Little Saskatchewan River

State of the Watershed

Report

July 2008

Table of Contents

Introduction

Welcome to the Little Saskatchewan River State of the Watershed Report. This report is a summary of natural resource and environmental management concerns for our watershed from government and non-government professionals. Their input is only half of the watershed management equation. Your input as a watershed stakeholder, in terms of your awareness of and experiences in the Little Saskatchewan River watershed are the other half. The purpose of this document is two-fold, first as an educational tool to increase awareness among the various types of watershed residents about the health of our watershed, and second, as a starting point for setting priorities to address resource concerns.

Each chapter of this report is organized into two distinct sections. The first section contains background information on the subject area and the second half outlines the resource and environment concerns that were identified as well as the management recommendations that professionals in the field have recommended in order to best address the concern.

This State of the Watershed Report is an important first step in the preparation of an Integrated Watershed Management Plan. The management plan will guide the development and delivery of land and water conservation programming in our watershed over the next 10 years.

As you read through this document ask yourself **"What are the resource and environmental issues that concern me the most?"** Your feedback will assist with the prioritization of activities in the stewardship of our watershed. Please complete and return the provided form to the Little Saskatchewan River Conservation District.

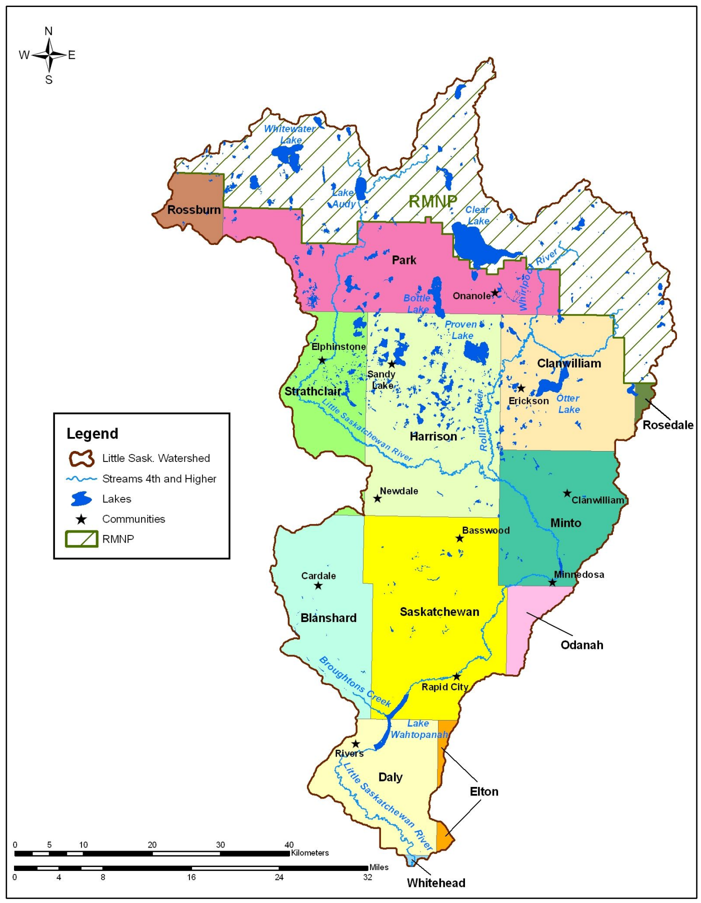


Figure 1: Administrative Boundaries within the Little Saskatchewan River Watershed

Public consultations will be held across our watershed and your input will determine how conservation agencies allocate resources to address natural resource and environmental concerns.

Watershed Overview[1]

The Little Saskatchewan River watershed extends from Riding Mountain National Park in the north to the Assiniboine River in the south (Figure 2). The northern part of the watershed falls in the boreal ecosystem, with the southern part of the watershed in the Aspen Parkland ecosystem. The watershed covers approximately 1,600 square miles and has a population of approximately 9,480, which increases during the summer months due to the numerous cottage developments.

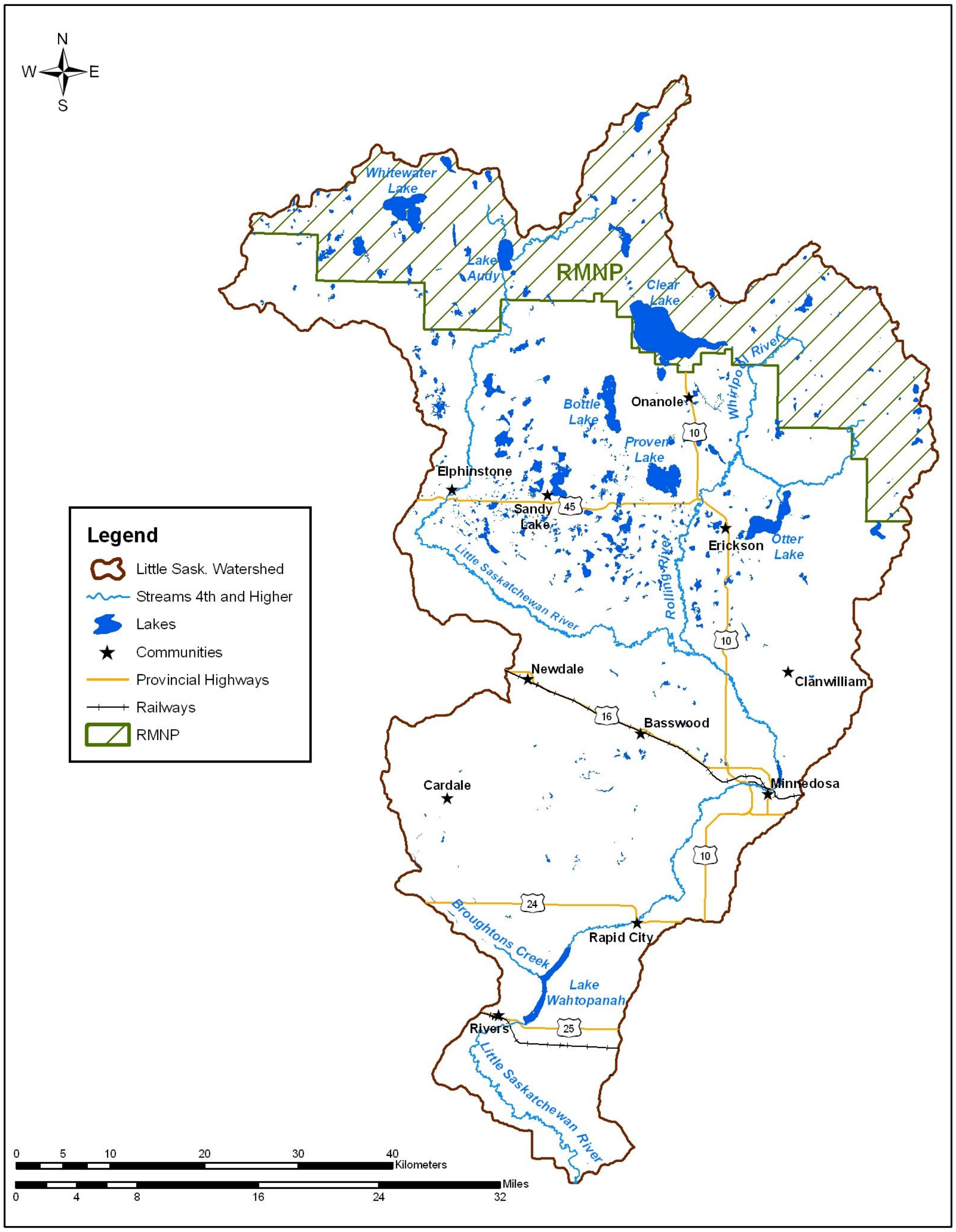


Figure 2: Little Saskatchewan River watershed

[1] Submitted by Manitoba Water Stewardship; Manitoba Agriculture, Food and Rural Initiatives; and Prairie Farm Rehabilitation Administration

Land Use/Land Cover

The land cover classification of the watershed has been interpreted from satellite imagery using computerized classification techniques. Land use was classified and grouped into six classes: annual crop land (35%), forage and grassland (21%), trees (30%), wetlands (7%), and water (5%) (Figure 3). Land cover information was collected between 1999 and 2002.

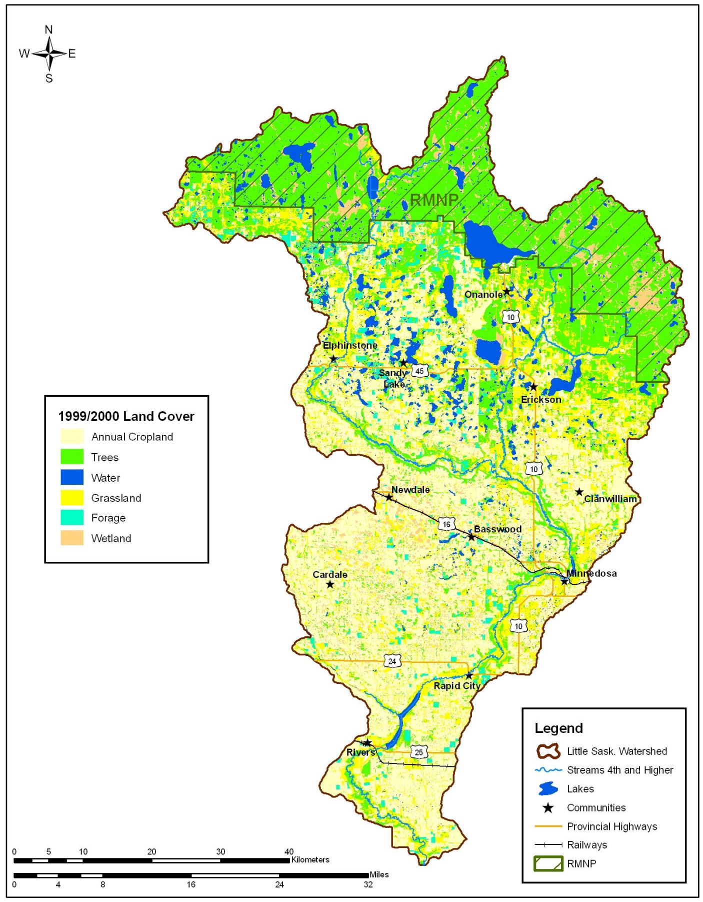


Figure 3: 1999-2002 Land Cover/Land Use in the Little Saskatchewan River Watershed

The LSR watershed is comprised of many different types of agricultural activities. From the headwater areas of the watershed, farms are defined as mainly mixed operations focused on grain and cattle. As one moves south, farming operations become larger, with a greater focus on grain and oil seed farming operations, until the bottom of the watershed where there are larger, more specialized operations such as hog, potato, and chicken.

Agriculture plays is an extremely important contributor to the economy in the Little Saskatchewan River watershed. Gross Farm Receipts, or the income from all farm related goods and services, totalled nearly $83,164,826 in the 2001 year. While the number of farms and the total acres farmed have been steadily decreasing since 1972, the average farm size has increased by almost 53% .

Land Practices

Zero-tillage is one of the more acceptable conservation management practices, and one adopted early in the watershed by producers. According to Census information, 1991 was the first year reported to have approximately 7,500 acres in zero-till management. In 2001, this number jumped to 32,500 acres reported. Combining this with conservation tillage numbers, residue management made up 33% of the farming practices on cropland in 1972. This jumped to 46% as identified in the 2001 Census Data, representing a 14% increase in uptake of practicing conservation management on the lands in the watershed for that thirty year period.

Within the 2001 Census, the three biggest crops identified within the watershed were Spring Wheat (27%), Oilseeds (21%), and Canola (17%).

Many people, with permanent homes both inside and outside the watershed, have taken advantage of the numerous seasonal lots and campgrounds that have been developed at the recreational lakes in the watershed. There are approximately eight lakes that have recreational facilities and at least two lakes where recreational opportunities are being explored.

Elevation

Significant changes in elevation occur throughout the watershed (Figure 4), with values ranging from 755 metres above sea level (masl) in the north-eastern portion of the watershed, down to 359 masl at the southern tip of the watershed. The Little Saskatchewan River valley is visible on this map as an area of lower elevation adjacent to the river.

