Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

Rural Municipality of Ethelbert

Information Bulletin 99-43

Soils and Terrain

An introduction to the land resource

Land Resource Unit
Brandon Research Centre

Canada

Rural Municipality of Ethelbert

Information Bulletin 99-43

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.

Printed March, 2000

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

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

CITATION
Land Resource Unit, 2000. Soils and Terrain. An Introduction to the Land Resource. Rural Municipality of Ethelbert. Information Bulletin 99-43, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada

ACKNOWLEDGMENTS

Continuing support for this project has been provided by Brandon Research Centre and PFRA Manitoba. The project was initiated by the Land Resource Unit 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:

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.
R. Lewis, PFRA, Agriculture and Agri-Food Canada.

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

W.R. Fraser and R.G. Eilers, Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada.
P. Haluschak and G. Podolsky, Soil Resource Section, Soils and Crops Branch, Manitoba Agriculture.

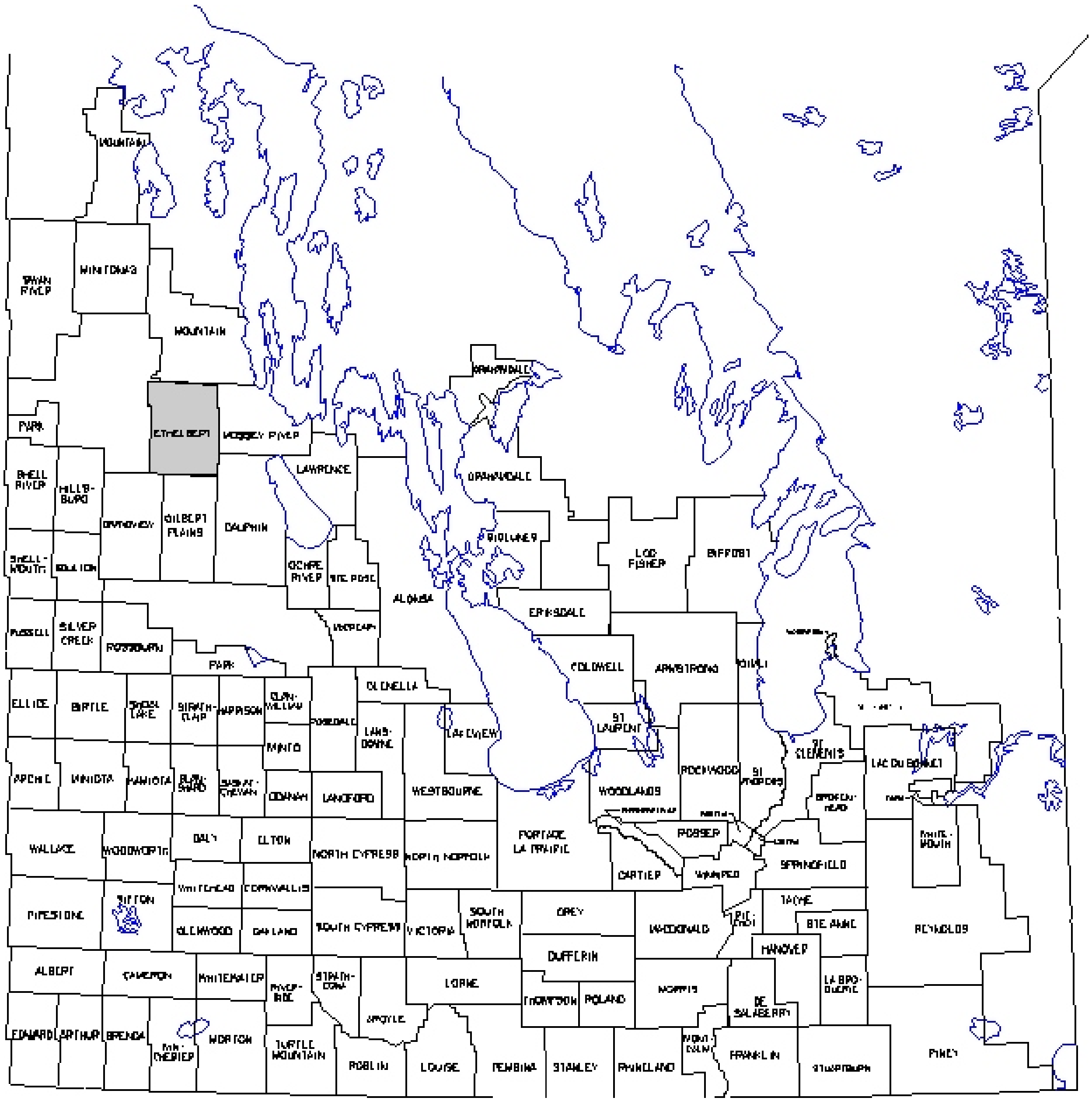


Figure 1. Rural municipalities of southern Manitoba.

INTRODUCTION

The location of the Rural Municipality of Ethelbert 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.

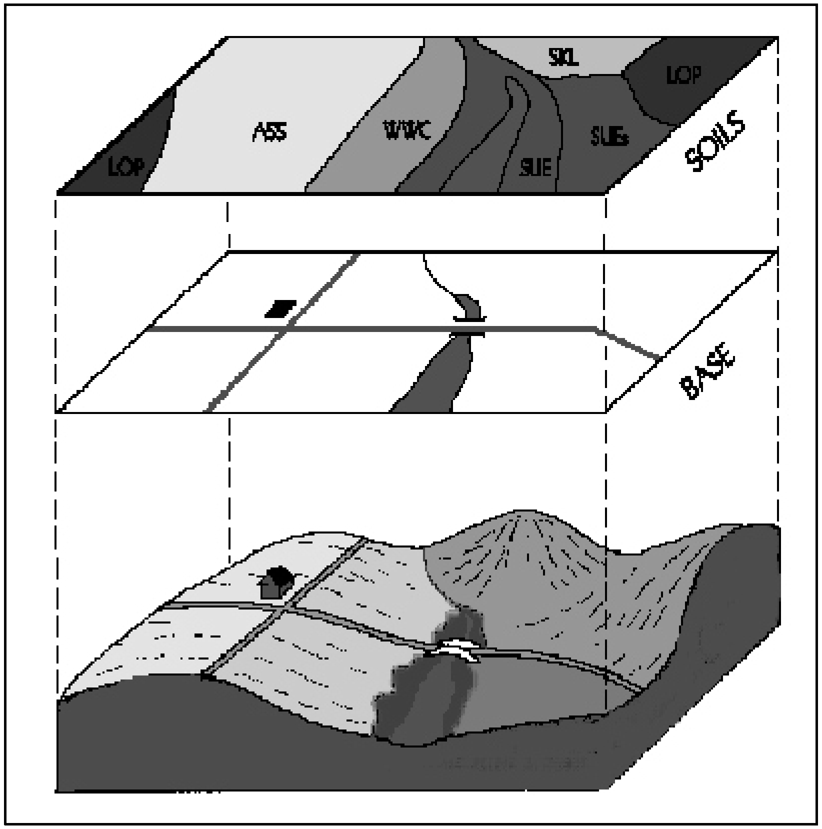


Figure 2. Soil and Base Map data.

