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Rural Municipality of Macdonald

Information Bulletin 98-25

Soils and Terrain

An introduction to the land resource

Land Resource Unit
Brandon Research Centre

Canada

Rural Municipality of Macdonald

Information Bulletin 98-25

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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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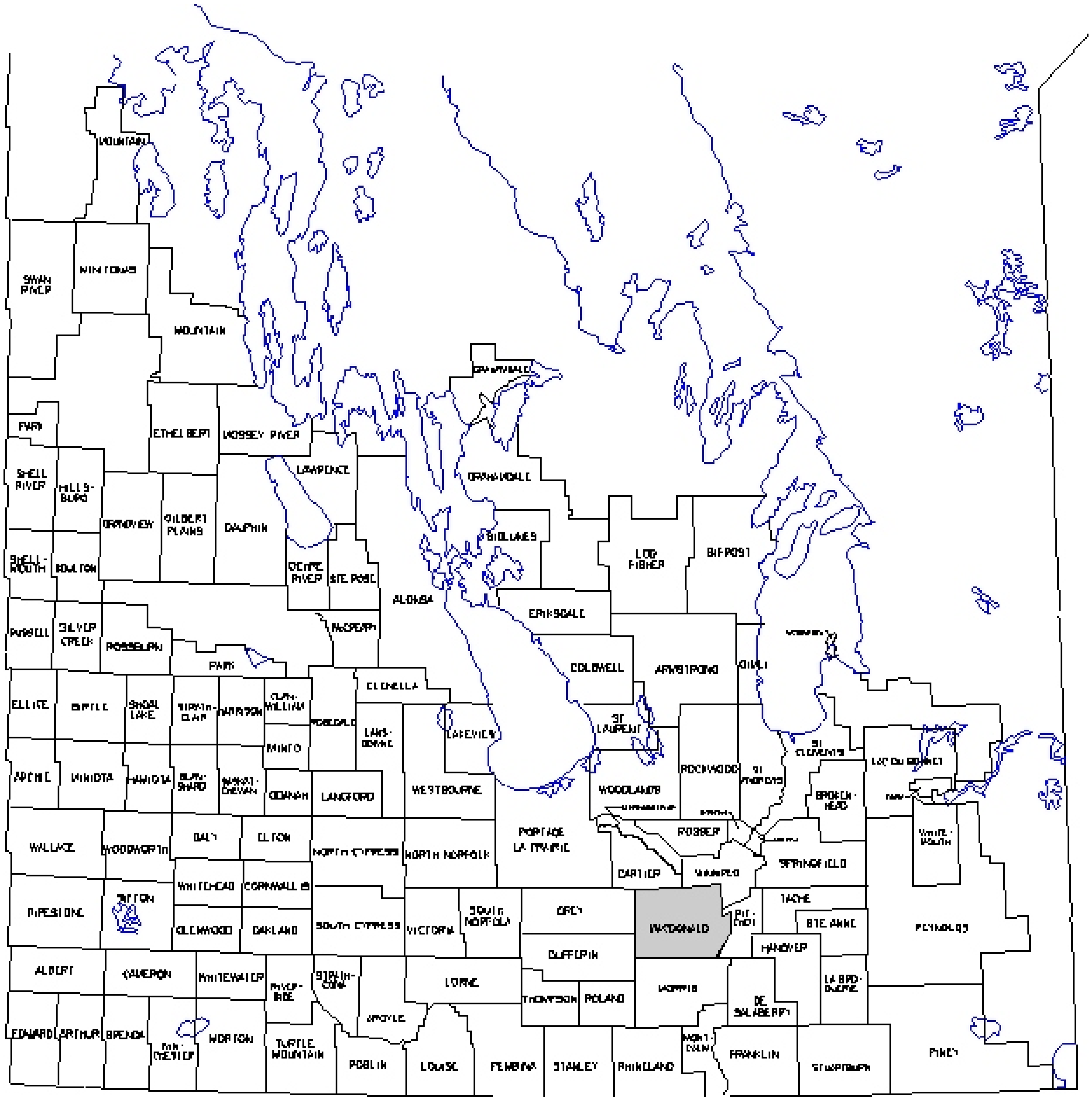


Figure 1. Rural municipalities of southern Manitoba.

INTRODUCTION

The location of the Rural Municipality of Macdonald 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.

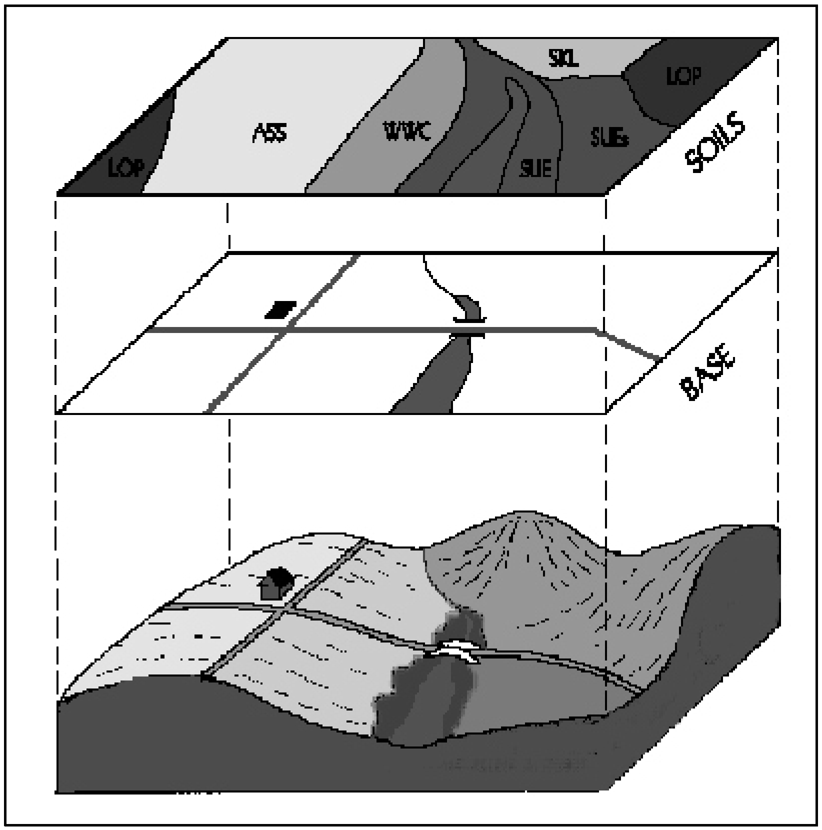


Figure 2. Soil and Base Map data.