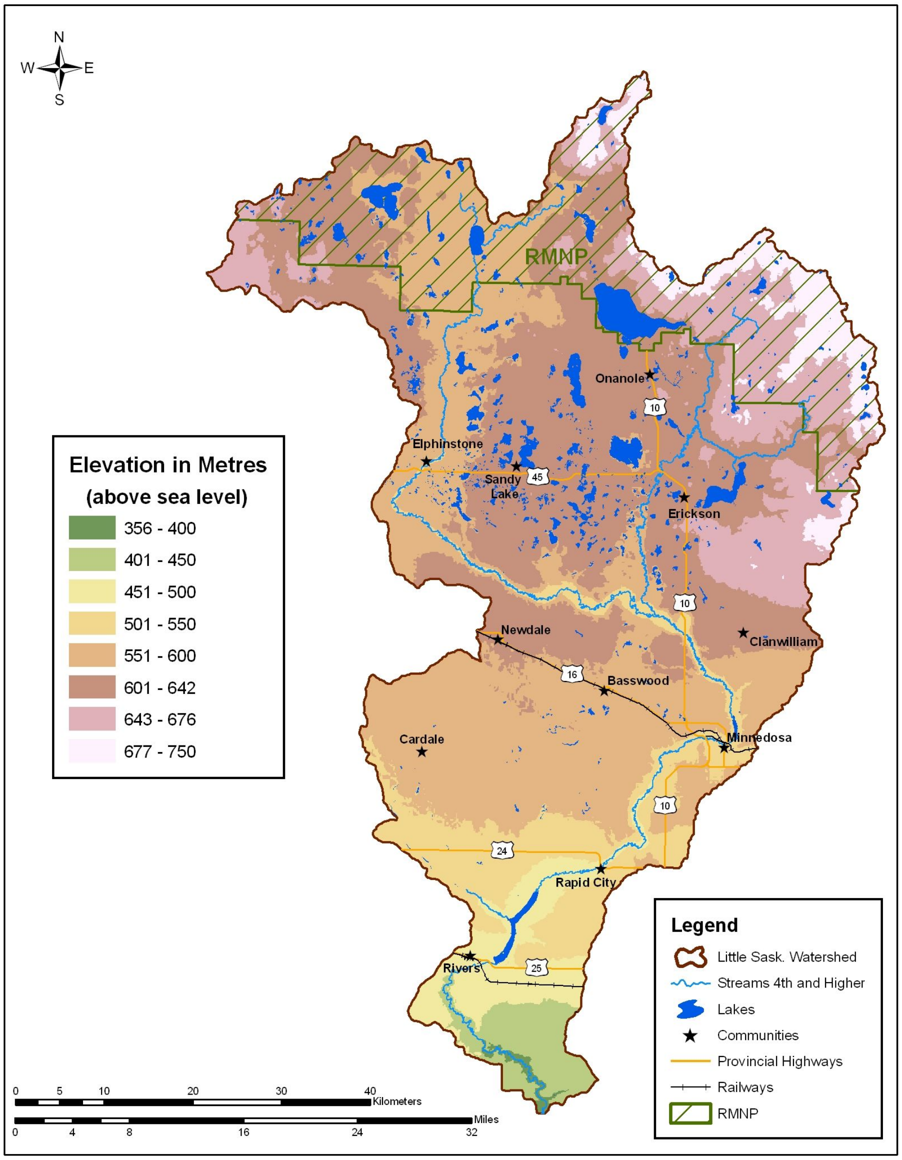


Figure 4: Elevation in the Little Saskatchewan River watershed

Surface Water[2]

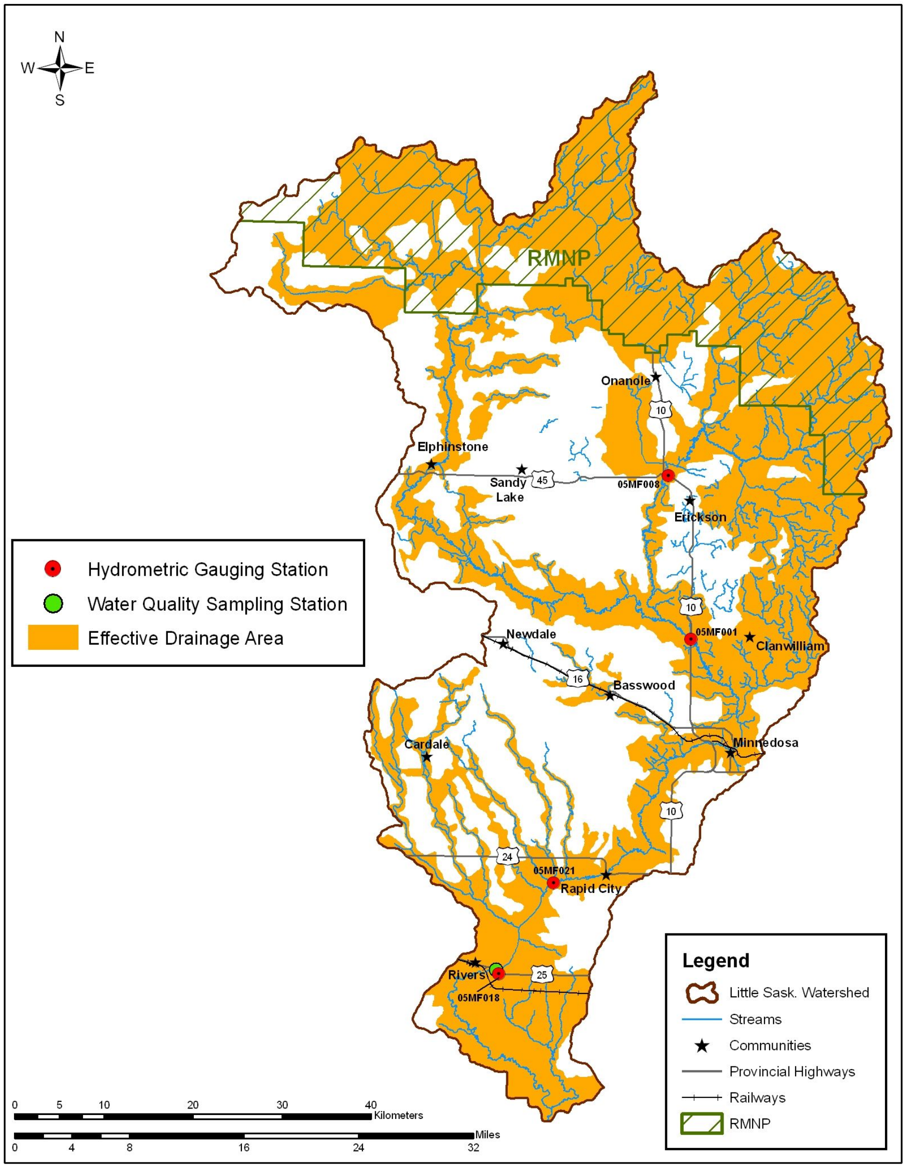


Figure 5: Gauging and Water Quality Sampling Station Locations and Effective Drainage Area

Hydrology

There are four Water Survey of Canada hydrometric gauging stations located in the watershed and are located as shown in Figure 5. Stream flow data has been collected at these stations within the Little Saskatchewan River watershed for varying time periods since 1914. The gauging stations were operated annually during the period of March through October up until the mid 1990s. In 1994, the operating period was reduced to the spring freshet period only, namely March through May. This captures the majority of flows in typical prairie streams.

[2] Submitted by Manitoba Water Stewardship

Table 1 shows the maximum daily discharge at various frequencies, i.e. 1% is a 1 in 100 year event, where as the 50% column shows what can be expected once in every two years.

Table 1: Frequency of Maximum Daily Discharge

Station Name	Station Number	Period of Record	Years of Data	Gross Area (mi^2)	Maximum Daily Discharges (cfs)							
					1%	2%	3%	5%	10%	20%	30%	50%
Little Saskatchewan River near Minnedosa	05MF001	1914-1929 R 1959-1998 R	63	1015	3813	3174	2814	2398	1861	1366	1091	749
Little Saskatchewan River near Rapid City	05MF021	1914-1978 R 1979-1994 C	66	1344	4484	3990	3672	3277	2719	2133	1769	1264
Little Saskatchewan River near Rivers	05MF018	1944-1996 R	50	1508	4732	4096	3743	3256	2595	1917	1515	989
Rolling River near Erickson	05MF008	1915-1922 R 1961-1998 R	46	294	2069	1734	1543	1321	1035	766	614	424
Note: R – recorded C – calculated												

Gross and Effective Drainage Areas

The gross drainage area boundary (Figure 5) is defined as the topographic limit of the watershed, commonly called the drainage divide. This area might be expected to entirely contribute runoff under extremely wet conditions. The effective drainage area is that portion of the watershed which can be expected to contribute runoff to the main stream during a median (1:2 year event) runoff year. This area excludes marsh and slough areas and other natural storage areas, which would prevent runoff from reaching the main stream in a year of average runoff. The effective drainage area is regularly up-dated, therefore, Figure 5 reflects the current situation. The effective to gross drainage area ratio (Table 2) is an indication of how well an area is drained; for example, a higher EDA/GDA ratio means that the area is more efficiently drained and therefore, stores less water in average years. Less water storage means that water is removed from the landscape more quickly. When water is removed quickly from the landscape there is a higher peak flow rate which can result in flooding downstream, greater erosion rates, siltation and water quality degradation, and a greater susceptibility to drought.

Table 2: Gross and Effective Drainage Area

Station Name	Station Number	EDA (mi^2)	GDA (mi^2)	EDA/GDA Ratio
Little Saskatchewan River Near Minnedosa	05MF001	575	1015	0.567
Little Saskatchewan River Near Rapid City	05MF021	746	1344	0.555
Little Saskatchewan River Near Rivers	05MF018	881	1508	0.584
Rolling River near Erickson	05MF008	241	294	0.820

Stream Run-off Characteristics

The majority of the run-off in the Little Saskatchewan River watershed occurs during the April to June time frame. The watercourses behave more like perennial streams than intermittent prairie watercourses, in that they maintain a base flow throughout the year. In comparison, stream flow on the prairies may vary considerably from month to month and year to year.

In the headwaters of the watershed, peak flows occur during the springtime only. As you move through the watershed towards the outlet, the frequency of summer and fall peak annual flows increases. On the major watercourses, spring flooding is more significant than flooding from summer precipitation events. Smaller drainage areas (less than 10 mi^2) are sensitive to rainfall events, and localized flooding can occur in the smaller poorly drained areas of the watershed due to excessive rainfall.

Surface Water Management

Under *The Water Rights Act*, water control works are defined as any dyke, dam, surface or subsurface drain, drainage, improved natural waterway, canal, tunnel, bridge, culvert borehole or contrivance for carrying or conducting water that (a) temporarily or permanently alters or may alter the flow or level of water, including but not limited to water in a water body, by any means, including drainage, or (b) changes or may change the location or direction of flow of water, including but not limited to water in a water body, by any means, including drainage.

With respect to drainage, one area of concern within this watershed is the creation of new drainage works and maintenance of historic drainage works without authorization under *The Water Rights Act.* The authorization process allows for consideration of impacts in project design and operation.

Stakeholders in the IWMP process should consider developing a Surface Water Management Plan (SWMP) which, if approved, would influence land development and use in the watershed. Approval of the province should be garnered for SWMPs, just as it is for IWMPs, in order to influence authorization of proposed drainage projects. A Land Use Management Plan (LUMP) and a SWMP are directly related in that the aspects of one plan influence the other. For example, if a SWMP dictates that development (drainage) of CLI Soils Class 6w not be undertaken, this would influence the options for land use on those soils.

With respect to dams, many dams have been constructed within the study area and authorized under the Act based on the terms of agreement with private landowners. Many of these agreements are reaching an end and as a result, the water control projects are being decommissioned. In most cases, the decommissioning of a dam results in restoration to pre-project (natural) conditions. Consideration should be given to offsetting any reductions in water storage or the ability of wetlands to temporarily store peak flows and reduce sediment transfer downstream which may occur as a result of project decommissioning.

With respect to construction of any surface or subsurface water control works, efforts should be made to prevent erosion of soils or transport of nutrients which may increase nutrient transfer into the receiving water body.

Water Allocation

Withdrawals of more than 5,500 imperial gallons/day require a water rights license from the Water Use Licensing Section of Water Stewardship. In addition, withdrawals in excess of 162 acre-feet per year trigger a requirement for an Environment Act Licence issued by the Environmental Approvals Branch of Manitoba Conservation. The intent of water rights licensing is to protect the interests of licensees, domestic users, the general public and the environment with respect to the use or diversion of water or the construction and operation of water control works under licence.

When licensing specific projects there are a number of factors considered in the assessment including: analysis of stream flow data, riparian needs, the water use requirements of senior water users, domestic needs, and in-stream flow requirements.

An important water supply in the watershed is the Little Saskatchewan River; it is the only water way in the region that has a firm flow component capable of meeting the demands of a municipal water supply system. Stream water budgets have not been established for the Little Saskatchewan River watershed as a whole. Therefore, the percentage of water available for allocation in the watershed has not been determined. However, based on an average annual stream flow of (3.63 m^3/sec (measured at Minnedosa) there is sufficient water available to allocate for the existing projects. The three in-stream reservoirs also greatly enhance the availability of water on the system. Table 3 provides a breakdown by use of licensed projects and allocated amounts, and applications on file. The municipal distribution system for the Town of Rivers is allocated 485 ac-ft per year.

A detailed in-stream flow needs assessment study is currently underway on the Little Saskatchewan River which will establish the minimum flow needed to maintain ecosystem health. The results of this study will be incorporated into future water rights licensing decisions.

Table 3: Surface Water Licenses, Allocations, and Applications

Purpose	Licences	Amount Allocated (acre-feet)	Applications
Agricultural	0	0.0	1
Industrial	0	0.0	0
Irrigation	7	411.0	4
Municipal	1	485.0	2
Other	0	0.0	1
Total	**8**	**896.0**	**8**

Water Quality

Water quality describes the chemical, biological, and physical characteristics of water. Manitoba standards, objectives, and guidelines for many water quality variables have been developed to protect water quality for various purposes including irrigation, recreation, and the protection of aquatic life.

Water quality is monitored at many sites throughout Manitoba to identify changes and examine long term trends in water quality variables. Although many sites throughout the Little Saskatchewan River Watershed have been sampled for water quality, this report will focus on data from the long term water quality monitoring station located near PTH #25 just downstream of Lake Wahtopanah east of Rivers, Manitoba. Samples were analyzed for concentrations of pesticides, metals, nutrients, general chemistry, and bacteria.

Most variables examined were generally within provincial objectives or guidelines, including dissolved oxygen, fecal coliform densities, pesticides, and most metals. Concentration of total phosphorus, iron, manganese, and conductivity consistently exceeded Manitoba Water Quality Standards, Objectives and Guidelines.