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 Ethelbert covers an area of 114 116 hectares of land (approximately 12 townships) east of the Duck Mountain in western Manitoba (page 3). Twenty-six percent of the area is located in the Duck Mountain Forest Reserve. Ethelbert is the main population and agriculture service centre in the municipality with smaller concentrations of people in Garland and Mink Creek.

The climate in the southern half of the municipality can be related to weather data from Dauphin while climatic conditions north of Ethelbert are best described by data from Swan River. The mean annual temperature at Dauphin is 1.7˚C and the mean annual precipitation is 492 mm while Swan River has a mean annual temperature of 1.4˚C and average precipitation of 499 mm (Environment Canada, 1993). The average frost-free period in the southern area is 112 days and degree-days above 5˚C average 1580. The slightly cooler and shorter growing season north of Ethelbert has an average frost-free period of 109 days with 1486 degree-days above 5˚C (Ash, 1991). The seasonal moisture deficit calculated for the period between May and September is just under 200 mm in the Duck Mountain Upland and slightly greater than 200 mm in the remainder 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 varies from less than 1100 in the Duck Mountain Upland to 1400 on the eastern edge of the municipality (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 and the Valley River Plain located west of the Manitoba Escarpment comprise the largest part of the municipality. The area east of the Escarpment is in the Dauphin Lake Plain and Westlake Till Plain (Canada-Manitoba Soil Survey, 1980). The Duck Mountain Upland is the highest part of the municipality. The elevations along its eastern boundary decrease from about 750 to 400 metres above sea level (m asl) in a distance of 9 km. The land surface east of the Duck Mountain Upland decreases gradually in elevation to about 300 m asl along the eastern edge of the municipality. A sharp break in the landscape occurs along the Manitoba Escarpment separating the Valley River Plain in the west from the Dauphin Lake Plain and the Westlake Till Plain to the east.

The Westlake Till Plain is characterized by a low ridge and swale topographic pattern trending in a north-south direction across the slope of the land. Local relief in these areas is low and the dominant slopes are under 2 percent (page 9). In contrast, the Duck Mountain Upland is hummocky with local relief between 3 and 8 metres and slopes of 5 to 9 percent. The escarpment bordering the Duck Mountain is dissected by drainage channels and gullies where local relief is higher and slopes range up to 15 and 30 percent. Surface drainage is provided by several creeks and streams flowing to Dauphin Lake while the Garland River flows northeasterly to Lake Winnipegosis. Soils in the western part of the area are well drained with minor areas of imperfect drainage on level areas and lower slopes. Imperfectly drained soils are dominant in the area east of the Manitoba Escarpment. Poorly drained and peaty soils occur in depressional areas throughout the municipality (page 13).

Soil materials in the municipality were deposited during the last glaciation and during the time of glacial Lake Agassiz. Thin, sandy textured sediments occur with stony, waterworked loam textured glacial till below the Manitoba Escarpment. West of the Escarpment, the Valley River Plain consists of highly calcareous loamy till with complexes of sand and gravel beach ridges and small floodplains of stratified alluvial deposits. The Duck Mountain Upland consists mainly of loamy textured till although the till may be mixed with colluvium and shale in steeply sloping areas (page 11).

Soils in the municipality have been mapped at a reconnaissance map scale of 1:126 720 and published in the soil survey report for the Grandview Map Sheet Area (Ehrlich et al., 1959) and in Open File for Soils of the Duck Mountain Forest Reserve (LRU, 2000b). According to the Canadian System of Soil Classification (Soil Classification Working Group, 1998), the soils at higher elevation are classified as Luvisols (Waitville and Grifton associations) and Dark Gray Chernozems (Leary and Rose Ridge associations). Black

Chernozem soils developed on loamy till (Meharry and Isafold associations) and sandy lacustrine sediments (Gilbert association) are common in the south with Eutric Brunisol and Dark Gray Chernozem soils of the Garson and Selina associations most common in the northern part of the municipality. Local areas of poorly drained soils (Gleysols) and shallow peat (Organic) soils occur in depressional areas of the landscape. Regosolic soils of the Edwards association occur on stratified alluvial deposits (page 11). A more detailed and complete description of the type, distribution and textural variability of soils in the municipality is provided in the published soil surveys.

Topography is a major management consideration on higher terrain in the west whereas coarse soil textures and local wet areas are more of a concern in the eastern part of the area (page 15). Variably stony conditions occur on the till soils although very stony soils are of particular concern in waterworked areas east of the Escarpment.

Forty-nine percent of the soils have moderate limitation for agriculture resulting from topography, stoniness and wetness and are rated in **Class 3** for agriculture capability. Well drained, medium textured soils in gently sloping landscapes are rated in **Class 2** (page 17). Increasingly severe limitations resulting from topography, stoniness and wetness are rated in **Class 4** or **5** with very poorly drained soils and steeply sloping lands rated in **Class 6**. About 23 percent of the area is rated **Good** for irrigation suitability (page 19). Hummocky landscapes and imperfectly drained sandy soils underlain by medium textured till are rated **Fair** for irrigation while poorly drained soils and permeable gravel soils are rated **Poor**.

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 majority of the area is at a **Low** to **Minimal** risk of degradation. Gently to moderately sloping soils have a **Moderate** risk of degradation and steeply sloping soils and areas of sandy and gravelly soils are rated as having a **High** potential impact. 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). About 39 percent of the land in the RM is at a **Negligible** risk for potential water erosion while 40 percent of the area with high relief, steep slopes or long slope lengths is considered to have a **Severe** risk. This risk is minimized for the area within the Forest Reserve and many of the steeper sloping soils in the agriculture area that remain under tree cover. Management practices for land in annual crop focus primarily on maintaining adequate crop residues to provide sufficient surface cover. However, protection of the steeper sloping lands and the coarse textured soils at risk from wind erosion may require a shift in land use away from annual cultivation to production of perennial forages, pasture or permanent tree cover.

Agriculture is the dominant land use in the area. An assessment of the status of land use in 1994 obtained through analysis of satellite imagery showed that 15 percent of the land is in annual cropland. Production of perennial forages takes place on about 2 percent of the area while grassland occupies 24 percent. Most of the wooded area (52 percent) occurs in the Forest Reserve but steeper sloping soils in the agricultural area are often tree covered. Wetlands and small water bodies occupy 6 percent of the land area and non-agricultural uses such as recreation and infrastructure for urban areas and transportation utilize nearly 2 percent.

The majority of soils in the RM of Ethelbert 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 sandy textures 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:

<u>Derived Maps</u>
Slope
Generalized Soil
Drainage
Management Considerations

<u>Interpretative Maps</u>
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.