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 MacDonald covers an area of 12.6 townships (approximately 116 000 ha) in southern Manitoba. It borders on the southwest perimeter of the City of Winnipeg (page 3). La Salle is the largest population and service centre in the municipality with smaller concentrations of people living in Sanford, Starbuck, Oak Bluff, Brunkild and Domain.

The climate in the municipality can be related to weather data from Winnipeg International Airport located 10 kilometres to the north. The mean annual temperature is 2.4˚C and the mean annual precipitation is 504 mm (Environment Canada, 1993). The average frost-free period is 118 days and degree-days above 5˚C accumulated from May to September average 1697 (Ash, 1991). An evaluation of growing conditions in this region of Manitoba can be related to estimates of seasonal moisture deficit and effective growing degree-days (EGDD) above 5˚C. The seasonal moisture deficit calculated between May and September is slightly greater than 250 mm and the estimated effective growing degree-days accumulated from May to September average slightly above 1600 (Agronomic Interpretations Working Group, 1995). These parameters provide an indication of moisture and heat energy available for crop growth and are generally adequate to support a wide range of crops adapted to western Canada.

Physiographically, the RM of MacDonald is located entirely in the Red River Valley subsection of the Manitoba Plain (Canada-Manitoba Soil Survey, 1980). This portion of the valley is very flat with slopes less than 2 percent (page 9). Elevation of the land surface decreases very gradually from 239 metres above sea level (m asl) in the southwest to about 230 m asl in the northeast near where the La Salle River flows into the Red River. The low surface gradient of 0.2 m/km or 1 ft/mi results in very slow surface drainage, mainly to the La Salle River in the north and the Morris River in the south. Both rivers flow easterly to the Red River. The natural drainage throughout the municipality is not well developed so surface drainage for agricultural purposes is facilitated by a network of man-made drains constructed to enhance runoff and reduce the duration of surface ponding. In addition to this local network, the Norquay and Boyne Channels are major drains designed to carry the influx of waters from the higher lands of the escarpment to the west as well as facilitate local runoff. They are constructed with side dikes to protect the adjacent landscape from flooding during runoff events.

Soil materials in the Red River Valley were deposited during the time of glacial Lake Agassiz and consist primarily of deep, clayey lacustrine sediments. Variable textured, stratified alluvial deposits occur in the floodplain associated with the La Salle River. Surface texture in the municipality is dominantly clayey (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 Winnipeg and Morris map sheet areas (Ehrlich et al., 1953). Detailed soil studies at a 1:20 000 scale are available for the area around the towns of La Salle and Sanford (Michalyna et al., 1975) and for the village of Brunkild, selected areas along the La Salle River and the area along the southwest perimeter around Winnipeg (Podolsky, 1989). According to the Canadian System of Soil Classification (Soil Classification Working Group, 1998), the soils are classified as dominantly Black Chernozems and Humic Gleysols of the Red River association. The St. Norbert clay soils developed under wooded vegetation along the La Salle River are classified as Chernozemic Dark Gray soils and are also within the Red River association. Regosolic soils of the Riverdale association occur in the channel containing the La Salle River (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 for the area.

The flat topography throughout the area and the high clay content of the Red River Valley result in the majority of soils being classified as imperfectly to poorly drained (page 13).

Management considerations are primarily related to heavy clay textures and wetness (page 15). There are no significant relief features or stoniness conditions to contend with in this area. Minor areas of weak salinity occur at scattered locations, primarily in poorly drained soils throughout the municipality. Less obvious subsoil salinity is common at depths below 50 cm. Some poorly drained areas are subject to periodic ponding during spring runoff.

Most of the soils in the municipality are rated in **Class 2** (56 percent) and **Class 3** (42 percent) for agricultural capability with moderate to moderately severe limitations for agriculture (page 17). The majority of the soils are rated as **Poor** for irrigation suitability, primarily due to fine texture and poor drainage. About 1.5 percent of the area, mainly the alluvial soils along the La Salle River are rated as **Fair** for irrigation suitability (page 19). The major problem limiting the agricultural use of soils is inadequate drainage. Unfavourable workability and potential degradation due to erosion by wind are other important limitations.

One of the issues 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 entire municipality is at **Minimal** risk of degradation due mainly to the heavy texture of the soil and the slow drainage. These conditions reduce the risk for deep leaching of potential contaminants on the soil surface. 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. Areas with potential for water erosion and where special practices should be adopted to mitigate this risk are shown on page 23. The risk for degradation due to water erosion is **Negligible** for 40 percent of the land in the municipality due to very flat topography, clayey texture and poor drainage. About 59 percent of the soils with clayey texture and imperfect drainage are consisdered to have a **Low** risk for water erosion. Management practices focus primarily on maintaining adequate crop residues to provide sufficient surface cover.

Land use in the RM of MacDonald is primarily agricultural with small areas of woodland around farmsteads and along the La Salle River. An assessment of the status of land use in 1994 was obtained through an analysis of satellite imagery. It showed that annual crops occupied about 89 percent of the land in the RM with forage production taking place on 2 percent of the area. Small areas of grassland, often associated with farmsteads and along major drainage channels occupy 3 percent of the area. Tree cover, mainly along the La Salle River and in shelter belts associated with farmsteads, covers about 2 percent of the area. Various non-agricultural uses such as infrastructure for urban areas, transportation and recreation occupy about 4 percent of the municipality (page 27).

While the majority of soils in the RM of MacDonald have moderate to moderately severe limitations for arable agriculture, the clayey textured soils require management practices which maintain adequate surface drainage, soil structure and tilth. All soils require careful management to protect against the risk of wind erosion. This includes leaving adequate crop residues on the surface to provide sufficient trash cover during the early spring period. The provision of shelter belts, minimum tillage practices, and crop rotations including forages will help to reduce the risk of soil degradation and maintain productivity.

A major portion of the municipality has low relief and a dominance of imperfectly to poorly drained soils. Clayey soils with slow to very slow permeability are subject to surface ponding and slow runoff unless adequate drainage is provided. These soils are frequently saturated and subject to surface ponding and slow runoff, particularly during spring snowmelt or following heavy rains. Consequently, improvement and maintenance of water management infrastructure on a watershed or regional basis is required to reduce surface ponding while maintaining adequate soil moisture for crop growth.

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.