Total Phosphorus

Phosphorus concentrations consistently exceeded the provincial guideline of 0.05 mg/L, a concentration above which nuisance algae and aquatic plant growth occurs. Manitoba Water Stewardship is currently developing new guidelines that will be more ecologically relevant to watersheds and water bodies in Manitoba. Phosphorus concentrations at the Little Saskatchewan River long term water quality monitoring station were analyzed with a statistical model that accounted for variations due to changing river flows. The flow adjusted trend analysis showed a significant increase (39.3%) in median concentration of total phosphorus (TP) from 1973 to 1999. The trend of increasing TP could be attributed to increased non-point source and point source loading from land-use practices such as agricultural activities and municipal lagoon discharg

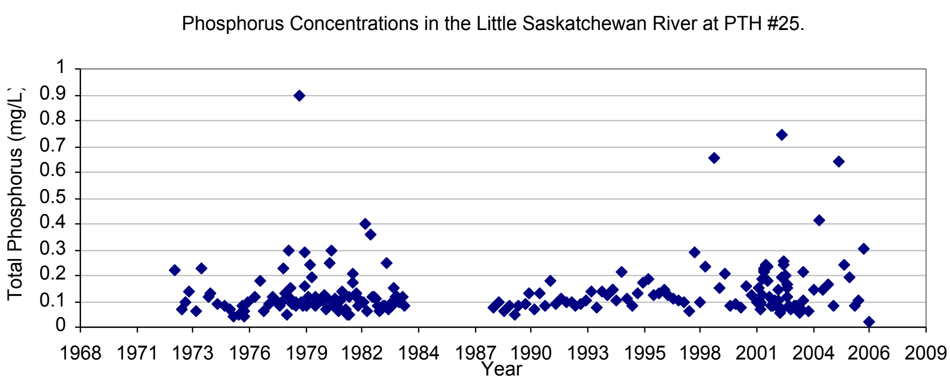


Figure 6: Phosphorus Concentrations in the Little Saskatchewan River at PTH #25

Conductivity

Conductivity in the Little Saskatchewan River occasionally exceeded the water quality objective for irrigation (1,000 µS/cm). Conductivity in water is a measure of the concentration of dissolved salts and minerals such as chloride, nitrate, sulphate, sodium, calcium, and iron. Conductivity is primarily influenced by soil characteristics of the watershed. Rivers and streams that flow through clay soils tend to have higher conductivity because of the presence of materials that ionize when washed into the water. Industrial and municipal discharges to rivers and streams can change the conductivity due to higher concentrations of sulphate, chloride, and nitrate.

Metals
Iron and manganese exceeded the aesthetic objective for drinking water in numerous samples over the period of record. Iron is naturally released to surface waters through weathering of iron bearing minerals but significant amounts are also released through industrial processes, corrosion of iron, and steel and mining effluents. Manganese is associated with iron in water and is also naturally found in water from weathering of minerals. High concentrations of iron and manganese in water can impart an unpleasant taste, and can produce a yellow precipitate; both of these concerns can be mitigated through the treatment of drinking water.

Clear Lake

A 2005 study conducted on Clear Lake and its watershed, *Securing the Integrity of Clear Lake and Area*, determined that nutrient enrichment was the single greatest threat to the health of the lake. A number of specific actions were identified in order to reduce the nutrient input into the lake, gather further data on nutrient dynamics and groundwater movement, and increase public awareness and support. Parks Canada has taken steps to implement many of the action items identified in the report.

Many of the recommendations to prevent nutrient enrichment provided in this State of the Watershed Report are the same or similar to the recommendations contained in the Clear Lake study. The Clear Lake watershed should be considered as a target area for nutrient reduction programming in our Integrated Watershed Management Plan – efforts should be made to work with Parks Canada to ensure the recommendations and specific actions identified in the Clear Lake Study are incorporated into future nutrient reduction programming in the Clear Lake watershed.

Management Concerns

Surface Water Management and Drainage

Water has largely been managed at an individual property scale, often without any form of comprehensive long-term planning in terms of the suitability of land for the intended use. Stakeholders in the IWMP process should consider developing a Surface Water Management Plan (SWMP) which, if approved, would influence land development and use in the watershed. Approval by the province should be garnered for SWMPs, just as it is for IWMPs, in order to influence authorization of proposed drainage projects.

Recommended Actions

- A surface water management plan should be developed through a partnership with all stakeholders in the watershed.

Nutrient Enrichment

Nutrient enrichment is one of the most important water quality issues in Manitoba. Excessive levels of phosphorus and nitrogen fuel the production of algae and aquatic plants. Excessive algal blooms can cause changes to aquatic habitat, reduce essential levels of oxygen resulting in fish kills, interfere with drinking water treatment removed facilities, cause taste and odour problems in drinking water, and reduce the recreational value of swimming areas. In addition, some forms of blue-green algae, or cyanobacteria, can produce highly potent toxins. Manitoba has adopted Health Canada's guidelines for toxins in drinking water and recreational waters.

Recommended Actions

- There should be no net-loss of semi-permanent sloughs, wetlands, potholes, or other similar bodies of water in the watershed within which drainage is occurring. Wetlands act as nutrient sinks and help reduce nutrient input to waterways.
- Ensure that drainage maintenance, construction, and re-construction occurs in an environmentally friendly manner, following best available technologies, and best management practices (BMPs) aimed at reducing impacts to water quality and fish habitat. Some key BMPs for drainage include:
    - Surface drainage should be constructed as shallow depressions and removal of vegetation and soil should be minimized during construction.
    - Based on Canada Land Inventory Soil Capability Classification for Agriculture, Class six and seven soils should not be drained.
    - Removal of vegetation and soil should be kept to a minimum during the construction and placement of culverts.
    - Exposed areas along banks of surface drainage channels should be re-vegetated.
    - Erosion control methodologies outlined in the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat should be used where the surface drain intersects with another water body and on both sides of culverts.
    - Discharge from tile drainage should enter a holding pond or wetland prior to discharging into a drain, creek, or river.
- Maintain healthy, natural riparian vegetated buffers along waterways. A strip of vegetation one to three metres wide should be maintained along drainage channels as a buffer. This will reduce erosion of channels and aid in nutrient removal.
- As proposed in the Nutrient Management Regulation under *The Water Protection Act*, no nutrients can be applied to lands that are designated as zone N4 for nutrients or in nutrient buffer zones as defined in the Regulation.

Ground Water[3]

Background

Groundwater is water that fills the pores and fractures in the ground. At some point as water recharges the soil and moves down through the profile all of the pore space will be saturated. The surface where this occurs is called the water table. Not only must sediment or rock be saturated to recover groundwater, it must also be permeable enough to allow the water to move at a reasonable rate. Because these properties are largely controlled by the material the water is moving through the geology of the formations are important in understanding water movement. Additionally the natural water quality which the water acquires is highly dependent upon the materials it flows through.

Groundwater moves from higher elevation to lower elevation or from higher pressure to lower pressure. During recharge, water moves vertically through the soil and shallow geologic horizons until it reaches the water table. Under ambient conditions, groundwater typically moves quite slowly. In a prairie pothole landscape, sloughs will focus recharge into localized flow systems. In these settings, the water table may be high under the sloughs; the amount of recharge coming from sloughs will greatly depend upon the location of the slough in the landscape and the material underlying the slough.

A geologic formation from which economically significant quantities of water flows to a spring or can be pumped for domestic, municipal, agricultural or other uses is called an aquifer. Aquifers can be separated vertically by less permeable layers; layers that do not readily allow water flow or act as barriers to flow. These confining layers are called aquitards. In an unconfined aquifer the water table and consequently the amount of water in storage, changes over the seasons or longer climatic periods as water levels fluctuate in response to recharge or discharge from the aquifer.

Bedrock Aquifers

The Odanah member of the Pierre Shale Formation consists of brittle layers of rock separated by softer bentonite clay layers. Fractures can form within the brittle layers which store and transmit water. The Odanah forms the uppermost bedrock unit beneath most of the watershed. The soft Millwood shale aquitard underlies the Odanah and forms the uppermost bedrock unit in areas where the Odanah has been eroded. For all practical purposes, the Millwood formation does not transmit water. The Odanah is absent from the southern most portion of the watershed, throughout most of the area south of Minnedosa. Below the Odanah, the groundwater is saline and non-potable. The top of the Millwood forms the base of groundwater exploration in the watershed.

Wells completed into the Odanah shale range from a few feet below ground to depths greater than 300 feet. Water supply from these wells ranges from less than adequate to more than adequate for most domestic needs. Driller's well test yields from the Odanah shale vary from less than 0.3 gallons per minute (gpm) to 160 gpm and average 24 gpm. The total dissolved solids

[3] Submitted by Manitoba Water Stewardship

(TDS) of the Odanah ranges from 360 parts per million (ppm) to greater than 3,000 ppm and averages 1,430 ppm. The northern portion of the watershed has a greater proportion of low TDS waters. The dissolved constituents primarily consist of sodium, (Na) calcium (Ca), magnesium (Mg), sulphate (SO_4), bicarbonate (HCO_3) and occasionally chloride (Cl). Lower TDS waters are predominantly Ca-Mg-HCO_3 with increasing sodium and sulphate occurring with increasing TDS. Hardness ranges from 150 to greater than 1,000 ppm $CaCO_3$ (approximately nine to 60 grains per gallon) and averages 440 ppm $CaCO_3$. Iron and manganese range from less than detection to greater than 10 ppm and 1.9 ppm, respectively, with average concentrations of 1.5 ppm for iron and 0.5 ppm manganese. This corresponds to almost 70% of the Fe and 95% of the Mn sample results above the aesthetic value for drinking water quality. Although there are few comprehensive analysis of groundwater from the shale within the provincial database the following samples are above the aesthetic guidelines for drinking: 50% of the samples for sodium (500 ppm), 41% for sulphate (500 ppm), and 12% for chloride (250 ppm). The Health-based limit was exceeded in one of 16 samples for nitrate (10 ppm as N) and in two of five samples for arsenic (0.010 ppm).

Extensive erosion and deposition prior to glaciation formed buried valleys cut into the bedrock that may contain permeable sediment and form aquifer systems. These valleys may be in-filled with Tertiary age sediments and/or Quaternary (glacial) sediments; one such valley was identified west of Minnedosa. Further work is required to explore and define buried valleys that contain sediments suitable for forming aquifers.

Sand & Gravel Aquifers

Within glacial and recent sediments, aquifers are formed as sand and gravel within or at the base of glacial till, at the ground surface or near surface from glacial outwash or alluvial sand deposited from modern or ancient rivers. Most sand and gravel aquifers within the watershed consist of buried lenses of sand and or gravel (Figure 8). Unconfined sand aquifers are found in the Rivers area and major buried sand and gravel aquifers are present in the area between Clear Lake and Proven Lake in the northern part of the watershed. On the eastern margin of the watershed, near Minnedosa, sand aquifers are scarce.

Well yield from sand and gravel aquifer is variable, but generally adequate for individual domestic uses. The average reported well yield is 25 gpm and there is potential in some aquifers for high capacity wells. Half of the wells are reported to yield greater than 16 gpm. The average total depth of wells completed into sand and gravel aquifers is 175 feet and the average depth to the top of the uppermost sand and gravel is greater than 50 feet; although these values are highly variable.

A relatively high percentage of groundwater samples from sand and gravel aquifers exceed one or more of the drinking water aesthetic objectives. Aesthetic objectives apply to constituents in the water that impart a taste, colour or odour that may affect the enjoyment or acceptance of that water. Sixty-five percent of 104 samples exceed the aesthetic objectives for iron (0.3 ppm) and 78% of 90 samples exceed the objective for manganese (0.05 ppm). Drinking water guidelines for aesthetic objective was exceeded for 85% of the TDS (500 ppm), 10% of the sodium (200 ppm), 37% of the sulphate (500 ppm), 1% of the chloride (250 ppm) in the samples measured.

There are very few analyses of relatively complete chemistry; and comprehensive metal analysis in the database. Aluminum, antimony, barium, boron, cadmium, chromium, copper, lead, uranium and zinc were all below drinking water guideline concentrations in these samples; one sample is above the health guideline for selenium. The Health-based limit was exceeded in 12% of 95 samples analysed for nitrate (10 ppm as N) and in one of eight samples for arsenic (0.010 ppm).

Total coliform bacteria are routinely detected in private well water. The presence of coliform bacteria is an indicator that the factors may exist where there are pathways for well water to be contaminated with water from the ground surface or from near surface. Twenty-four percent of the 37 samples had detectable coliform bacteria. E. coli is an indicator of contamination from a fecal source; eight percent of the 39 samples had measurable E. coli. Well owners that have had positive bacteria results need to assess their well for security and maintenance, and proximity to potential sources of contamination.

Groundwater Use

Driller logs specify the intended water use for new production wells. The well use can be recorded as a single or multiple uses. Within the Little Saskatchewan River watershed the following water uses are recorded (Figure 7): 1,039 domestic, 103 livestock, 363 combined domestic and livestock, 63 municipal, and 25 being used for irrigation and other uses. Almost 90% of the wells provide water to private domestic applications. Water used for domestic purposes, such as a private well, does not require licensing. Aquifer budgets have not been established for the Little Saskatchewan river watershed.

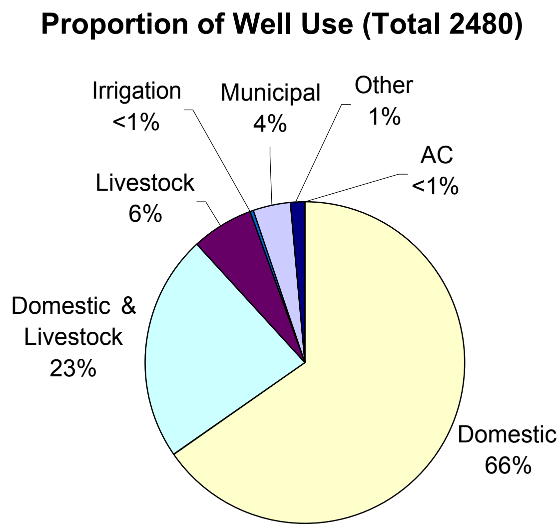


Figure 7: Proportion of production well use within the watershed: almost 90% of the wells provide private domestic water supplies.