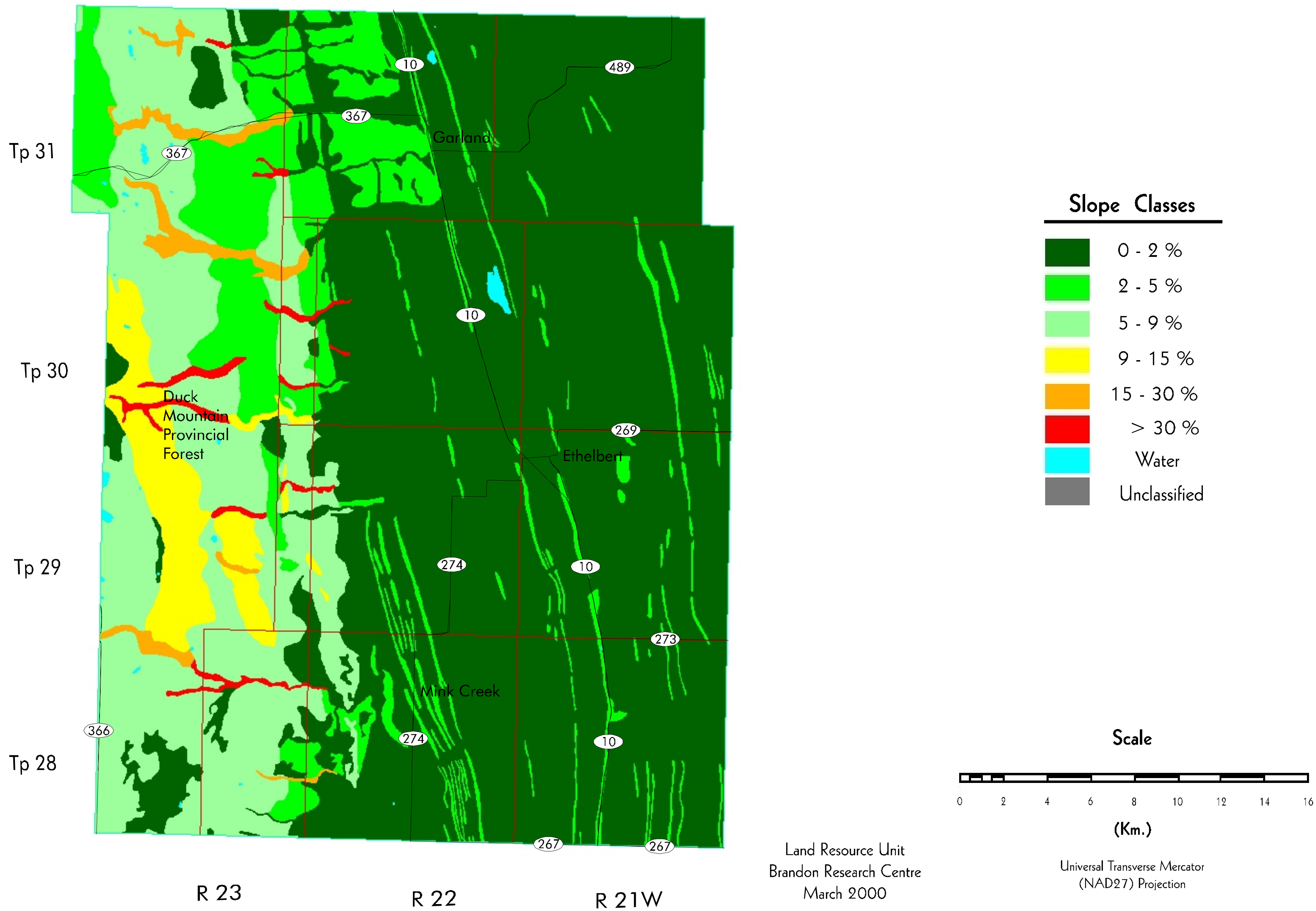
Slope describes the steepness of the landscape surface. The slope classes shown on this map are derived from the digital soil and terrain layer database. Specific colours are used to indicate the dominant slope class for each polygon in the RM. Additional slope classes may occur in each polygon area,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

Table 1. Slope Classes[1]

Slope Class	Area (ha)	Percent of RM
0 - 2 %	69639	61.0
2 - 5 %	14741	12.9
5 - 9 %	22241	19.5
9 - 15 %	4692	4.1
15 - 30 %	1601	1.4
> 30 %	979	0.9
Unclassified	0	0.0
Water	223	0.2
Total	114116	100.0

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

Slope Map



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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.

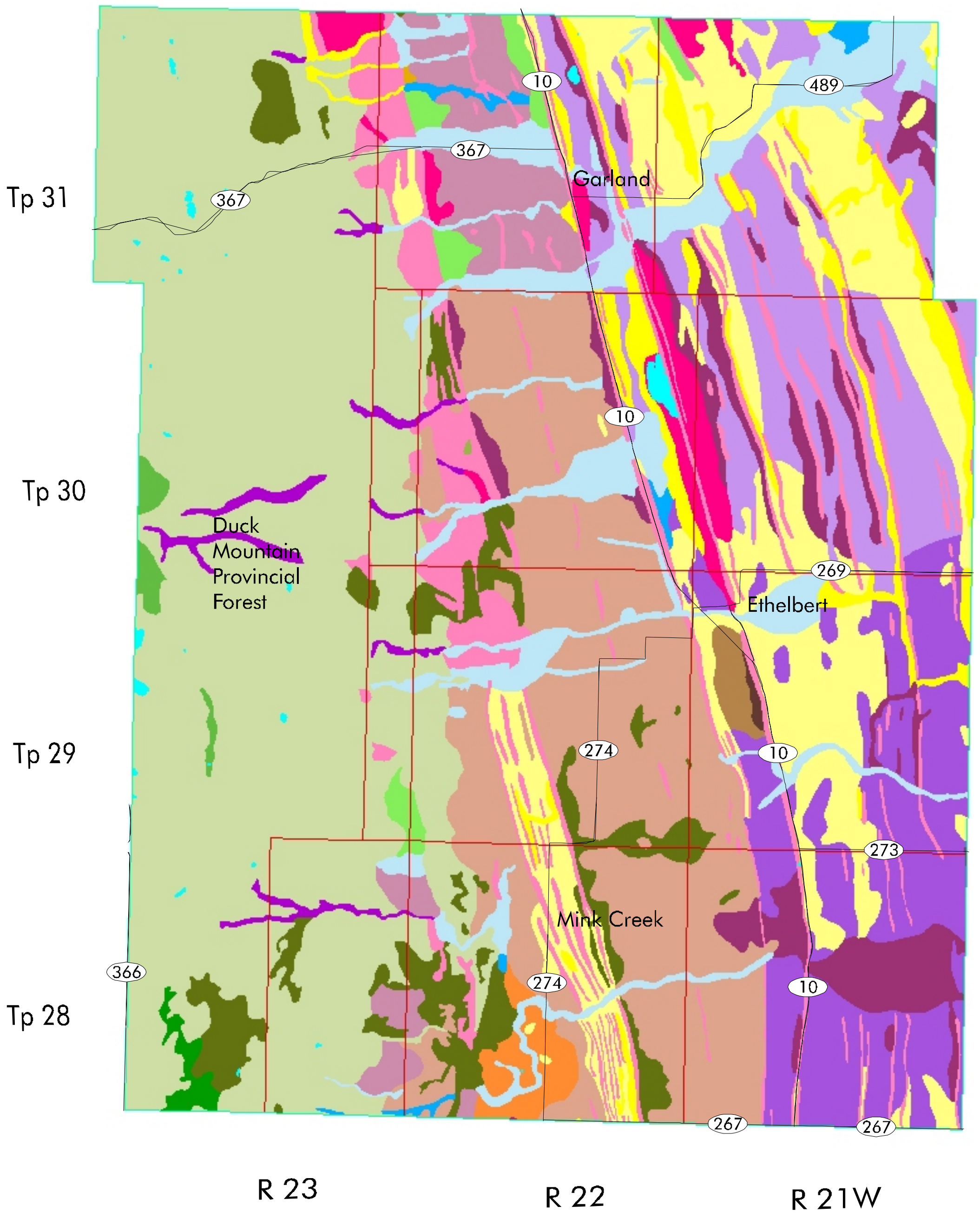
More detailed maps showing the dominant and subdominant soils in each polygon can also be produced at larger map scales.