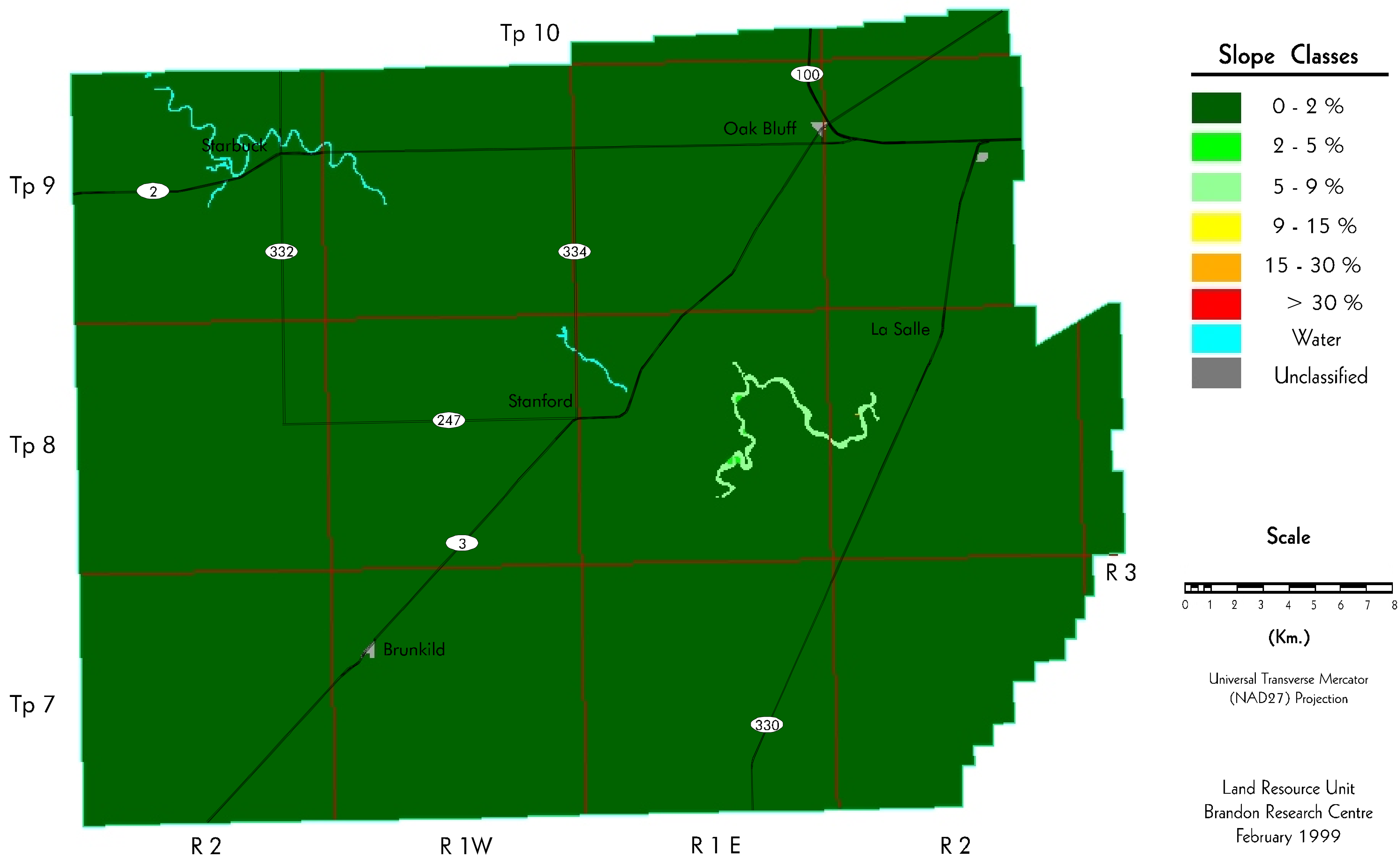
Slope describes the steepness of the landscape surface. The slope classes shown on this map are derived from the digital soil and terrain layer database. Specific colours are used to indicate the dominant slope class for each polygon in the RM. Additional slope classes may occur in each polygon area,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

Table 1. Slope Classes[1]

Slope Class	Area (ha)	Percent of RM
0 - 2 %	115279	99.6
2 - 5 %	16	0.0
5 - 9 %	281	0.2
9 - 15 %	0	0.0
15 - 30 %	1	0.0
> 30 %	0	0.0
Unclassified	55	0.0
Water	52	0.0
Total	115685	100.0

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

Slope Map


Tp 10
Tp 9
Tp 8
Tp 7
R 2
R 1W
R 1 E
R 2
R 3
Oak Bluff
Starbuck
La Salle
Stanford
Brunkild
100
2
332
334
247
3
330
Slope Classes
0 - 2 %
2 - 5 %
5 - 9 %
9 - 15 %
15 - 30 %
> 30 %
Water
Unclassified
Scale
0 1 2 3 4 5 6 7 8
(Km.)
Universal Transverse Mercator
(NAD27) Projection
Land Resource Unit
Brandon Research Centre
February 1999

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.

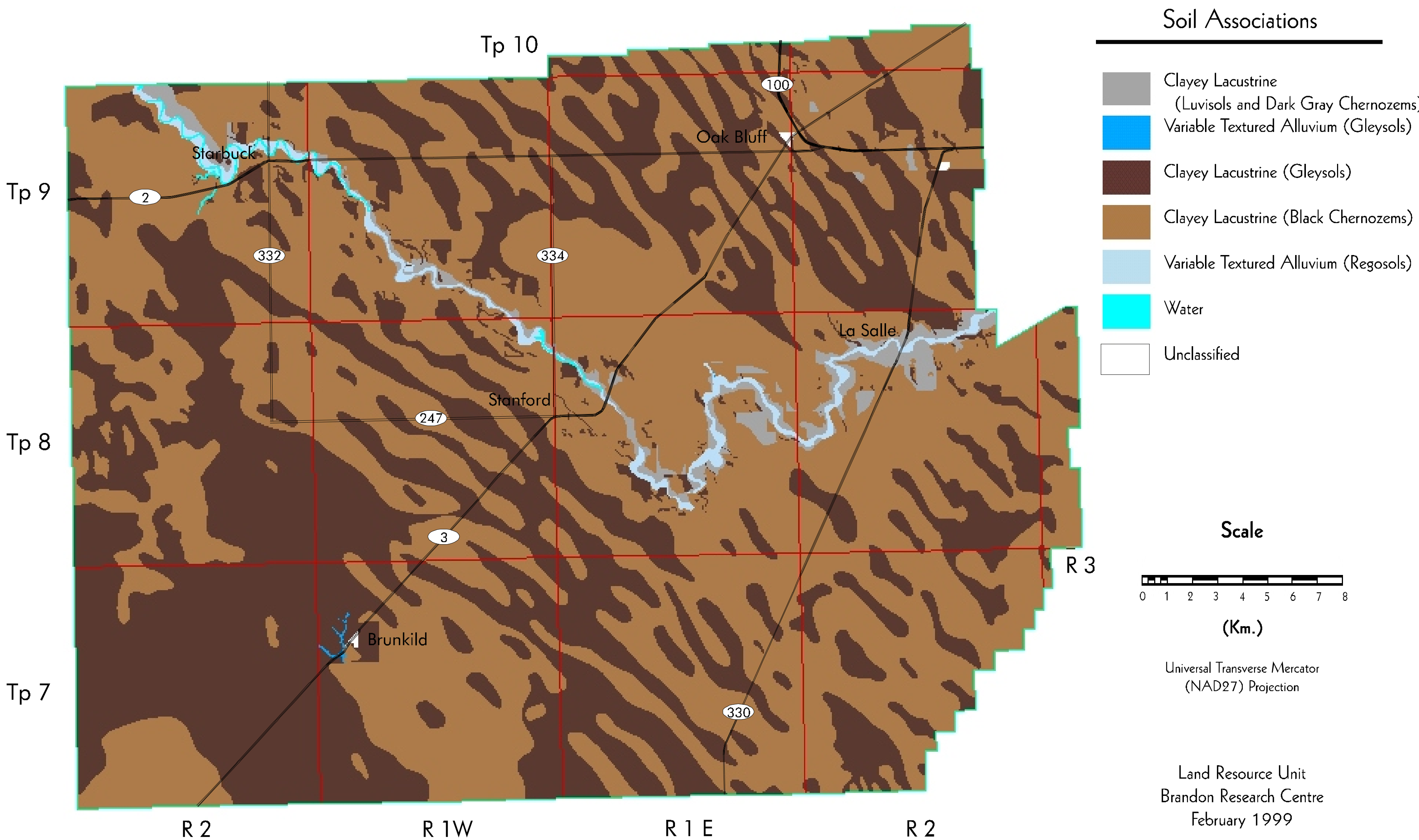
More detailed maps showing the dominant and subdominant soils in each polygon can also be produced at larger map scales.