Licensing

Withdrawals of more than 5,500 imperial gallons/day require a water rights license. For groundwater projects, allocation amounts are determined based on an assessment of hydrogeological information including: geological information on aquifers, aquifer sustainable yield estimates, and water allocation budgets, where available, as well the water use requirements of senior users and domestic needs. Further information regarding water allocation can be found in the Water Allocation section beginning on page 9 of this report. Table 4 provides a breakdown by use of licensed projects and allocated amounts, and applications on file.

Table 4: Groundwater Licenses, Allocations, and Applications

Purpose	Licences	Amount Allocated (acre-feet)	Applications
Agricultural	9	64.0	1
Industrial	0	0.0	1
Irrigation	1	39.7	0
Municipal	2	42.0	2
Other	0	0.0	1
Total	**12**	**145.7**	**5**

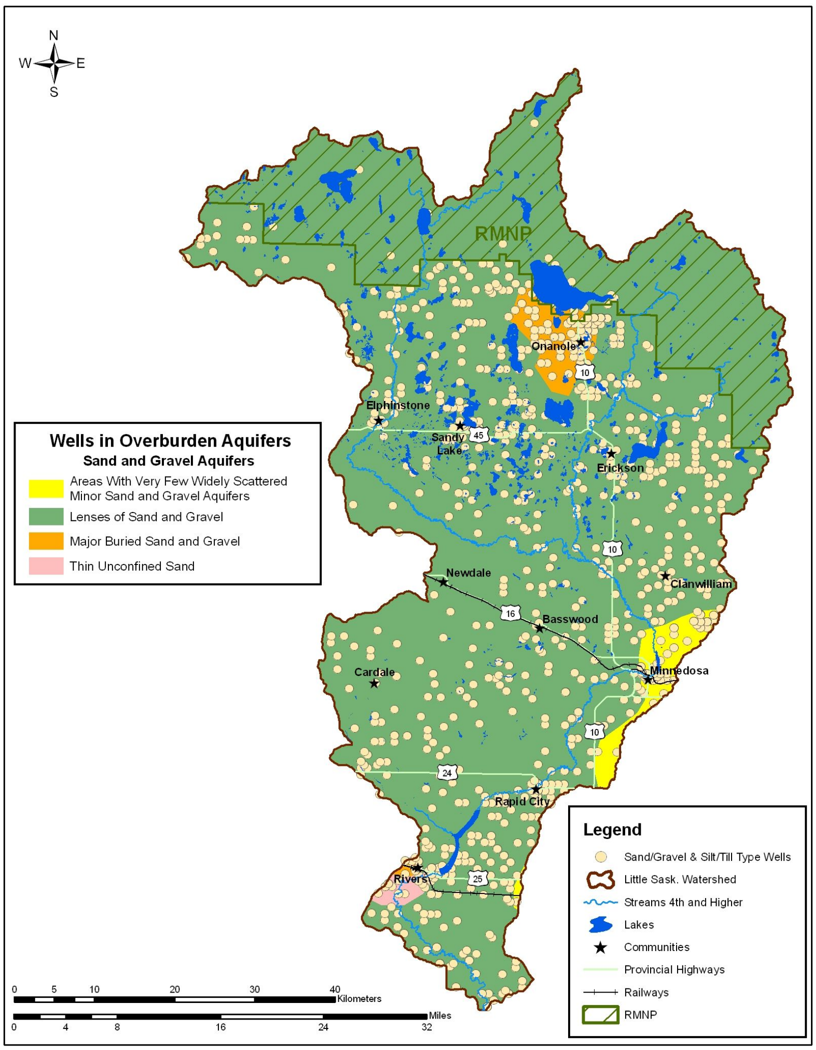


Figure 8: Diagram showing locations of wells completed into overburden material. Throughout most of the area overburden aquifers consist of buried lenses of sand and gravel, except in the Rivers area where unconfined sand and gravel is found and a major buried aquifer south of Clear Lake (after Rutulis 1986).

Management Concerns

Data Gaps

Groundwater forms the baseflow to streams. When run-off from the land surface ceases, the water sustaining the flow of the streams comes from groundwater. The contribution of baseflow to streams and rivers has not been well quantified nor has any water quality impact from these waters. Regional scale stratigraphic and hydrogeologic mapping and compilation would be beneficial in providing an increased knowledge of the extent, properties, and relationships between stratigraphy, aquifers, and surface water.

The province has undertaken groundwater investigations within this watershed resulting in a number of test holes being completed; however, there currently are no groundwater monitoring points established. There is also a lack of information on many water quality parameters for some of the groundwater sources, including many solutes with drinking water guidelines.

Well log and groundwater information is stored by the Groundwater Management Section, Manitoba Water Stewardship. Results from past well surveys indicate that only about half of the wells in service are recorded and the accuracy of the location of the majority of wells is to the quarter section on which it is drilled. The knowledge of accurate well location is an important step in identifying sites for future well sealing. The province does not have access to well surveys conducted by other organizations; additional information on wells and locations would be beneficial in managing the province's groundwater resources.

Recommended Actions/Actions Currently Underway

- A well inventory for the watershed should be completed. It should include GPS coordinates, information on well construction and rudimentary water quality.
- Comprehensive groundwater chemistry should be completed on wells selected during the well inventorying process.
- The Groundwater Management Section is committed to completing a new set of digital maps based on the watershed scale.
- The Groundwater Management Section is currently evaluating the provincial monitoring well network to determine where there are redundancies or areas that could benefit from new or additional monitoring locations. This watershed will be included in that evaluation.

Wellhead Protection

Previous well surveys by Manitoba and other provinces show that well location, construction and maintenance are important factors in man-made water quality problems. Many of the parameters measured that lead to less than desirable potable water quality such as TDS or hardness, occur naturally and not the result of man's influence on the environment. However there are local impacts commonly measured in well water throughout the province.

Recommended Actions

- Owners of private wells should be encouraged to self-assess or have their well assessed for physical conditions that may affect water quality such as poor wellhead conditions, well construction, location or maintenance.
- Water testing should be encouraged for all drinking water sources on a regular basis.
- Well specific assessments should be conducted on community or municipal wells to determine the vulnerability during the development of well head protection policies. As a minimum, the individual characteristics of each well, aquifer, and geology should be considered to assess vulnerability.

Abandoned Wells

Wells are often located in areas of convenience and in the same general areas as potential contamination sources. Neglected, abandoned, or unused wells can act as a direct conduit for contaminants from the surface to enter aquifers.

Recommended Action

- Abandoned wells should be sealed to lessen the potential spread of contaminants to an aquifer.

Sustainable Groundwater Development

Sustainable yield values have not been determined for aquifers in the watershed. Therefore, the amount that can be withdrawn from the aquifers without depleting them over time is unknown.

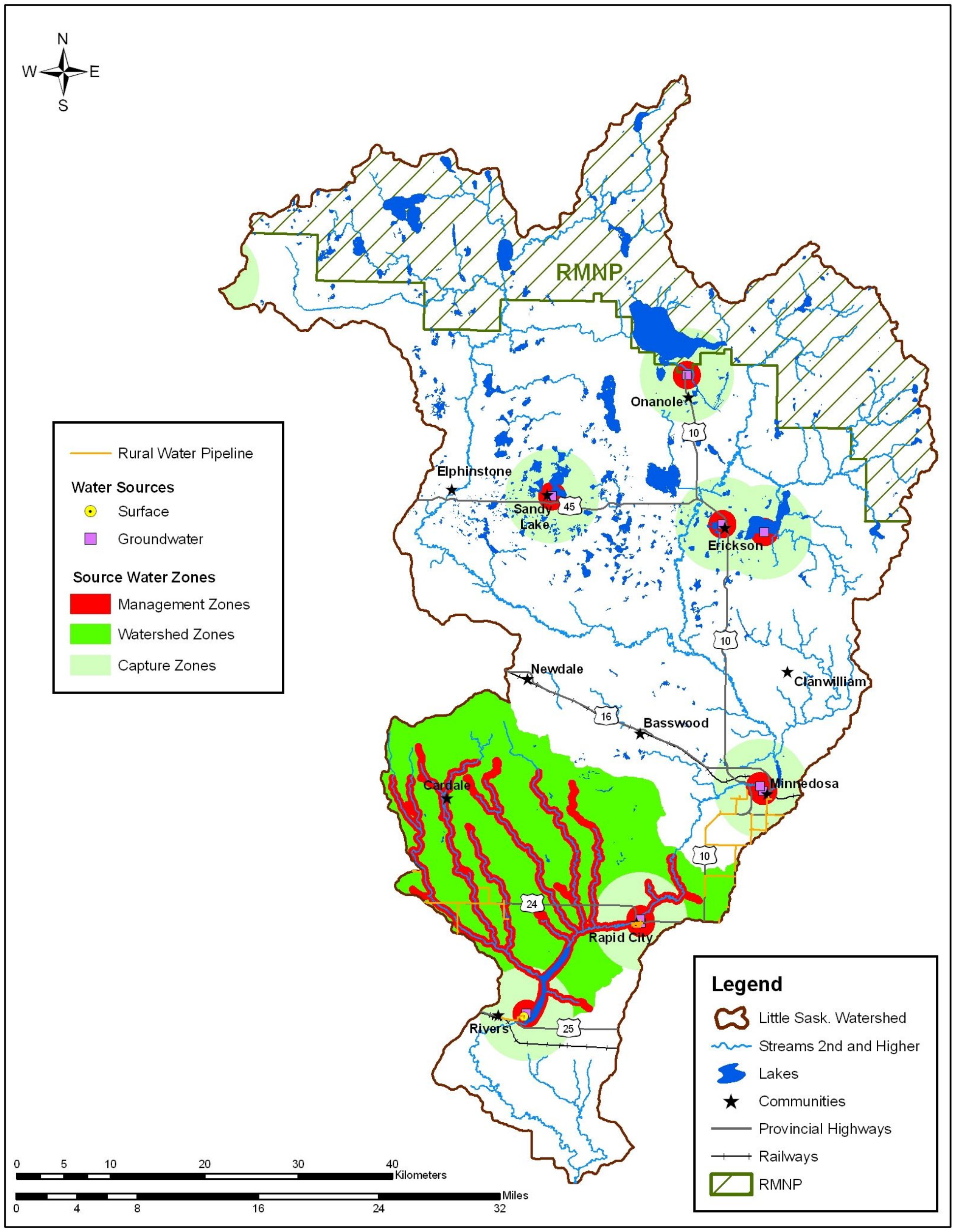
Recommended Action

- Assess all high use groundwater withdrawals on an individual project basis.

Source Water Protection Assessment[4]

Drinking Water Background

Clean, potable drinking water is critical for human life and, therefore, a necessity for prosperous, sustainable communities. Drinking water sources can be sorted into three types: public systems contain 15 or more service connections, semi-public systems contain less than 15 service connections but are not private systems (e.g. a school or hospital with it's own well), and private systems that supply water to only one private residence. The Little Saskatchewan River watershed contains 14 public drinking water sources (Table 6). Figure 9 maps each surface and groundwater source along with the management and either the watershed or capture zone for each source. No semi-public sources were identified and private sources were not examined because comprehensive data is unavailable.



Watershed

[4] Submitted by Manitoba Water Stewardship, Manitoba Water Services Board, and Manitoba Conservation

Table 5: Drinking Water Exceedances and Population

Public Water Treatment Plant	Population Served (Approximate)	Guidelines for Canadian Drinking Water Health Exceedence	Guidelines for Canadian Drinking Water Aesthetic Exceedence
ERICKSON	450		TDS, Manganese, Sodium
MINNEDOSA 1	2,500		TDS
MINNEDOSA 2			TDS, Manganese
RM of ODANAH	300 (most outside the watershed)		TDS, Hardness
OTTER LAKE	Seasonal		
RAPID CITY	425	Possibly THM	TDS, Manganese, Hardness
RIVERS	1,200	Possibly THM	
RIVERS PROVINCIAL PARK	Seasonal		
SANDY LAKE	300		
SPORTSMAN PARK	Seasonal		

The Guidelines for Canadian Drinking Water Quality were established to provide an indication of drinking water quality from a health and aesthetic perspective. Some of these guidelines have been adopted as drinking water standards under Manitoba's Drinking Water Safety Act.

As Table 5 shows, there are two public water sources that exceed the Guidelines for Canadian Drinking Water Quality and Manitoba's Drinking Water Quality Standard. Initial samples of the water from Rapid City and Rivers indicate that the drinking water may exceed the standards for Trihalomethanes (THMs). These standards are based on the average of four samples collected in a year. Therefore, further sampling is required to verify these levels. Trihalomethanes are a disinfection by-product created during the treatment process by the interaction of organic material in the source water with chlorine.

Aesthetic quality guidelines are in place to address factors such as taste, odour, and colour which, although they do not affect human health, may affect public acceptance of drinking water. Five source waters: Minnedosa, Erickson, Rapid City, and the RM of Odanah, exceed the aesthetic guidelines for Canadian Drinking Water Health for factors such as Total Dissolved Solids (TDS), hardness, manganese, and sodium. Since aesthetic guidelines are in place to ensure public acceptance of drinking water and not to protect human health, these aesthetic exceedences should be considered lower priority issues.