Table 2. Generalized Soil Groups[1]

Soil Groups	Area (ha)	Percent of RM
Shallow Organic Forest Peat	325	0.3
Highly Calcareous Loamy Till (Gleysols)	4245	3.7
Variable Textured Alluvium (Gleysols)	409	0.4
Extremely Calcareous Loamy Till (Black Chernozems)	8015	7.0
Extremely Calcareous Loamy Till (Brunisols and Dark Gray Chernozems)	7312	6.4
Highly Calcareous Loamy Till (Black Chernozems)	15825	13.9
Loamy Till (Luvisols)	35135	30.8
Highly Calcareous Loamy Till (Brunisols and Dark Gray Chernozems)	3320	2.9
Loamy Till (Dark Gray Chernozem)	11	0.0
Clayey Lacustrine (Gleysols)	66	0.1
Sandy Loam Lacustrine (Gleysols)	18	0.0
Deep Organic Fen Peat	394	0.3
Shallow Organic Fen Peat	915	0.8
Sandy Lacustrine (Gleysols)	3519	3.1
Clayey Lacustrine (Black Chernozems)	398	0.3
Loamy Lacustrine	886	0.8
Loamy Till (Gleysols)	4286	3.8
Variable Textured Alluvium (Regosols)	6718	5.9
Sandy Lacustrine	11723	10.3
Sand and Gravel (Gleysols)	1822	1.6
Eroded Slopes	906	0.8
Sand and Gravel	7647	6.7
Water	223	0.2
Total	114116	100.0

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

Generalized Soil Map



Soil Associations

- Shallow Organic Forest Peat
- Highly Calcareous Loamy Till (Gleysols)
- Variable Textured Alluvium (Gleysols)
- Extremely Calcareous Loamy Till (Black Chernozems)
- Extremely Calcareous Loamy Till (Brunisols and Dark Gray Chernozems)
- Highly Calcareous Loamy Till (Black Chernozems)
- Loamy Till (Luvisols)
- Highly Calcareous Loamy Till (Brunisols and Dark Gray Chernozems)
- Loamy Till (Dark Gray Chernozems)
- Clayey Lacustrine (Gleysols)
- Sandy Loam Lacustrine (Gleysols)
- Deep Organic Fen Peat
- Shallow Organic Fen Peat
- Sandy Lacustrine (Gleysols)
- Clayey Lacustrine (Black Chernozems)
- Loamy Lacustrine
- Loamy Till (Gleysols)
- Variable Textured Alluvium (Regosols)
- Sandy Lacustrine
- Sand & Gravel (Gleysols)
- Eroded Slopes
- Sand & Gravel
- Water
- Unclassified

Scale

0 2 4 6 8 10 12 14 16

(Km.)

Universal Transverse Mercator
(NAD27) Projection

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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.

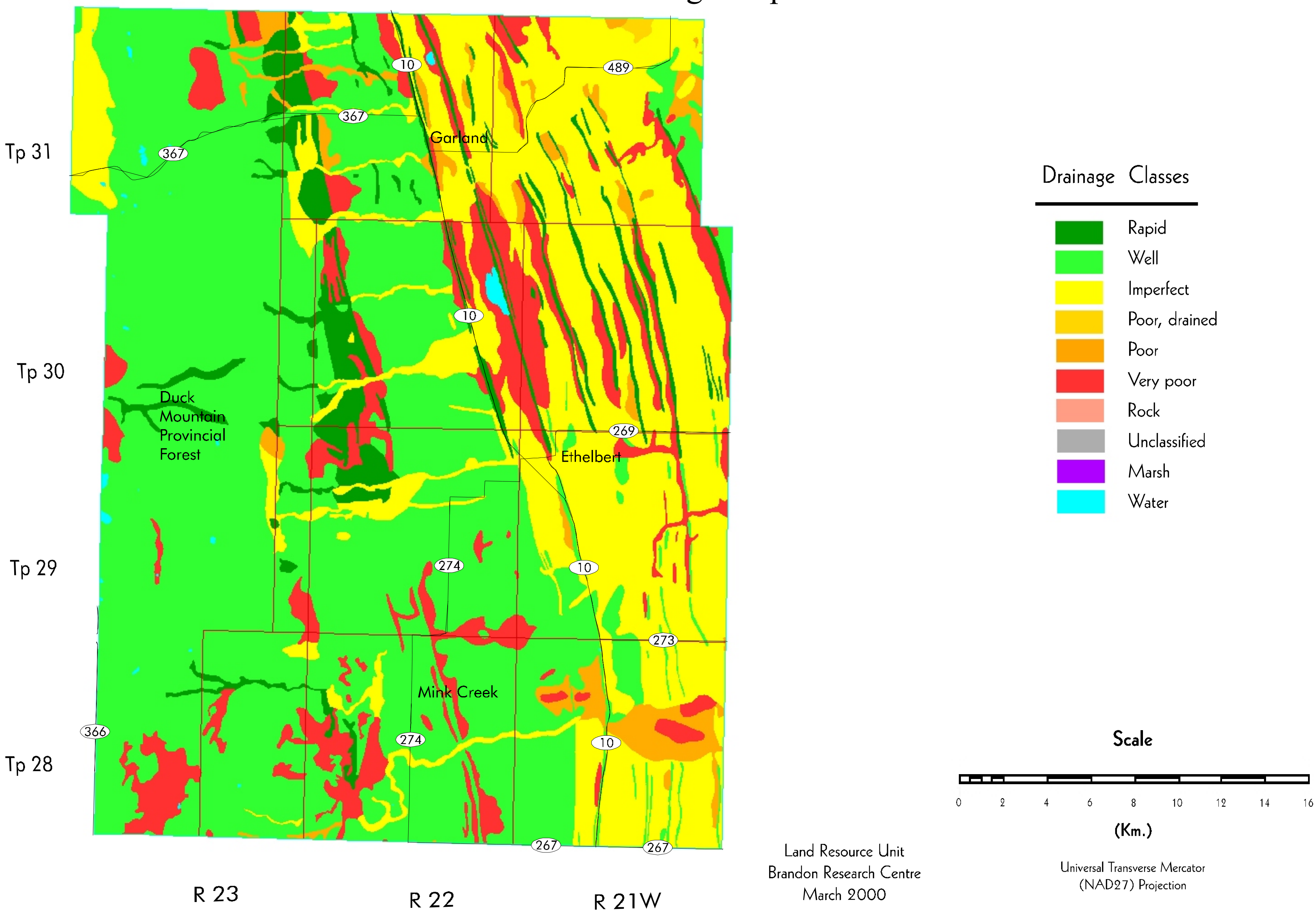
Drainage classification is based on the dominant soil series within each individual soil polygon.