Table 2. Generalized Soil Groups[1]

Soil Groups	Area (ha)	Percent of RM
Clayey Lacustrine (Luvisols and Dark Gray Chernozems)	2155	1.9
Variable Textured Alluvium (Gleysols)	31	0.0
Clayey Lacustrine (Gleysols)	46453	40.2
Clayey Lacustrine (Black Chernozems)	65650	56.7
Variable Textured Alluvium (Regosols)	1290	1.1
Water	52	0.0
Unclassified	55	0.0
Total	115685	100.0

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

Generalized Soil 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. 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.

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.

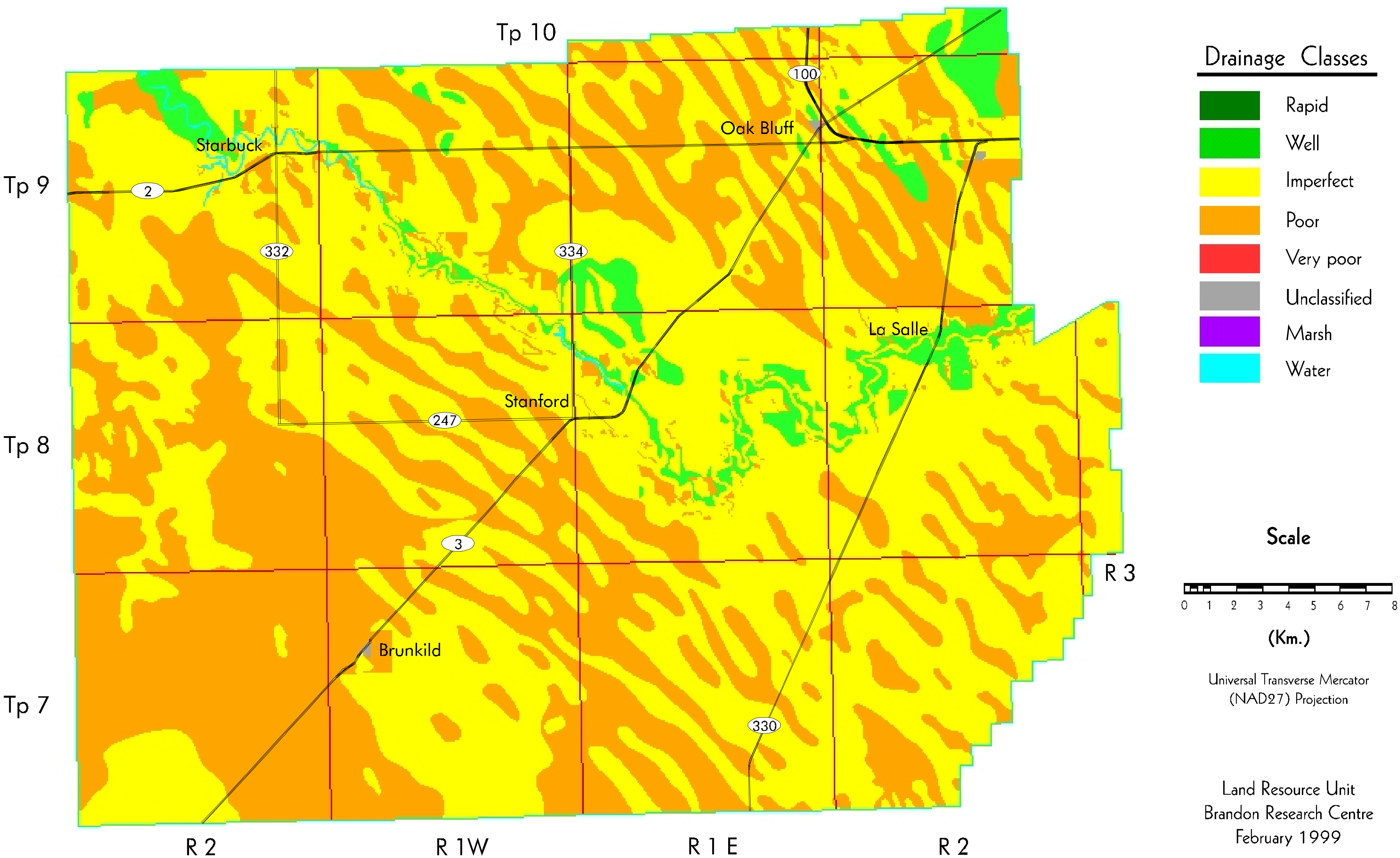
Drainage classification is based on the dominant soil series within each individual soil polygon.

Table 3. Drainage Classes[1]

Drainage Class	Area (ha)	Percent of RM
Very Poor	0	0.0
Poor	46484	40.2
Imperfect	64575	55.8
Well	4519	3.9
Rapid	0	0.0
Marsh	0	0.0
Unclassified	55	0.0
Water	52	0.0
Total	115685	100.0

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

Soil Drainage Map



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.