Trends in drinking water include the upgrading of water treatment and distribution facilities to comply with provincial regulations. Rural water pipelines are also being used to convert from private to public water sources, thus making it easier to ensure that drinking water standards are met.

Potential Pollutants Background

It is an accepted fact that drinking water must be clean and of pristine quality – nobody wants to drink water which tastes odd, looks dirty, or which may negatively impact human health. Unfortunately, many human activities and natural processes on the landscape hold the potential to degrade the quality of our drinking water sources. It is impossible to capture all of the potential risks to drinking water quality, this section attempts to capture those potential threats which are most serious or most likely to pose a hazard to drinking water sources. Figure 9 illustrates where potential hazards exist in the watershed.

It is important to recognize that when a potential pollutant risk exists, it may not be possible to simply eliminate the risk. For example, a highway upstream of a drinking water intake poses a potential risk from a spill of hazardous goods, this does not mean that the highway should be closed – a comprehensive spill response plan may be sufficient to protect the drinking water source and human health from any contamination.

It is also critical to remember that the management of a given operation (waste disposal ground, intensive livestock operation, oil well or other facility) is as important as the presence of the operation. A well managed operation which operates according to best management practices (BMPs) may be low risk even if it is large. A poorly managed operation which does not follow BMPs may higher risk even if it is small.

Management Concerns

Drinking Waters Exceeding the Guidelines for Canadian Drinking Water

Within the Little Saskatchewan River watershed, initial sampling of two public water supplies exceeded the health based Guidelines or Standard. Initial data collection indicates that Rivers and Rapid City may exceed the levels of THM. Further sampling will be required to assess these levels. Under current regulations, these municipalities have until March 1, 2012 to comply with the drinking water quality standards.

Recommended Actions

- Rivers and Rapid City must continue to sample for trihalomethanes to establish an annual average and determine if they exceed the guidelines.
- Removal of organic material in the source water is the best method of reducing THM levels in the drinking water.

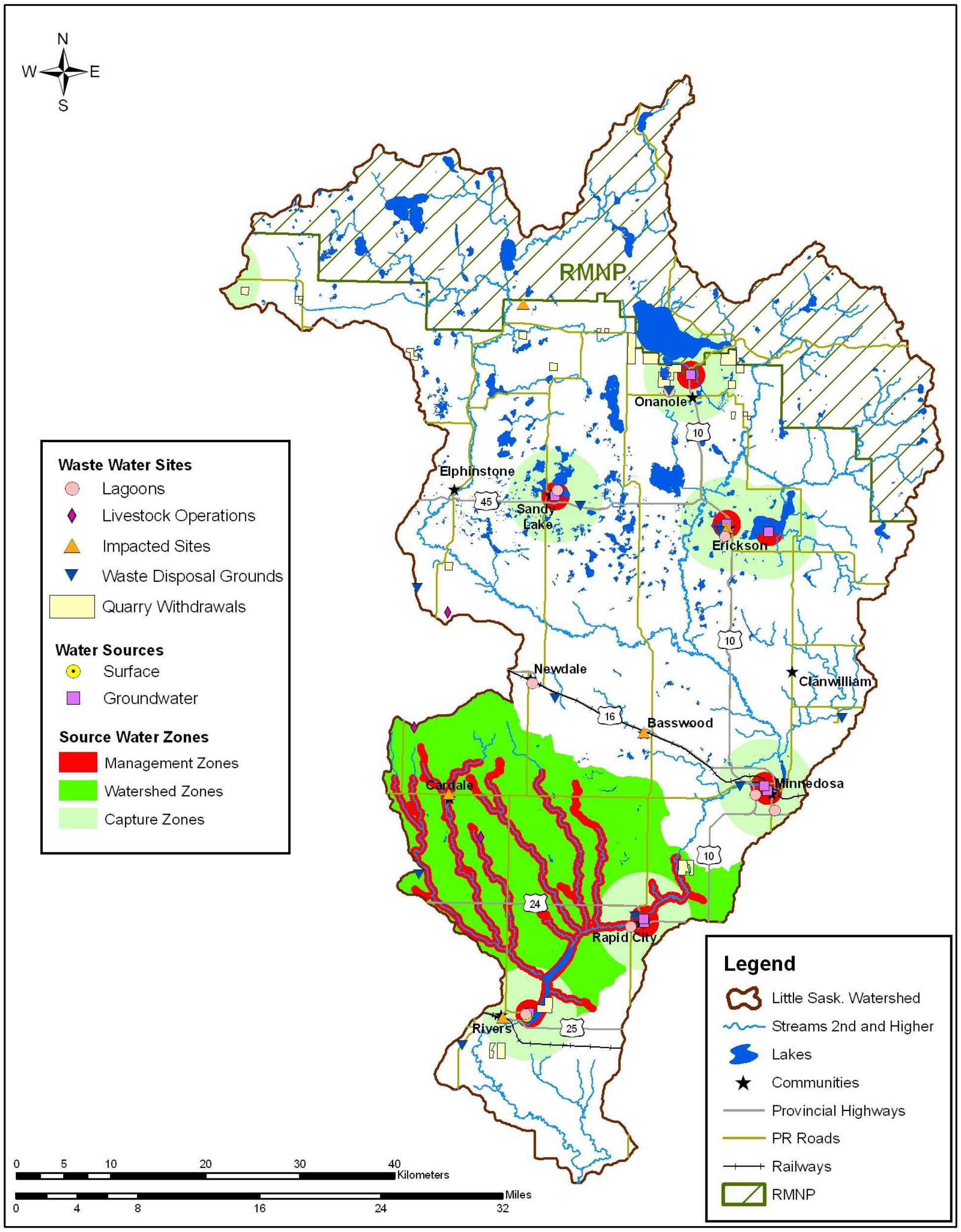


Figure 9: Potential Pollutant Sources in the Little Saskatchewan River Watershed

Drinking Water Susceptibility

Public water supplies are managed by the Office of Drinking Water to ensure adequate treatment and safe distribution for the protection of human health. One of the key factors that affect drinking water quality is the quality of the untreated water at the intake location. Source water protection is the first barrier in a multi-barrier approach to protect drinking water which also includes adequate treatment and distribution systems. Source water will vary in quality due to natural processes; the potential also exists for human activities to introduce pollutants, bacteria, and pathogens which may harm human health. This section of the report examines the relative susceptibility of drinking water sources to pollution introduced as a result of human activities.

Drinking water susceptibility includes measures of a number of different indicators including: wastewater treatment facilities, transport of Dangerous Goods routes, mines and quarries, large livestock operations, landfills, impacted sites, petroleum storage facilities, and landscape disturbance based on land use. A standardized methodology has been adopted for the province of Manitoba which will allow for relative comparison of susceptibility of drinking water sources across the province. It is important to note that this is only a measurement of susceptibility – not of risk. This is an important consideration as the susceptibility measurement only checks for the presence of a potential pollutant but does not include any measure of probability of pollution occurring. Table 7 outlines the susceptibility of each source water in the watershed and the factors affecting susceptibility. All unknown/unconfirmed (?) well types are assumed to be unconfined for the purposes of assessment.

Table 7: Drinking Water Susceptibility

Public Water Treatment Plan	Water Source	Well Type	Susceptibility Rating	Factors Impacting Susceptibility Rating
Erickson	Well 1	Confined	Moderate	Highway x3, impacted sites x3, wastewater treatment lagoons, waste disposal grounds
	Well 2	Confined	Moderate	Highway x3, impacted sites x3, wastewater treatment lagoons, waste disposal grounds
Minnedosa 1	Well 1	Unconfined	High	Disturbance, highway x7, railway, wastewater treatment lagoons x2, waste disposal grounds, unconfined aquifer in management zone
Minnedosa 2	Well 2	Unconfined	High	Disturbance, highway x7, railway, wastewater treatment lagoons x2, waste disposal grounds, unconfined aquifer in management zone
	Well 3	Unconfined	High	Disturbance, highway x7, railway, wastewater treatment lagoons x2, waste disposal grounds, unconfined aquifer in management zone
RM of Odanah	Water Supplied by Minnedosa's water system			
Otter Lake	Well	Unknown (assuming unconfined)	High	Disturbance, highway, wastewater treatment lagoon, impacted sites x3
Rapid City	East Well	Unconfined	High	Disturbance, highway, waste disposal grounds, wastewater treatment lagoons, unconfined aquifer in management zone
	West Well	Unconfined	High	Disturbance, highway, waste disposal grounds, wastewater treatment lagoons, unconfined aquifer in management zone
	Back-up Well	Unconfined	High	Disturbance, highway, waste disposal grounds, wastewater treatment lagoons, unconfined aquifer in management zone
Rivers	Surface (Lake Wahtopanah)	N/A	High	Disturbance, highway, quarries x2, impacted site, wastewater treatment lagoon x2
Rivers Provincial Park	Well	Unconfined	High	Disturbance, quarries x3, highway, railway, wastewater treatment lagoon, impacted site
Sandy Lake	East Well 1	Confined	Moderate	Highway, waste disposal ground, wastewater treatment lagoon
	West Well 2	Confined	Moderate	Highway, waste disposal ground, wastewater treatment lagoon
Sportsman Park	Well 1	Unconfined (?)	High	Quarries x5, highways x2, waste disposal grounds, wastewater treatment lagoon, unconfined aquifer in

				management zone

It is critical to recognize that a high or moderate susceptibility rating does not mean that water from these sources is unsafe. The source water protection assessment only indicates the relative susceptibility of the water source to potential pollution or contamination. Thus, a water source which is rated with a high susceptibility is not unsafe to drink; but it is subject to more potential pollutants than a moderately susceptible water source.

Recommended Actions

- Ten water supplies were identified as high risk – a more detailed assessment is required for these water sources.
- Steps should be taken to address the potential pollutant sources for each water source.
- Obtain more detailed data on the identified potential pollutant sources.

Data Gaps

- The susceptibility rating does not include any measure of probability from indicators – it simply checks for the presence of indicators – probability information would lend greater precision to future Source Water Protection Assessments.
- Semi-public water sources in the watershed were not identified.
- Many potential pollutant sources in the watershed could not be identified and located, for example, septic fields/tanks, storm water outfalls, petrochemical/chemical storage, livestock access to water sources.
- The location of groundwater wells in floodprone areas may present a hazard to groundwater sources through potential contamination of the aquifer during times of flooding. Drinking water sources were not analyzed in regards to their proximity to floodplains.

Habitat[5]

Native Wildlife Species

The Little Saskatchewan River watershed provides important habitat for a diverse set of wildlife species. White-tailed deer is the most common and populous ungulate in the watershed, while elk, and moose also commonly inhabit portions of the watershed. Populations of ungulates are generally considered healthy and support both eco-tourism and hunting opportunities. Black Bear inhabit the watershed however population estimates are difficult to determine. The population is generally considered to be healthy and expanding in some areas. A variety of furbearers including beaver, muskrat, coyote, red fox, timber wolves, mink, fisher, and others are found within the watershed as well as numerous small mammals. In excess of 200 bird species can be found in the aspen parkland region.

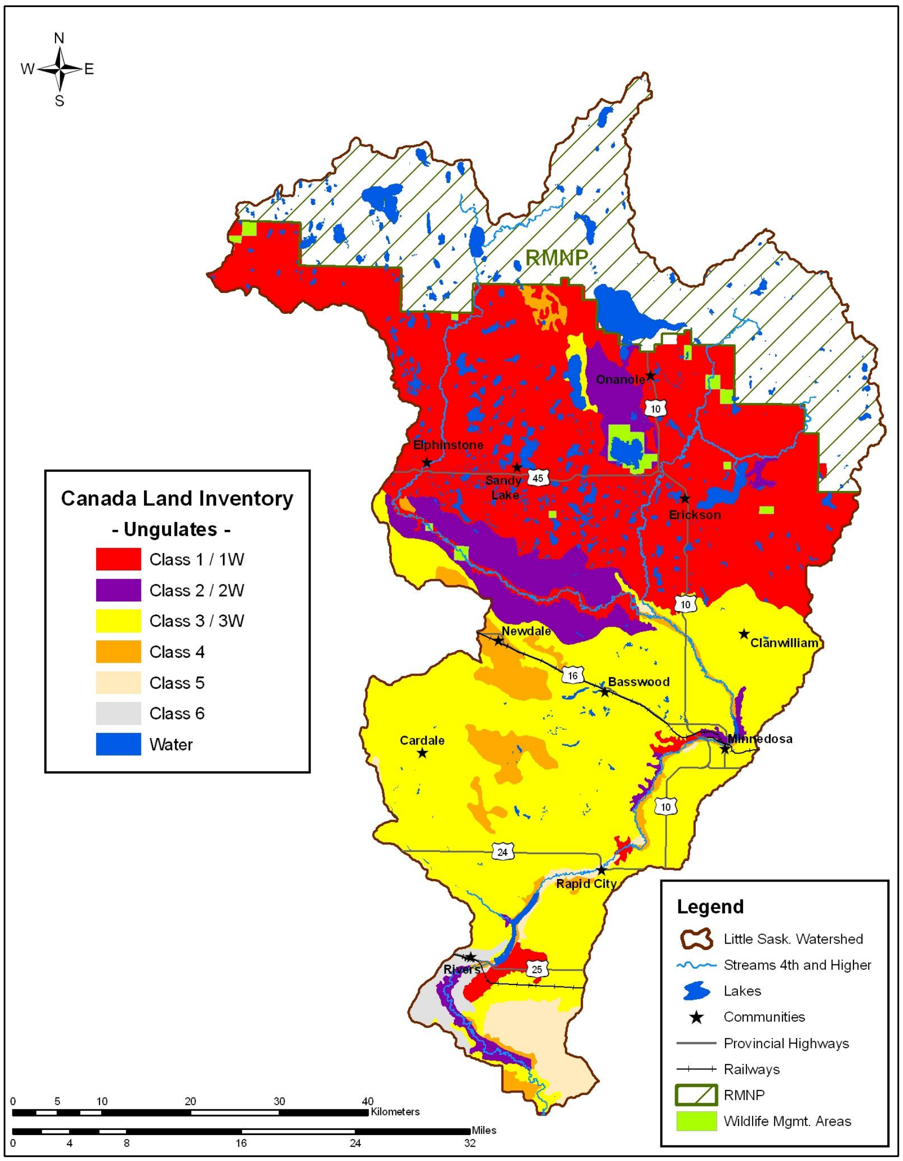


Figure 10: CLI Land Capability for Wildlife -Ungulates

The Canada Land Inventory Classification (CLI) System provides a good indication on upland habitat capability presently available. Figure 10 illustrates that 91% of the watershed outside of Riding Mountain National Park is Class one to three habitat, with the more productive of these lands being located primarily in the headwaters of the watershed.