Table 3. Drainage Classes[1]

Drainage Class	Area (ha)	Percent of RM
Very Poor	12364	10.8
Poor	3524	3.1
Poor, drained	109	0.1
Imperfect	31725	27.8
Well	59649	52.3
Rapid	6521	5.7
Rock	0	0.0
Marsh	0	0.0
Unclassified	0	0.0
Water	223	0.2
Total	114116	100.0

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

Soil Drainage Map



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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.

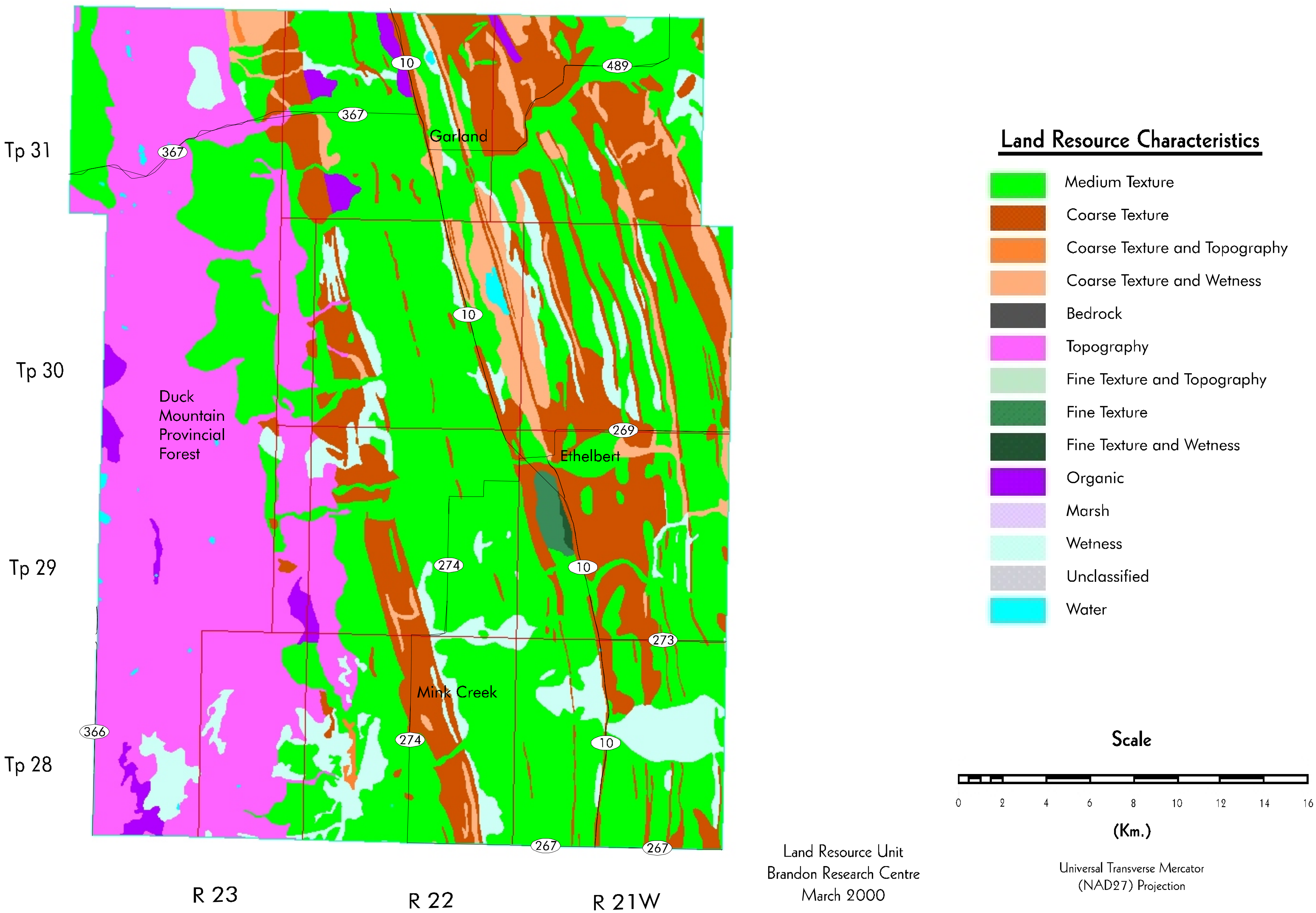
R = Bedrock - soil landscapes that have shallow depth to bedrock (< 50 cm) and/or exposed bedrock which may prevent the use of some or all tillage practices as well as the range of potential crops. They require special cropping and management practices to sustain agricultural production.

Table 4. Management Considerations[1]

Land Resource Characteristics	Area (ha)	Percent of RM
Fine Texture	398	0.3
Fine Texture and Wetness	66	0.1
Fine Texture and Topography	0	0.0
Medium Texture	48767	42.7
Coarse Texture	19218	16.8
Coarse Texture and Wetness	5341	4.7
Coarse Texture and Topography	152	0.1
Topography	29361	25.7
Bedrock	0	0.0
Wetness	8957	7.8
Organic	1634	1.4
Marsh	0	0.0
Unclassified	0	0.0
Water	223	0.2
Total	114116	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]