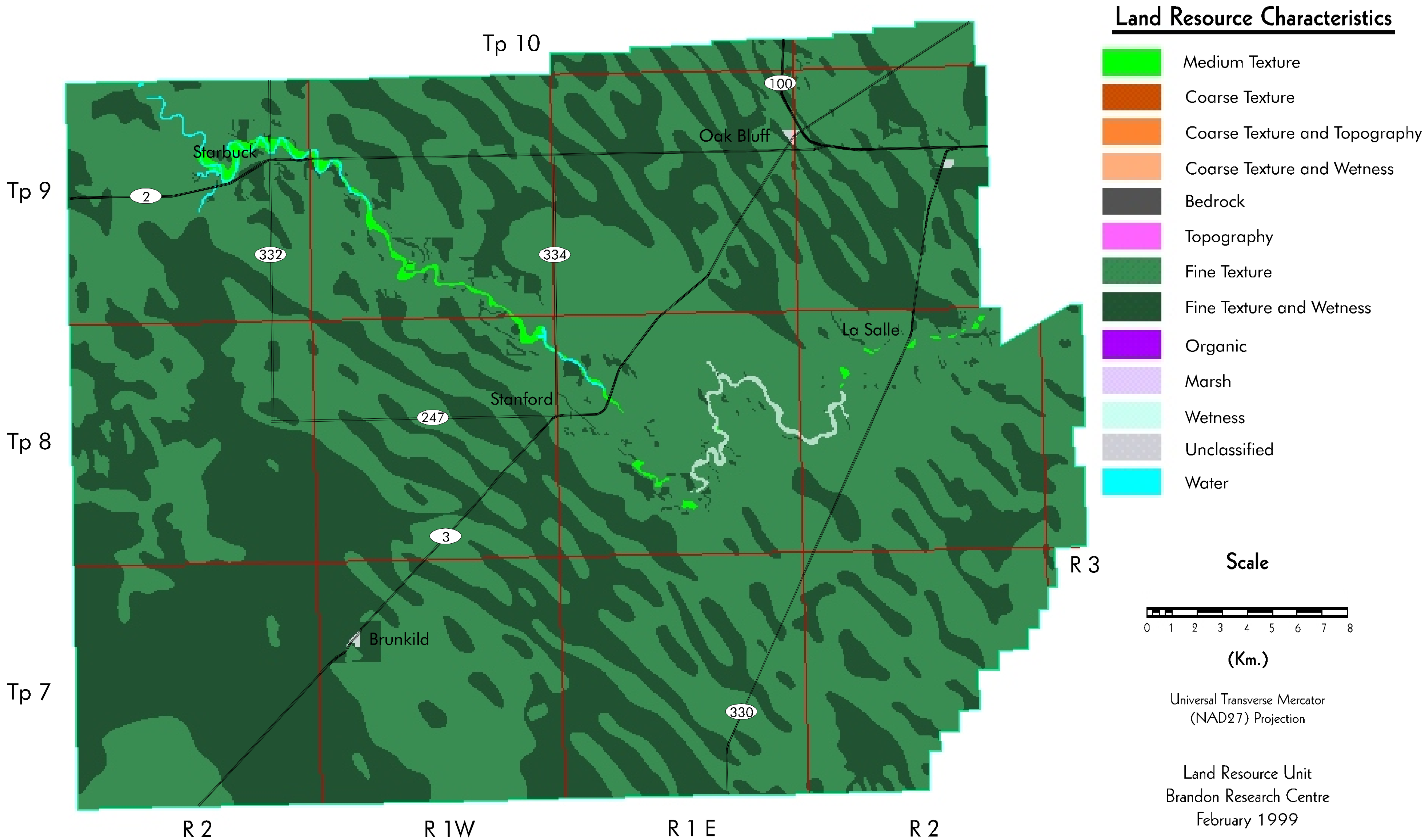
R = Bedrock - soil landscapes that have shallow depth to bedrock (< 50 cm) and/or exposed bedrock which may prevent the use of some or all tillage practices as well as the range of potential crops. They require special cropping and management practices to sustain agricultural production.

Table 4. Management Considerations[1]

Land Resource Characteristics	Area (ha)	Percent of RM
Fine Texture	68175	58.9
Fine Texture and Wetness	46484	40.2
Fine Texture and Topography	282	0.2
Medium Texture	637	0.6
Coarse Texture	0	0.0
Coarse Texture and Wetness	0	0.0
Coarse Texture and Topography	0	0.0
Topography	0	0.0
Bedrock	0	0.0
Wetness	0	0.0
Organic	0	0.0
Marsh	0	0.0
Unclassified	55	0.0
Water	52	0.0
Total	115685	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).

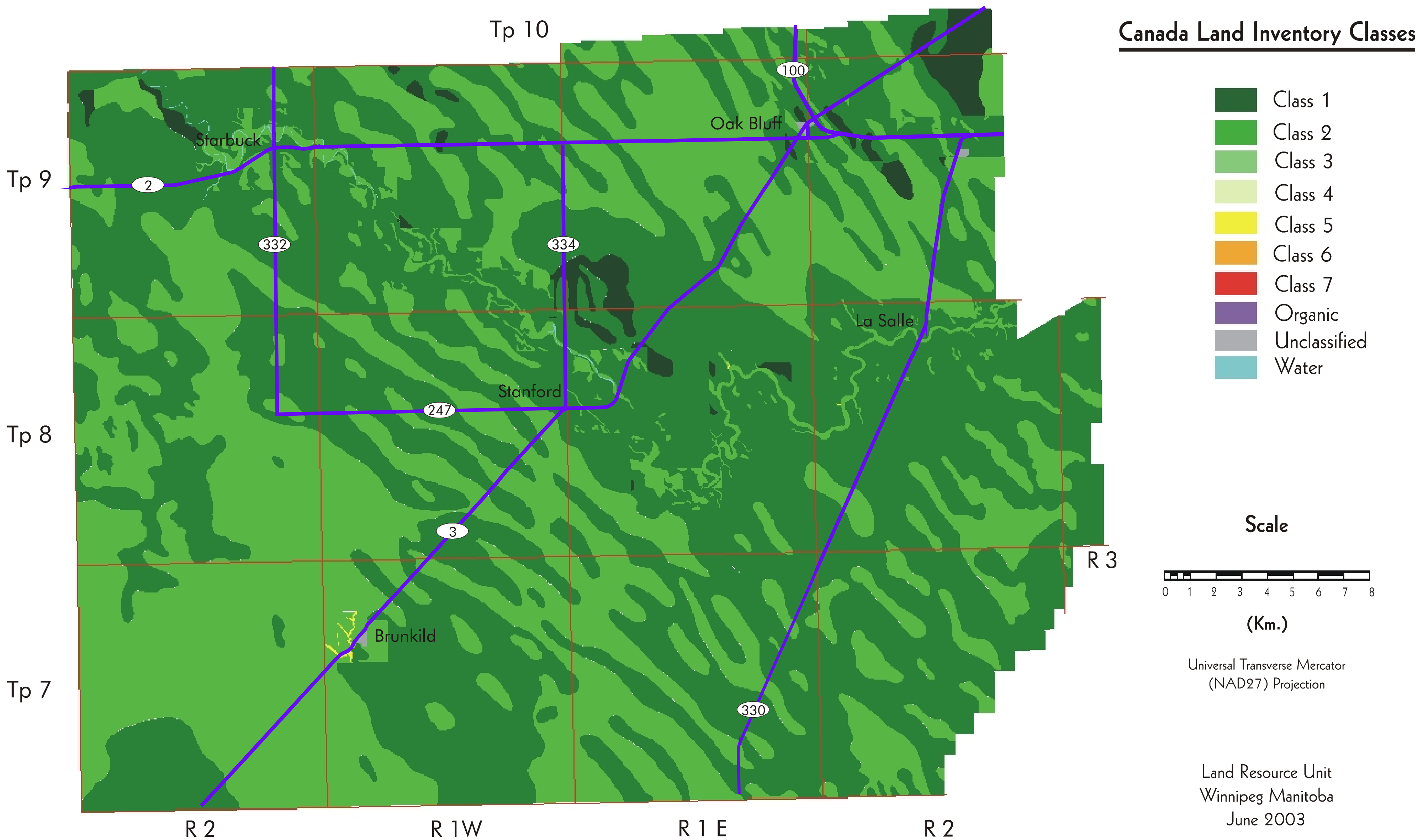
This generalized interpretive map is based on the dominant soil series and phases for each soil polygon. The CLI subclass limitations cannot be portrayed at this generalized map scale.