[5] Submitted by Manitoba Conservation, Ducks Unlimited Canada, Manitoba Water Stewardship, Manitoba Habitat Heritage Corporation, and Canadian Wildlife Service

Non-Native Species

Invasive species are plants, animals, or other organisms that are growing out of their country or region of origin and are out-competing or even displacing native organisms. These "unwanted invaders" have become a major threat to the world's ecosystems, and Manitoba's lands and waters are no exception. In addition to environmental damage, invasive terrestrial plants (weeds) such as leafy spurge cost Manitobans millions of dollars each year in control, management, decreased land values, and lost agricultural production. These plants are more competitive than native plants and are often the first to colonize disturbed lands. They can be spread or introduced by global and regional movement of goods and people via air, rail, water, or roads. In particular, waterways are a main conduit for spread of invasive plants because herbicide restrictions near water, limit control options, and water has the ability to carry seeds long distances to new areas. For these reasons it is important to leave areas near water as undisturbed as possible.

Protected Areas

Private and public lands provide key wildlife habitat within the watershed. Riding Mountain National Park (RMNP) is an important area for wildlife both inside the Park and the surrounding area. The protected areas comprise approximately 25% of the land within the watershed (Figure 11). Crown land uses include provincial parks, federal parks, and wildlife management areas (WMAs). Of the approximately 258,902 acres of protected land, 241,806 acres are within RMNP, 14,221 acres are in wildlife management areas or refuges, 2,755 acres are privately protected with the remaining 120 acres in provincial parks.

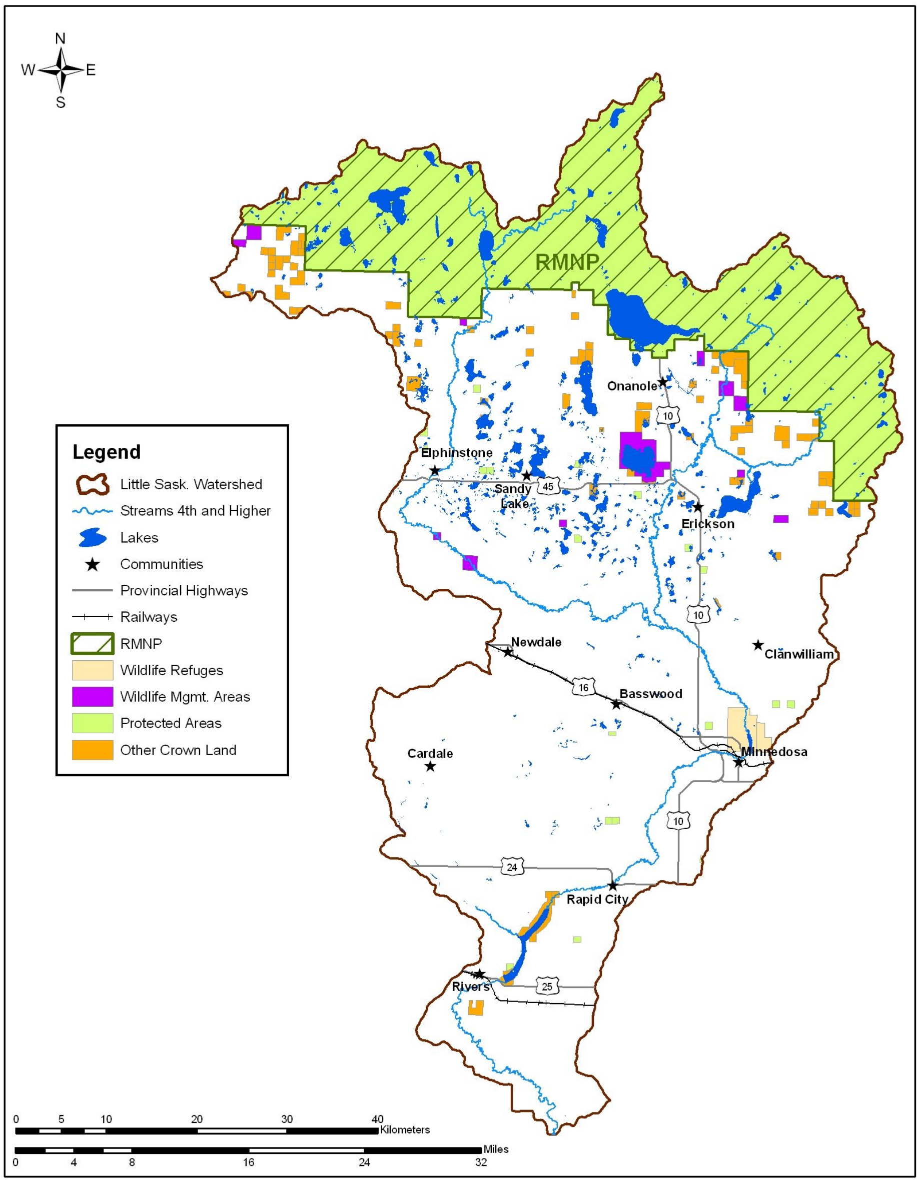


Figure 11: Protected areas in the Little Saskatchewan River

Rare, Threatened, and Endangered Species

Information on rare, threatened, or endangered plant, animal and native plant communities has been collected in the Little Saskatchewan River watershed. There have been 79 occurrences where species at risk have been sighted in the watershed, 36 being plant records (including 26 different species), 38 animal records (eight species), one snake hibernacula, and four native plant communities. Animal species that have been sighted are – Baird's Sparrow, Trumpeter Swan, Sprague's Pipit, Rusty Blackbird, Yellow Rail, and Red-headed Woodpecker. Figure 12 illustrates where these occurrences have taken place. The majority of these occurrences have occurred in RMNP.

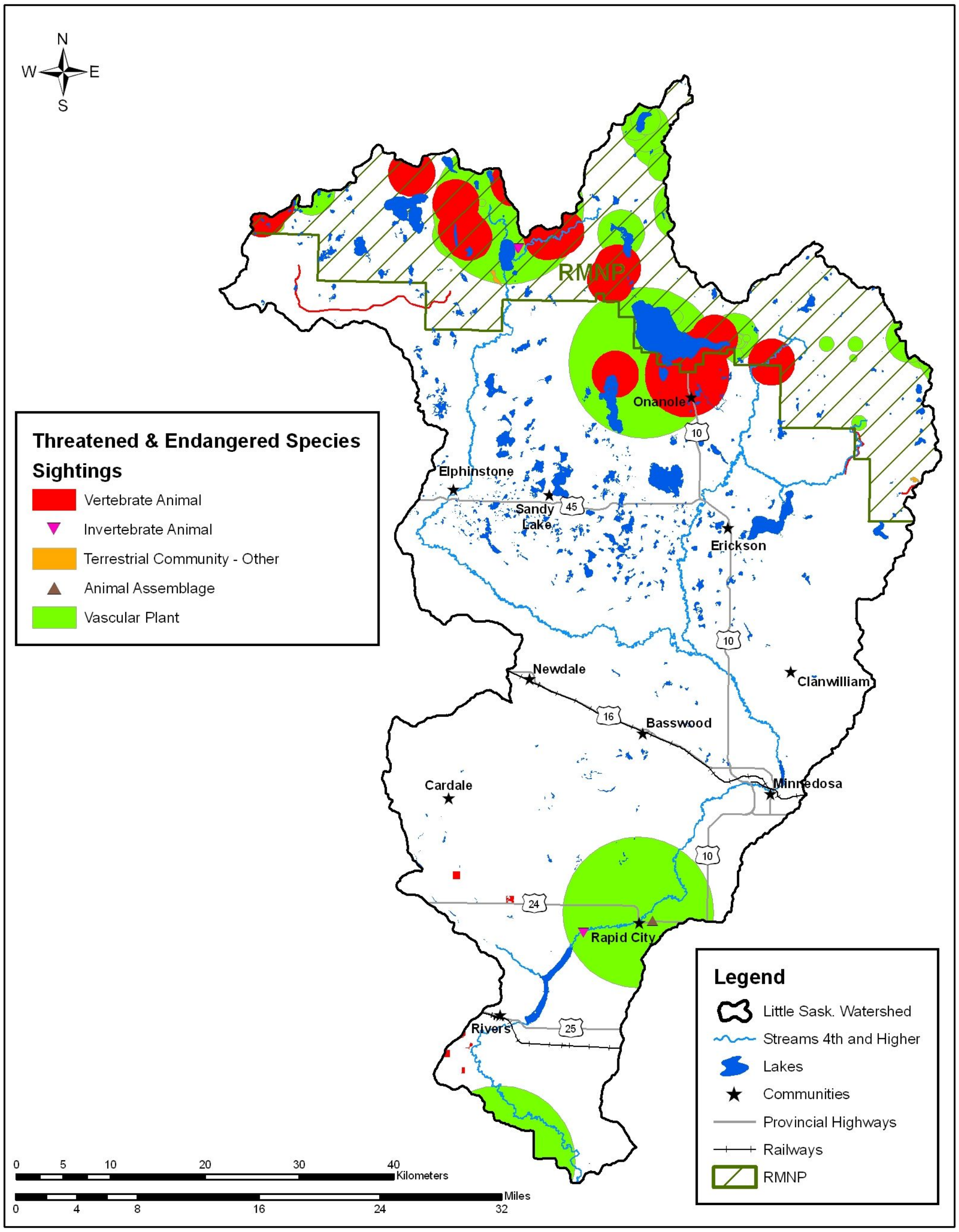


Figure 12: Sighting Locations of Rare, Threatened, and Endangered Species

Riparian Habitat

Riparian areas are key areas for protecting watershed health. These transitional areas between upland habitat and the water's edge provide key habitat for wildlife and play an important role with respect to the movement of wildlife. The maintenance and/or protection of connective habitat such as riparian areas and other habitat corridors between larger habitat areas are important for the maintenance of wildlife populations.

Two key indicators of riparian health are the loss of natural vegetation and stream bank erosion. Very little riparian area data exists for our watershed. To get an approximation of the land cover that exists along the 1,271 miles of waterways in the watershed, a quick land cover analysis was conducted along a 165 foot buffer of the waterways. This study revealed that 7,529 acres of the waterways riparian area are cropland, 13,441 acres have grassland and 12,500 acres have woodland cover. It should be noted that 72 % of the waterways are Class one to three waterways. Figure 5 shows the abundance of waterways in the watershed.

Little Saskatchewan River Watershed Riparian Analysis

The Little Saskatchewan River was the subject of a riparian rehabilitation project with the goal of improving water quality. As part of this study, a riparian assessment, conducted by aerial survey, evaluated the riparian corridor of the Little Saskatchewan River from the mouth to Horod. This survey indicated that land use practices around the Little Saskatchewan River have altered the riparian area around the river. Table 7 summarizes the findings for this waterway.

Table 7: Riparian Buffers Present

Class	Stream Distance (miles)
Buffer <10 ft and/or primary nutrient source	9
Buffer 10 ft – 16 ft and/or occasional nutrient source	42
Buffer 16 ft – 50 ft and/or limited nutrient source	63
Buffer >33 ft and/or no nutrient source	162

Wetlands

Wetlands are areas of depression in the watershed that retain water for varying periods of time. There are different types and sizes of wetlands ranging from small, shallow temporary wetlands to deep, large permanent wetlands. Each type of wetland plays a significant role in the ecology of the watershed and it is very important to maintain the appropriate mixture of these wetland types to maintain the ecological function of the watershed. Temporary and seasonal wetlands typically hold water for a week to a couple of months, yet are very important to waterfowl as they warm-up first in the spring and provide a valuable food source for waterfowl. They also provide much needed pair space in the spring for breeding waterfowl. The deeper semi-permanent and permanent wetlands typically hold water for the duration of the growing season/year round and provide much needed brood-rearing water for breeding waterfowl as well as safe areas to stage and moult.

In addition to providing habitat for fish, waterfowl, and wildlife, wetlands provide a variety of functions and benefits to the watershed. Wetlands improve water quality by filtering 70-90 % of sediments, nutrients, and bacteria from receiving waters. They also assist in reducing the impacts of flood and drought by capturing water and releasing it slowly. Wetlands also allow water to percolate through soils and recharge groundwater supplies.

A 1986 Ducks Unlimited Canada wetland inventory revealed that there are approximately 49,000 wetland basins in the watershed covering an area of about 171,000 acres.