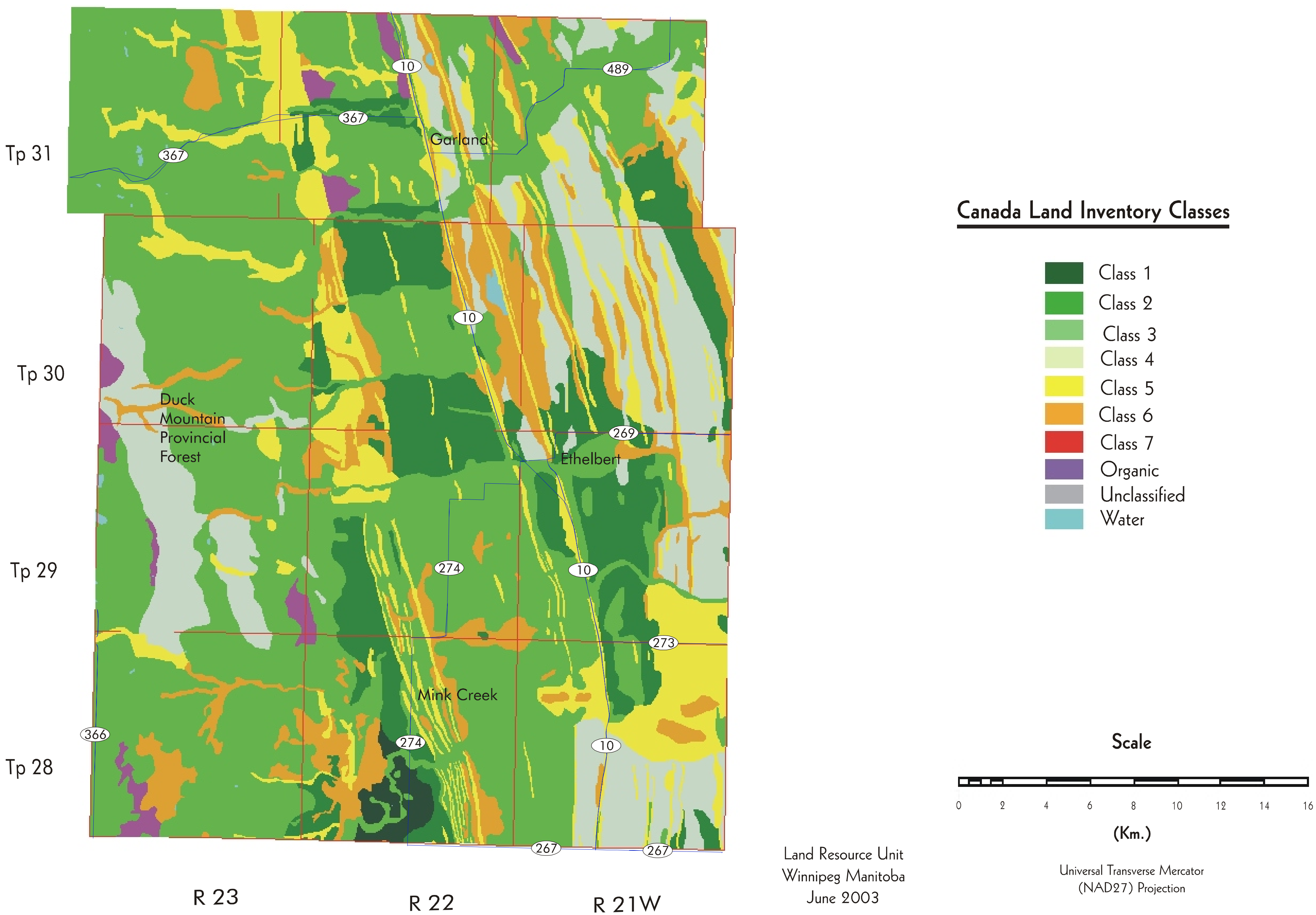
Class / Subclass	Area (ha)	Percent of RM
1	**886**	**0.8**
2	**13063**	**11.5**
2I	603	0.5
2M	5649	5.0
2P	3616	3.2
2T	446	0.4
2W	397	0.3
2X	2352	2.1

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

Class / Subclass	Area (ha)	Percent of RM
3	**55426**	**48.6**
3D	1773	1.6
3I	6103	5.4
3M	6045	5.3
3P	9811	8.6
3T	21622	19.0
3TP	492	0.4
3X	9580	8.4
4	**16768**	**14.7**
4DP	11965	10.5
4IW	109	0.1
4T	4694	4.1
5	**14331**	**12.6**
5M	7641	6.7
5P	1565	1.4
5T	1600	1.4
5W	3319	2.9
5WI	206	0.2
6	**11697**	**10.3**
6T	977	0.9
6W	10625	9.3
6WI	95	0.1
Water	**223**	**0.2**
Organic	**1639**	**1.4**
Total	**114033**	**100.0**

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

Agriculture Capability Map



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.

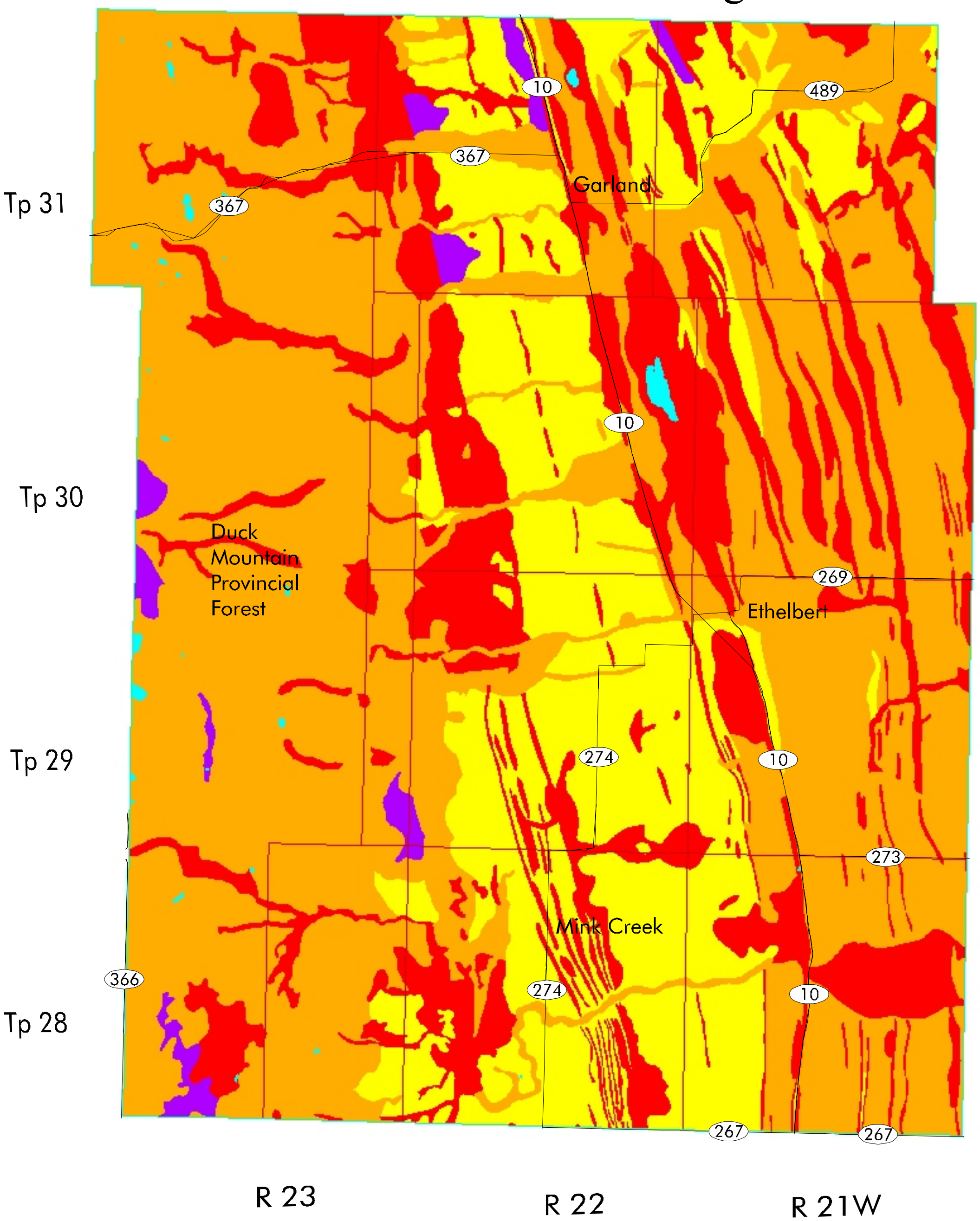
This generalized interpretive map is based on the dominant soil series for each soil polygon, in combination with the dominant slope class. The nature of the subclass limitations and the classification of subdominant components is not shown at this generalized map scale.