Table 5. Agricultural Capability[1]

Class Subclass	Area (ha)	Percent of RM
1	**2126**	**1.8**
2	**64669**	**55.9**
2D	2142	1.9
2DW	111	0.1
2I	257	0.2
2TI	16	0.0
2W	62142	53.7
3	**48695**	**42.1**
3I	735	0.6
3NW	3	0.0
3T	6	0.0
3TI	274	0.2
3W	47677	41.2
5	**34**	**0.0**
5T	1	0.0
5W	2	0.0
5WI	31	0.0
Unclassified	**55**	**0.0**
Water	**61**	**0.1**
Total	**115640**	**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.

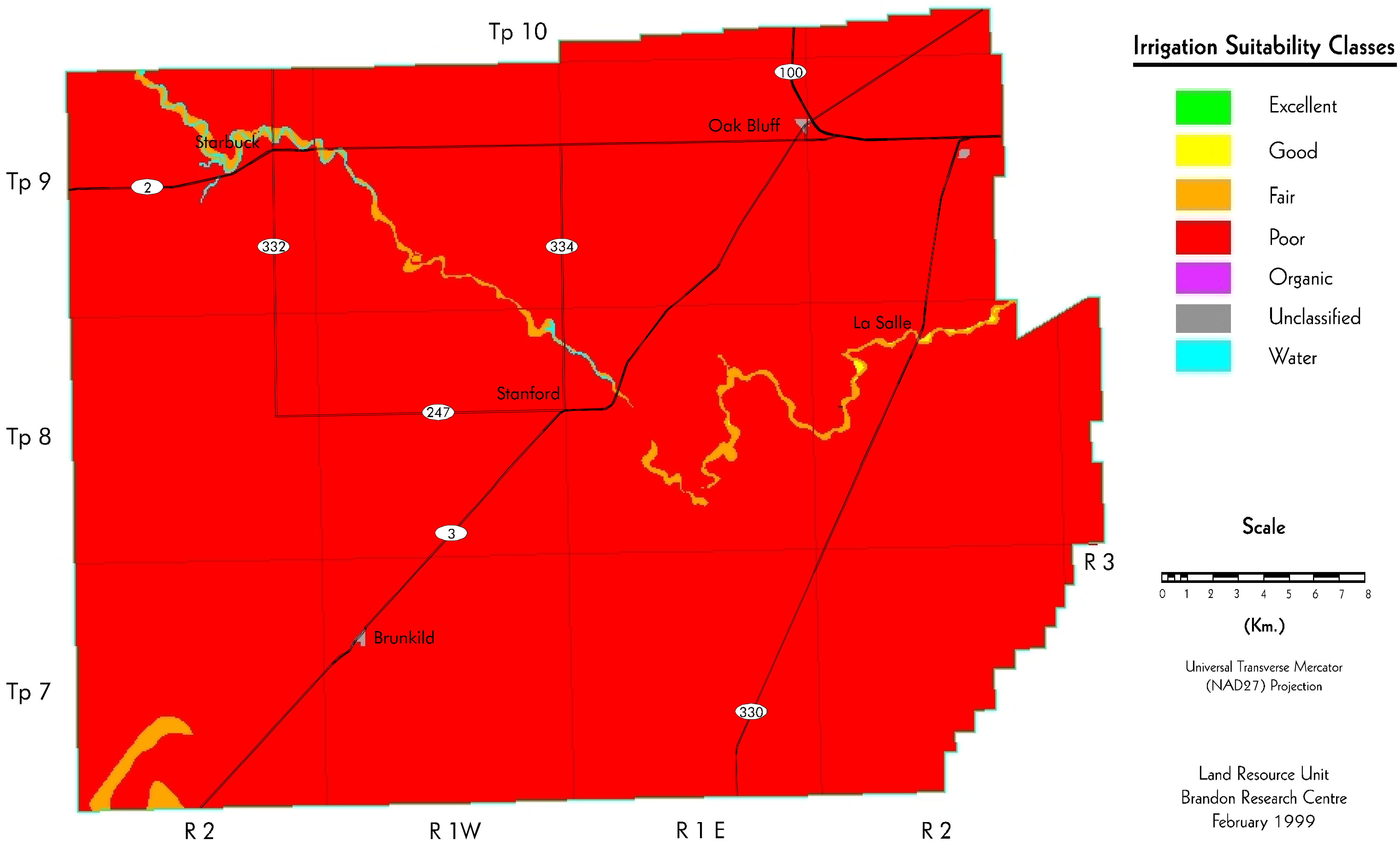
This generalized interpretive map is based on the dominant soil series for each soil polygon, in combination with the dominant slope class. The nature of the subclass limitations and the classification of subdominant components is not shown at this generalized map scale.

Table 6. Irrigation Suitability[1]

Class	Area (ha)	Percent of RM
Excellent	0	0.0
Good	41	0.0
Fair	1683	1.5
Poor	113853	98.4
Organic	0	0.0
Unclassified	55	0.0
Water	52	0.0
Total	115685	100.0

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

Irrigation Suitability Map



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.