Ducks Unlimited Canada has developed a model that predicts annual waterfowl breeding densities under average conditions for the watershed. Figure 13 represents the predicted breeding pairs /sq. mi of the seven most common duck species for the watershed.

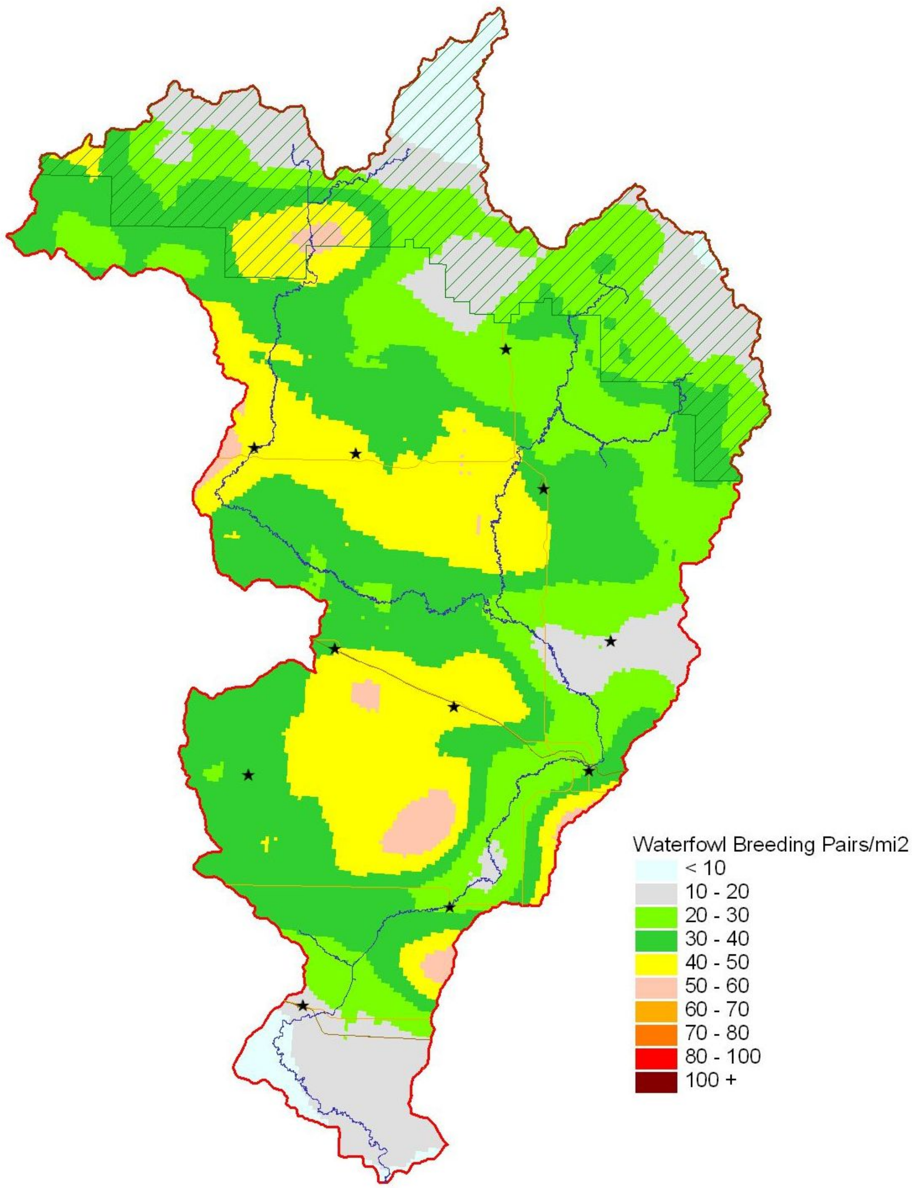


Figure 13: Estimated Waterfowl Breeding Density in the Little Saskatchewan River Watershed

Fisheries

There are three major dams on the Little Saskatchewan River, located near Minnedosa, Rapid City, and Rivers; each of these dams has created reservoirs that have developed into sport fisheries. Lake Wahtopanah, at Rivers, is the largest of these and is an extremely important walleye fishery to the area, both in recreational and economic terms. Two pool and riffle fish ladders have been constructed in an attempt to re-establish traditional fish migration routes on the Little Saskatchewan River. The Rapid City fish ladder was constructed in 1992 and the Lake Minnedosa fish ladder was constructed in 1999. Rivers dam remains a barrier to fish movement.

Recreational fishing is a popular activity and a contributor to the local economuy Four lake aeration systems have been installed on Antons, Eagle, Pybus and Corstophine Lakes, these lakes were experiencing winter fish kills. The aeration systems have expanded these lakes from providing solely seasonal habitat to year-round habitat. These systems are installed and operated in partnership between the municipalities and Fish and Lake Improvement Program for the Parkland Region (FLIPPR).

Numerous water bodies have also been stocked with indigenous or salmonoid fish species on an annual basis due to angling pressure and the fact that salmonoid species do not reproduce. The stocking program has been and continues to be coordinated by the provincial Fisheries Branch. Thomas and Ditch lakes are two examples of stocked water bodies. This area has many internationally renowned stocked trout fisheries that attract anglers from all over. This area hosted the Canadian National Fly Fishing Championships in 2003 and is scheduled to do the same in 2010.

Data Trends

- There are a variety of data sets available to assess the trend in habitat. At the watershed scale, the Ag Census data provides a good estimate of landscape change. This data suggests that there has been roughly a 50 % loss of native habitats in the area from 1951 to 2001.
- Wetland habitat loss and degradation is highly variable across the landscape and the quantity of wetland areas impacted fluctuates over time. Current, detailed wetland loss studies suggest that 70% of wetlands on the prairies have been either lost or degraded.
- A CWS study from 1985-2002, indicates an average wetland loss of 6 % in transects taken in our Assiniboine four-watershed study area.
- Recent studies by Ducks Unlimited Canada found that from 1968 to 2005 64% of wetlands in the Smith Creek sub-watershed (Shell River) and 76% of wetlands in the Broughton’s Creek sub-watershed (Little Saskatchewan) have either been lost or degraded.
- A further cause of concern is that not only has a significant portion of native habitat already been lost on the landscape, but evidence suggests that this loss is continuing. Despite efforts from a variety of conservation agencies, the current rate of habitat loss exceeds the rate of preservation and restoration.

Management Concerns

Habitat loss, degradation, and fragmentation

Various studies and sources indicate a significant portion of wildlife habitat has been lost or degraded, and that this loss continues at a rate greater than preservation and restoration efforts. Preserving a mosaic of interconnected habitat in the watershed is the key to maintaining biodiversity. For example, the Rivers dams on the Little Saskatchewan River acts as a barrier to fish passage.

Recommended Actions

- Preserve and restore native habitats throughout the watershed. Priority should be given to key fish, waterfowl, and wildlife habitats, as well as those habitats that support rare, threatened, and endangered species.
- Efforts should be made to ensure that corridors are available and that habitat is not preserved in isolated blocks.
- Create a fair trade market for landowners who wish to receive market value for the ecological goods and services they provide.

Loss and draining of wetlands

Wetlands are important wildlife habitat and provide numerous ecological services. Presently, draining and filling of wetlands often occurs without regard to ecological significance and against provincial regulations. In addition to the negative ecological consequences, these uncoordinated drainage activities can have negative impacts on downstream water quality and quantity.

Recommended Action

- Adopt a no net-loss of wetlands policy in the watershed – A majority of the naturally occurring wetlands in our watershed have already been lost and existing wetlands continue to see losses due to drainage and in-filling. Preventing further loss of wetlands is important to maintain ecological and hydrological function in the watershed. It is ultimately a better approach to protect existing wetlands now versus restoring them in the future. Once adopted, this policy should be incorporated into the existing drainage licensing process.

Riparian Management

Presently, there is little information on the condition of riparian areas in the watershed. There is concern over the encroachment and elimination of riparian habitat, especially by human activities. As a result of poor riparian health, nutrient and sediment loading has increased and many water bodies are experiencing accelerated eutrophication and related problems (algae blooms, summer and winter fish kills). Another riparian concern is the ongoing channelization and drain maintenance in this watershed. The increase in speed and water volumes result in bank erosion on receiving water courses and it is also facilitating the transport of nutrients and sediments. This is exacerbated by the rolling terrain in this watershed.

Recommended Actions

- Conduct a watershed-wide riparian assessment, to identify areas in need of restoration or management. Priorities should be given to source water areas, important recreational water bodies, and key fish habitat.
- Establish, maintain, or improve vegetative cover in riparian areas. Priority should be given to source waters, key fish, waterfowl, and wildlife areas, areas which support rare, threatened, and endangered species, as well as areas identified in the riparian impact assessment study outlined above. Attention should be given to drain maintenance and channelization activities to ensure adequate vegetation is maintained to prevent soil erosion and subsequent nutrient and sediment transport.

Aquatic Ecosystem Health

There is concern that natural and human induced changes to the quantity and timing of water flow are altering and impairing the health and sustainability of aquatic and riparian ecosystems. Specifically, some of the streams in our watershed are suffering from periods of low water flow which fall below the historical stream flows at specific times of the year. These shortfalls of water influence all components of the ecosystem, from highly visible sport fish such as walleye or northern pike down to aquatic insects and micro-organisms. Water flows can vary due to a number of causes including natural variations in weather and long-term shifts in climate. Flows are also modified by anthropogenic activities such as water withdrawals, land use activities, land drainage, and water impoundment, which alter the timing and quantity of water flow.

Recommended Actions

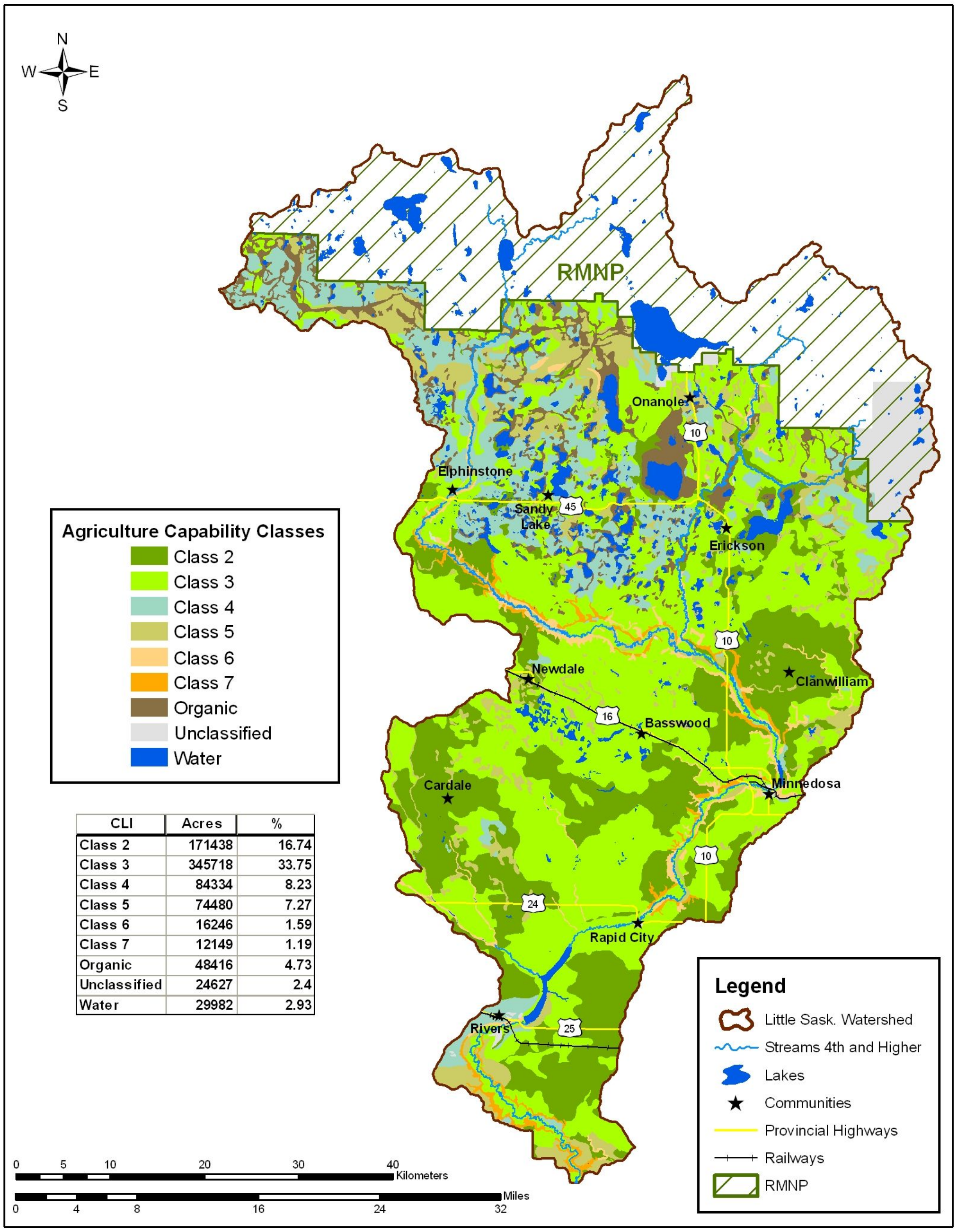
- In-stream flow needs assessments should be done on all major watercourses in the watershed – the Little Saskatchewan River assessment is currently in progress and the Rolling River is also a priority stream. These assessments should go beyond providing single annual targets for in-stream flow needs and instead provide targets on a seasonal or monthly basis so that use of the water resources can more closely mimic a natural system.

Data Gaps

- Invasive species data is not available for the watershed.
- Detailed information on riparian habitat is unavailable.

