregions in Manitoba. Ellis Bldg., University of Manitoba, Winnipeg. Revised. Unpublished Report.

Eilers, R.G., Hopkins, L.A., and Smith, R.E., 1978. Soils of the Boissevain - Melita Area. Report No. 20. Canada-Manitoba Soil Survey. Winnipeg.

Environment Canada. 1982. Canadian Climatic Normals 1951-1980. Frost, Vol. 6; Atmospheric Environment, Downsview, Ontario.

Environment Canada. 1993. Canadian Climatic Normals 1961-1990. Prairie Provinces. Atmospheric Environment, Downsview, Ontario.

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

Irrigation Suitability Classification Working Group. 1987. An Irrigation Suitability Classification System for the Canadian Prairies. LRRC contribution no. 87-83, Land Resource Research Centre, Research Branch, Agriculture Canada, Ottawa

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. 1998. Soil and Terrain Classification System Manual. In preparation. Ellis Bldg. University of Manitoba. Winnipeg.

Wischmeier, 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.