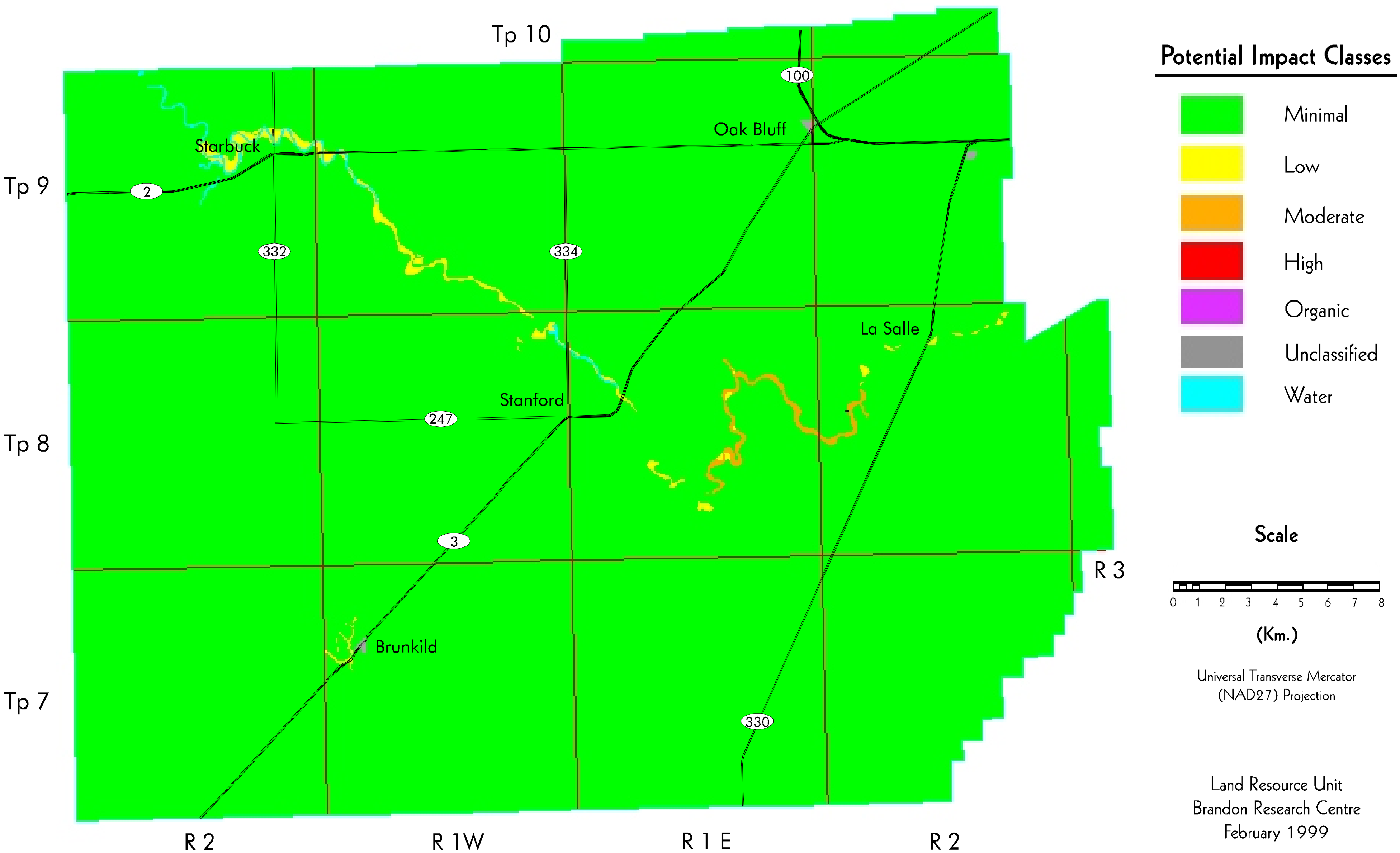
This generalized interpretive map is based on the dominant soil series and slope class for each soil polygon. The nature of the subclass limitations, and the classification of subdominant components is not shown at this generalized map scale.

Table 7. Potential Environmental Impact Under Irrigation[1]

Class	Area (ha)	Percent of RM
Minimal	114639	99.1
Low	657	0.6
Moderate	281	0.2
High	0	0.0
Organic	0	0.0
Unclassified	55	0.0
Water	52	0.0
Total	115685	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, 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

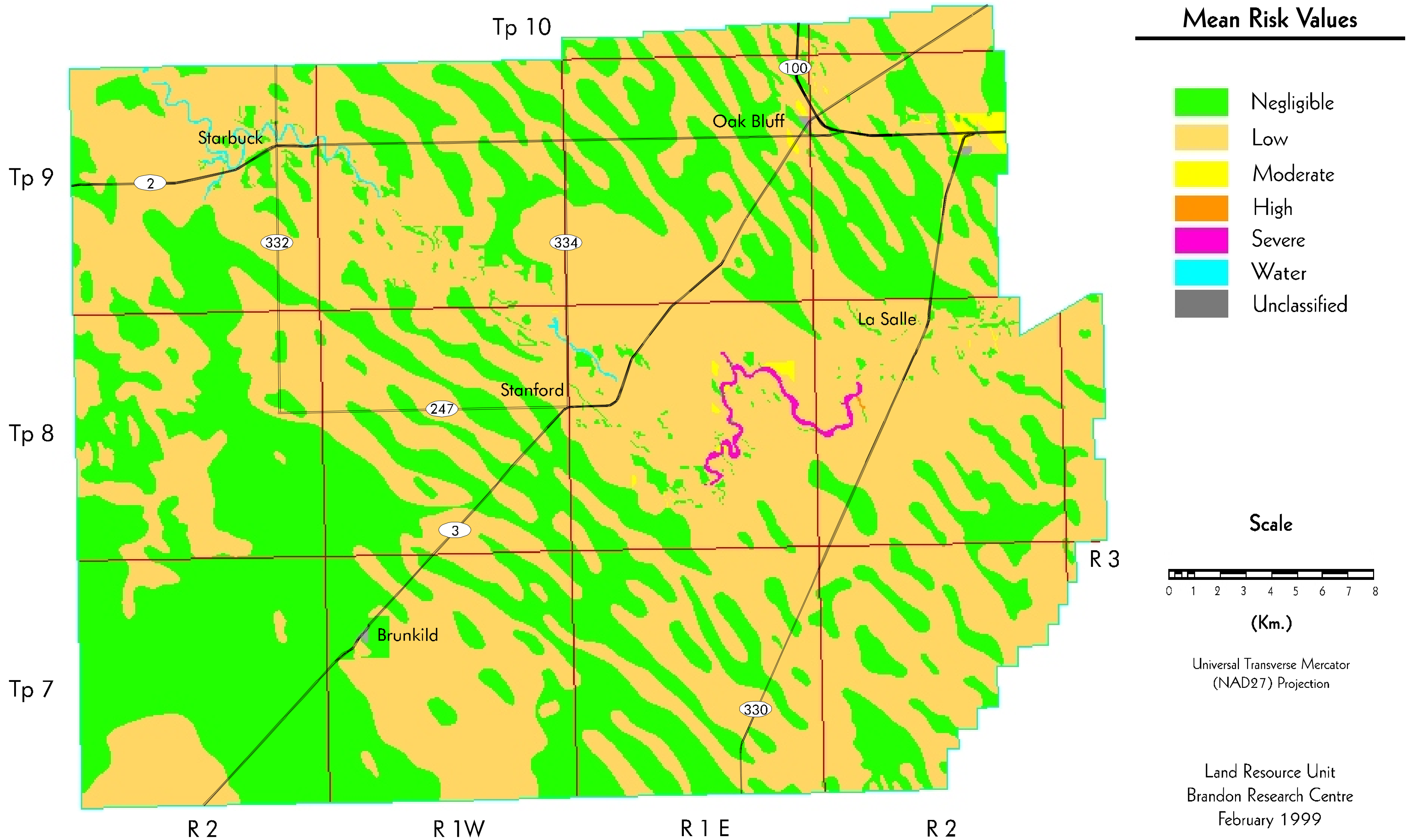
Cropping and residue management practices will significantly reduce this risk depending on crop rotation program, soil type, and landscape features.