Table 6. Irrigation Suitability[1]

Class	Area (ha)	Percent of RM
Excellent	0	0.0
Good	26094	22.9
Fair	61177	53.6
Poor	24989	21.9
Organic	1634	1.4
Unclassified	0	0.0
Water	223	0.2
Total	114116	100.0

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

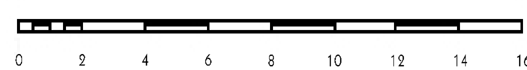
Irrigation Suitability Map



Irrigation Suitability Classes

- Excellent
- Good
- Fair
- Poor
- Organic
- Unclassified
- Water

Scale



(Km.)

Universal Transverse Mercator
(NAD27) Projection

Land Resource Unit
Brandon Research Centre
March 2000

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.

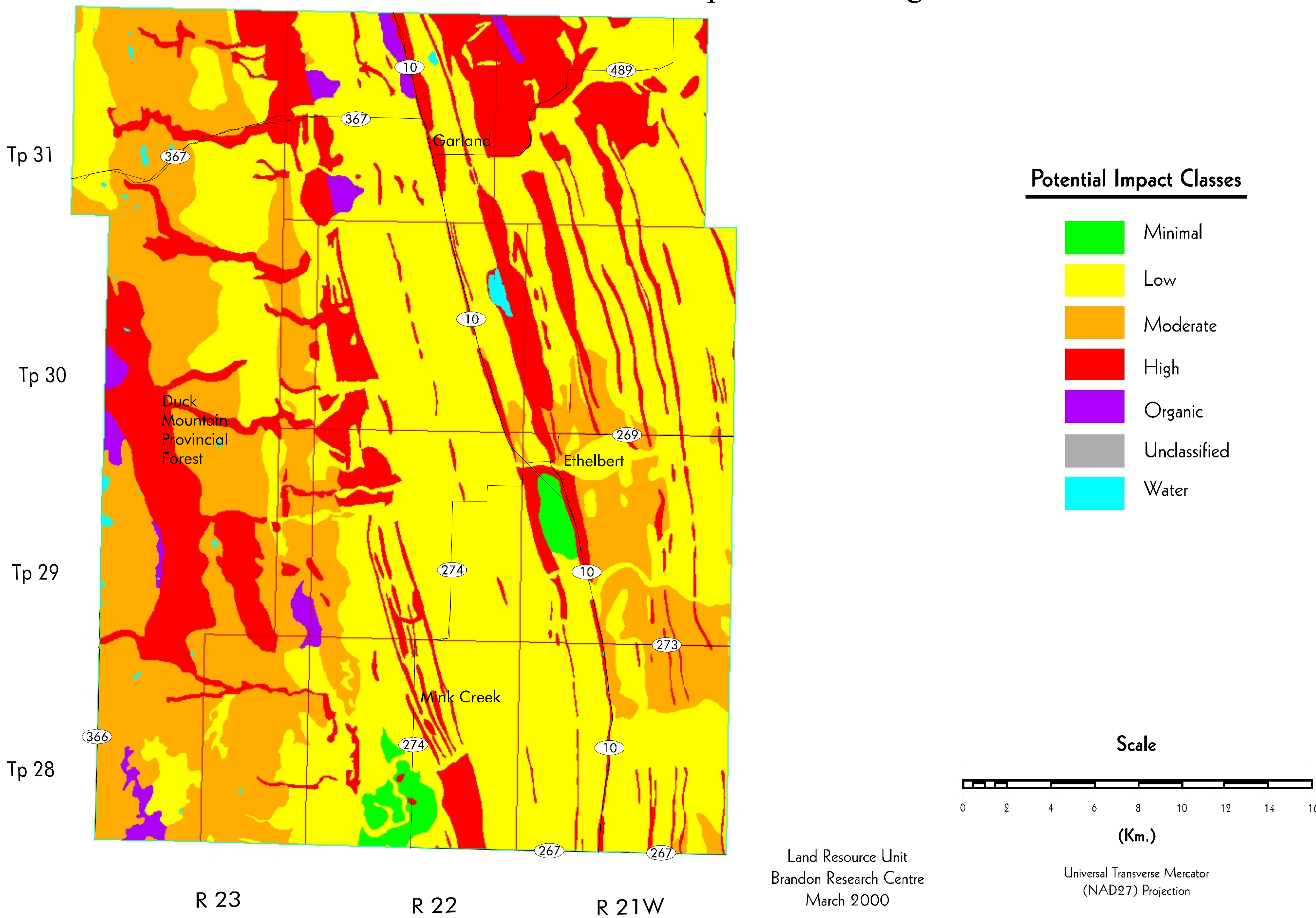
This generalized interpretive map is based on the dominant soil series and slope class for each soil polygon. The nature of the subclass limitations, and the classification of subdominant components is not shown at this generalized map scale.

Table 7. Potential Environmental Impact Under Irrigation[1]

Class	Area (ha)	Percent of RM
Minimal	1349	1.2
Low	60682	53.2
Moderate	27565	24.2
High	22664	19.9
Organic	1634	1.4
Unclassified	0	0.0
Water	223	0.2
Total	114116	100.0

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

Potential Environmental Impact Under Irrigation



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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