Table 8. Water Erosion Risk[1]

Class	Area (ha)	Percent of RM
Negligible	**46542**	**40.2**
Low	**68361**	**59.1**
Moderate	**393**	**0.3**
High	**6**	**0.0**
Severe	**277**	**0.2**
Unclassified	**55**	**0.0**
Water	**52**	**0.0**
Total	**115685**	**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 Resource Unit
Brandon Research Centre
February 1999

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.

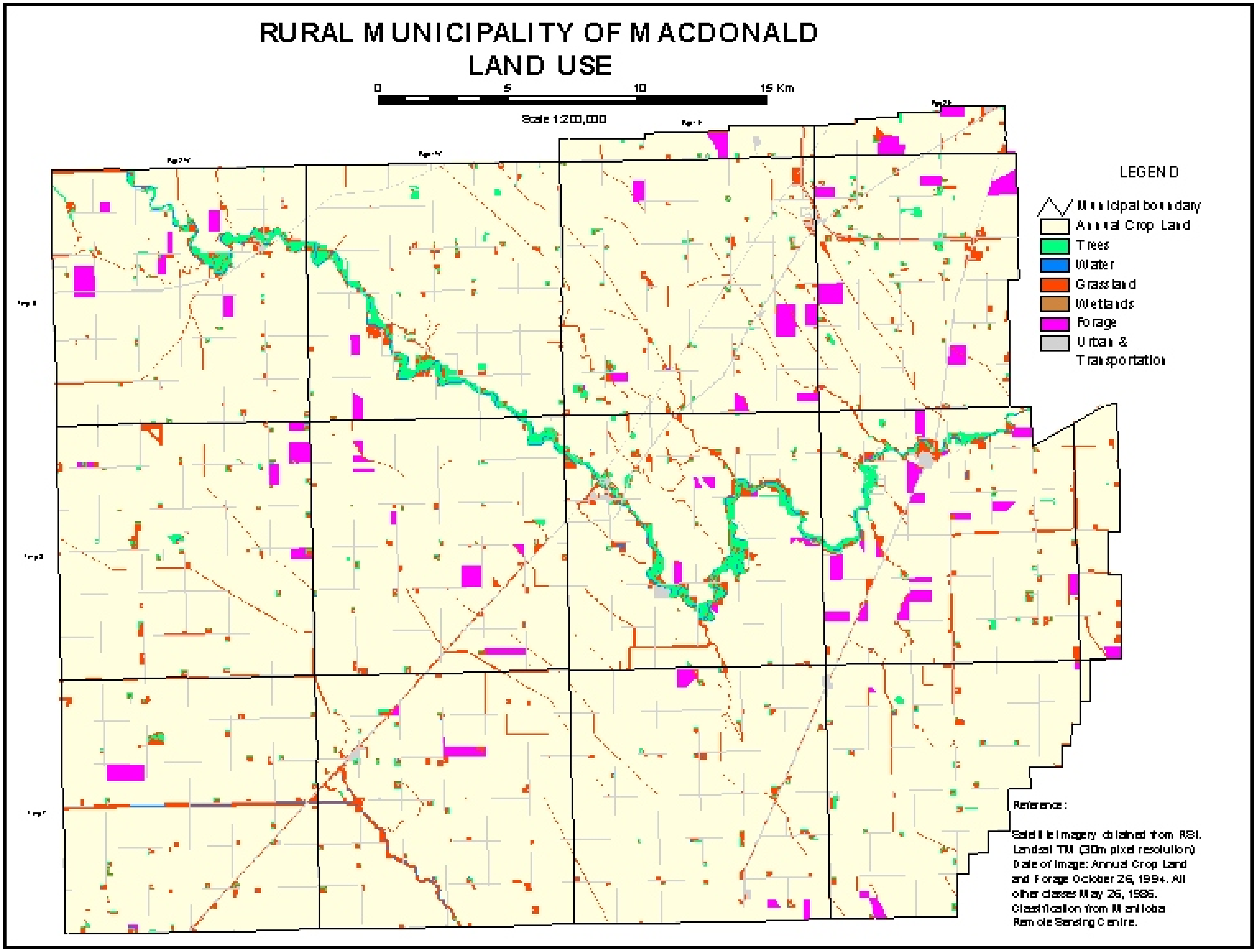
Water - open water - lakes, rivers streams, ponds, and lagoons.

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

Table 9. Land Use[1]

Class	Area (ha)	Percent of RM
Annual Crop Land	**102935**	**88.8**
Forage	**2087**	**1.8**
Grasslands	**3718**	**3.2**
Trees	**1976**	**1.7**
Wetlands	**8**	**0.0**
Water	**296**	**0.3**
Urban and transportation	**4812**	**4.2**
Total	**115832**	**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 MACDONALD
LAND USE
0 5 10 15 Km
Scale 1:200,000
LEGEND
Municipal boundary
Annual Crop Land
Trees
Water
Grassland
Wetlands
Forage
Urban & Transportation
Reference:
Satellite Imagery obtained from RSI.
Landsat TM (30m pixel resolution)
Date of Image: Annual Crop Land
and Forage October 26, 1994. All
other classes May 26, 1986.
Classification from Manitoba
Remote Sensing Centre.

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