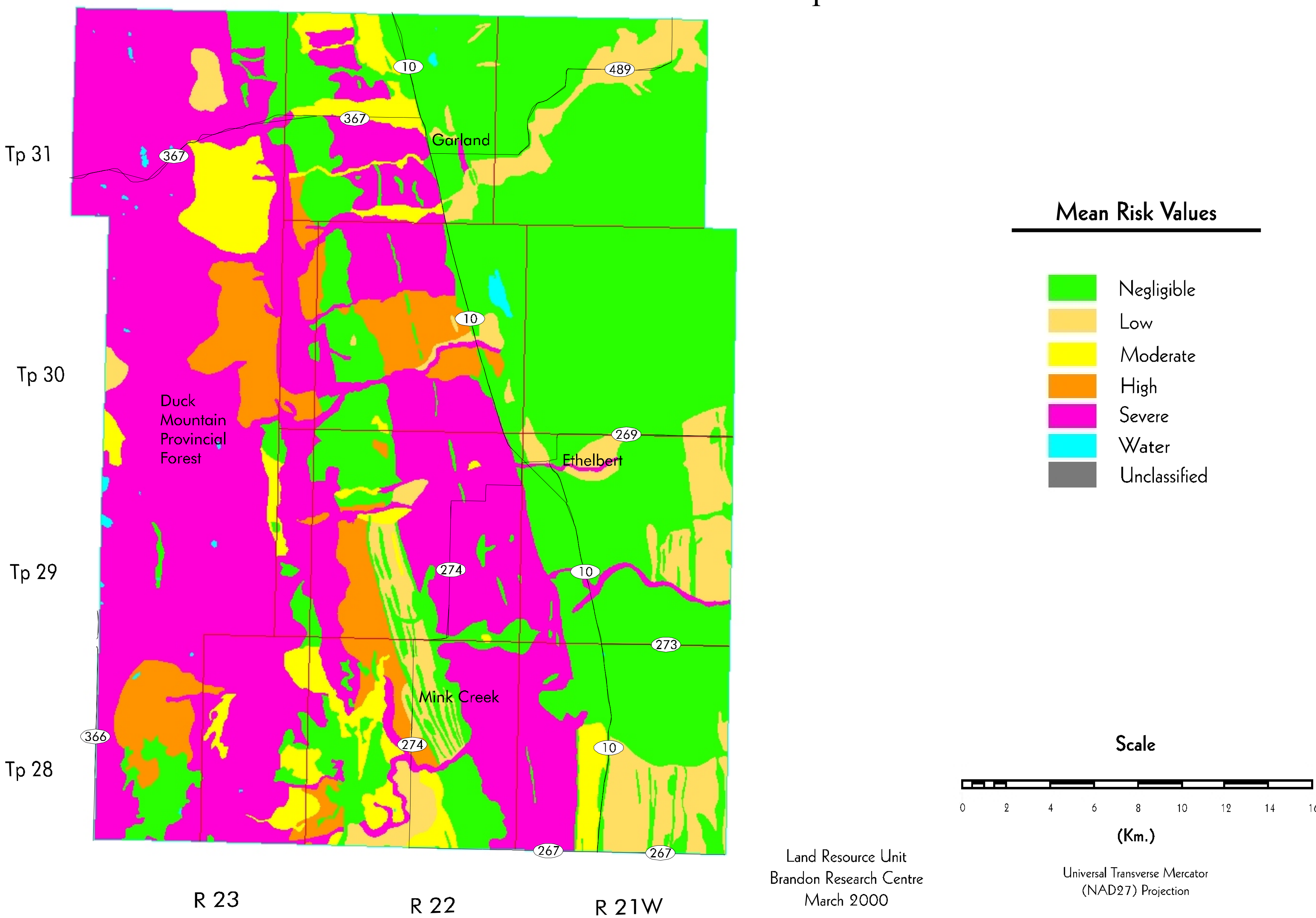
Cropping and residue management practices will significantly reduce this risk depending on crop rotation program, soil type, and landscape features.

Table 8. Water Erosion Risk[1]

Class	Area (ha)	Percent of RM
Negligible	**44234**	**38.8**
Low	**9150**	**8.0**
Moderate	**6728**	**5.9**
High	**7728**	**6.8**
Severe	**46054**	**40.4**
Unclassified	**0**	**0.0**
Water	**223**	**0.2**
Total	**114116**	**100.0**

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

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.

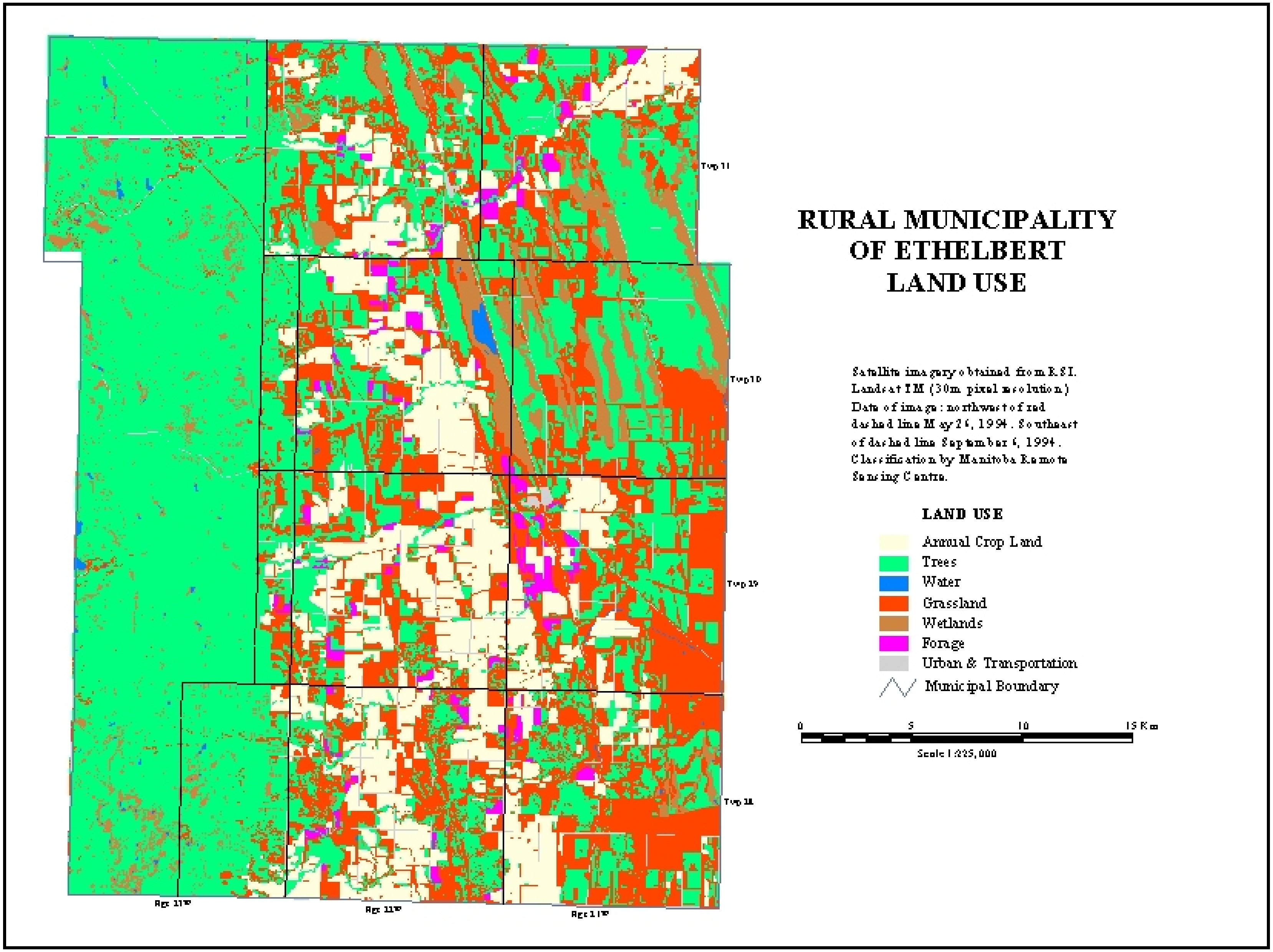
Water - open water - lakes, rivers streams, ponds, and lagoons.

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

Table 9. Land Use[1]

Class	Area (ha)	Percent of RM
Annual Crop Land	16932	14.7
Forage	1895	1.7
Grasslands	27670	24.1
Trees	59191	51.6
Wetlands	6756	5.9
Water	369	0.3
Urban and transportation	1991	1.7
Undifferentiated	0	0.0
Total	114,804	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 ETHELBERT
LAND USE
Satellite imagery obtained from RSI.
Landsat TM (30m pixel resolution)
Date of image: northwest of red
dashed line May 26, 1994. Southeast
of dashed line September 6, 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 Km
Scale 1:225,000

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