Soils[6]

Agricultural Capability



CLI	Acres	%
Class 2	171438	16.74
Class 3	345718	33.75
Class 4	84334	8.23
Class 5	74480	7.27
Class 6	16246	1.59
Class 7	12149	1.19
Organic	48416	4.73
Unclassified	24627	2.4
Water	29982	2.93

Figure 14: Agricultural Capability in the Little Saskatchewan River Watershed

[6] Submitted by Manitoba Agriculture, Food and Rural Initiatives and Prairie Farm Rehabilitation Administration

NOTE: "Riparian Areas Most At Risk of Soil Erosion" submitted by the Conservation District as a member of the Watershed Planning Advisory Team

Agricultural capability is best described as the ability of the land to support the production of agricultural crops. Not all land can be used in the same manner and it varies according to soil type, topography, stoniness, soil moisture deficiency, and low fertility, to name only a few of the potential limitations. Classes have been established and range from one to seven, with class one offering the highest potential productivity and class seven offering the lowest potential productivity. Generally, areas in the northern part of the watershed have reduced potential in terms of agricultural capability (Figure 14).

Soil Surface Texture

Soil surface texture strongly influences the soil's ability to retain moisture, its general level of fertility, and the ease or difficulty of cultivation. For example, water moves easily through coarse-textured (sandy) soils, so little moisture is retained and these soils dry out more quickly than fine-textured (clayey) soils. Sandy soils are often characterized by a loose or single-grained structure which is very susceptible to wind erosion. On the other hand, clay soils have a high proportion of very small pore spaces which hold moisture tightly. Clay soils are usually fertile because they are able to retain plant nutrients better than sandy soils. However, they transmit water very slowly and are therefore susceptible to excess moisture conditions.

The predominant soil surface texture within the watershed is fine loamy (59%) (Figure 15). Loam is a mixture of clay, silt, and sand particles. Sandy soils predominately occur in the northern portion and along the southern portion of the watershed (5%). These areas are also known to have significant slopes and could lead to possible erosion issues if not under proper soil conservation management practices. Scattered pockets of organic soil are found throughout the watershed. Organic soils are created from the breakdown of plant and animal life. Eroded slopes occur along the Little Saskatchewan River and associated waterways (3%).

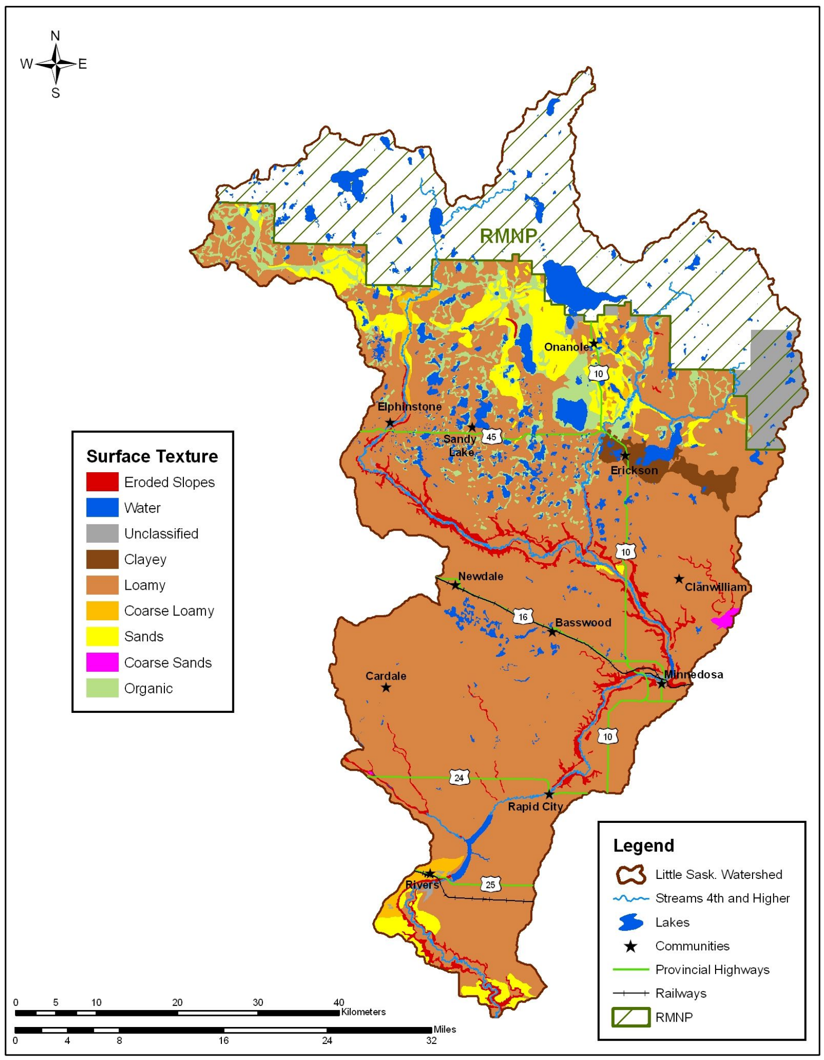


Figure 15: Surface Soil Texture in the Little Saskatchewan River Watershed

Management Concerns

Soil Salinity

Soil salinity is a limitation where plant growth is reduced due to the presence of soluble salts in the soil. These soluble salts hold water more tightly limiting the ability of plants to extract water from the soil. As a result, many plants will exhibit symptoms of drought, even though the soil may have sufficient moisture.

Currently there are 74,841 acres of annual cropland in moderately saline and saline prone areas (Figure 16). The saline soils are primarily located at the bottom of the watershed in the Rivers - Minnedosa Prairie Pothole region. The presence of moderately saline soils tends to be located south and east of Rivers in an area of imperfectly drained lands. Salinity is an increasing problem within the watershed in recent years. Salinity problems are also influenced by the weather; however the problems can be more evident in both dry and wet years.

Recommended Actions

- Efforts should be made to encourage landowners to convert saline prone areas to permanent cover, which will reduce water movement to the soil surface.
- Use saline tolerant species (wheat grasses, clover, and alfalfa) that will gradually reduce the salt levels in soil in identified saline areas.
- Within those target areas, offer incentive programs that reduce drainage of the prairie potholes, encourage the development of buffer establishment around wetlands, and incentives to maintain wetland complexes.
- Adopt zero-till or conservation tillage practices in wetter areas, this will help reduce salts moving up in the soil profile.

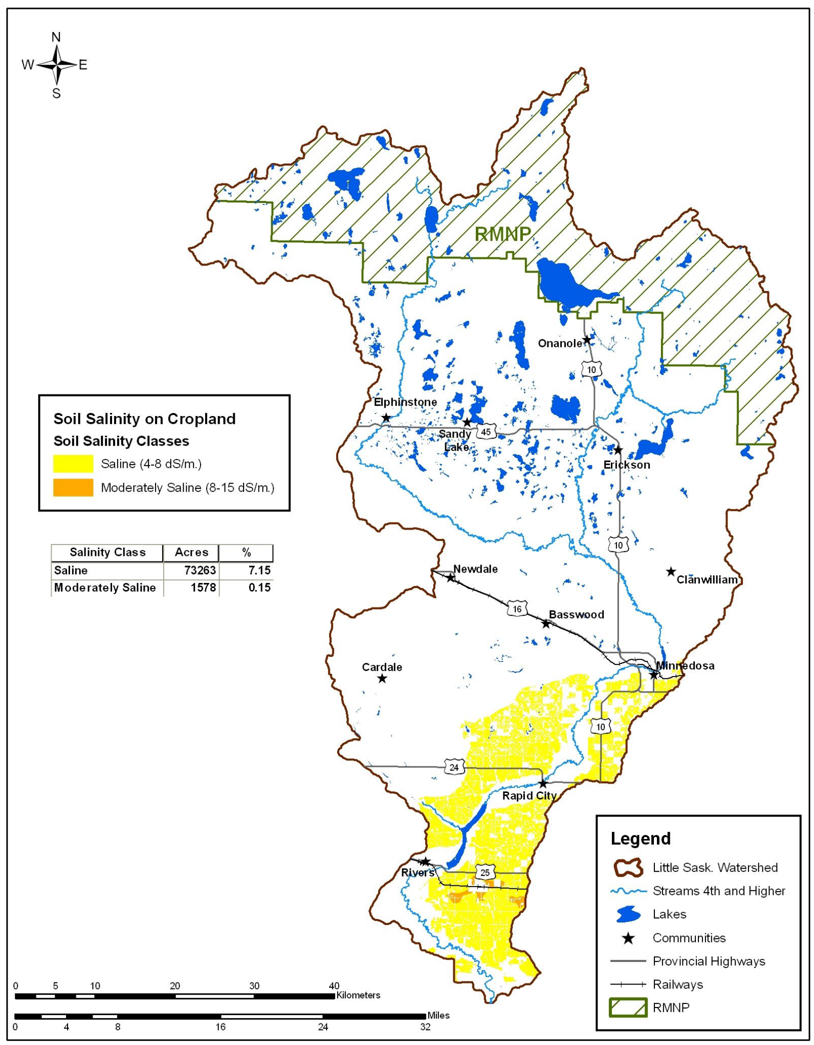
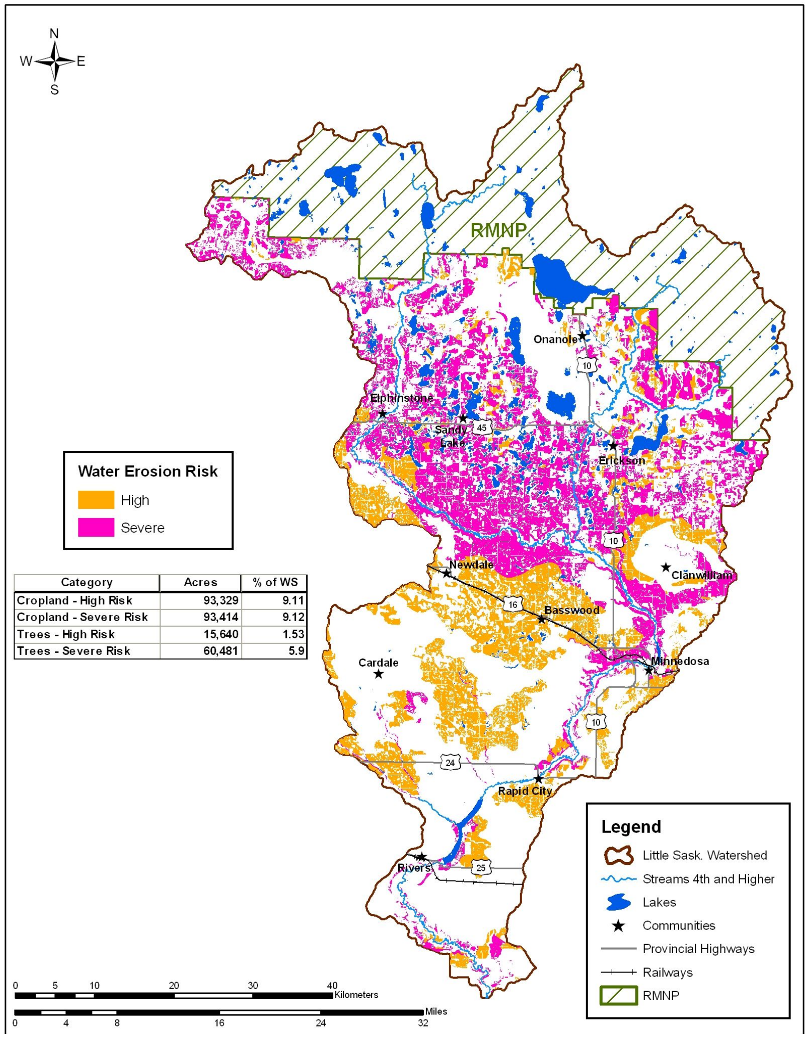


Figure 16: Areas of High Salinity in Cropland

Water Erosion

Water erosion is the removal of soil particles by water. The water often removes topsoil, the soil layer best fitted to support life. Any reduction in the quantity of topsoil reduces the soil's ability to produce a crop by reducing its fertility and its ability to accept and store water and air. Changes in landcover, such as the removal of forest vegetation will increase runoff.

Approximately 186,743 acres in the watershed is considered cropland on areas with high to severe risk for water erosion (Figure 17). These areas are found mainly near Riding Mountain National Park and along the Little Saskatchewan River valley in the upper reaches of the watershed where the land is rolling with steep slopes.



Category	Acres	% of WS
Cropland - High Risk	93,329	9.11
Cropland - Severe Risk	93,414	9.12
Trees - High Risk	15,640	1.53
Trees - Severe Risk	60,481	5.9

Figure 17: Forest & Cropland with High and Severe Water Erosion Risk

It is important to note that this water erosion risk is based upon bare soil, management practices such as zero till, or conversion to permanent cover will significantly reduce the risk of erosion. The economics of reduced tillage and the changing demographics of producers may even further reduce the water erosion risk on cropland. Soaring commodity prices may encourage the clearing of forested areas for annual crop production. This will lead to short-term financial gain, but will decrease watershed health in the long-term. The LSRCD has identified 76,121 acres of forested areas with a high and severe water erosion risk, the LSRCD thinks these areas should remain in woodland cover.

Recommended Actions

- Adopt conservation tillage practices to protect the soil surface.
- Establish/maintain permanent cover - sensitive areas may be taken out of annual crop production for forage production, pasture production, or as a set aside for non-agricultural uses. It may be most beneficial to establish permanent cover on headlands or at points where soil and water are likely to exit the property.

Riparian Areas most at Risk of Soil Erosion[7]

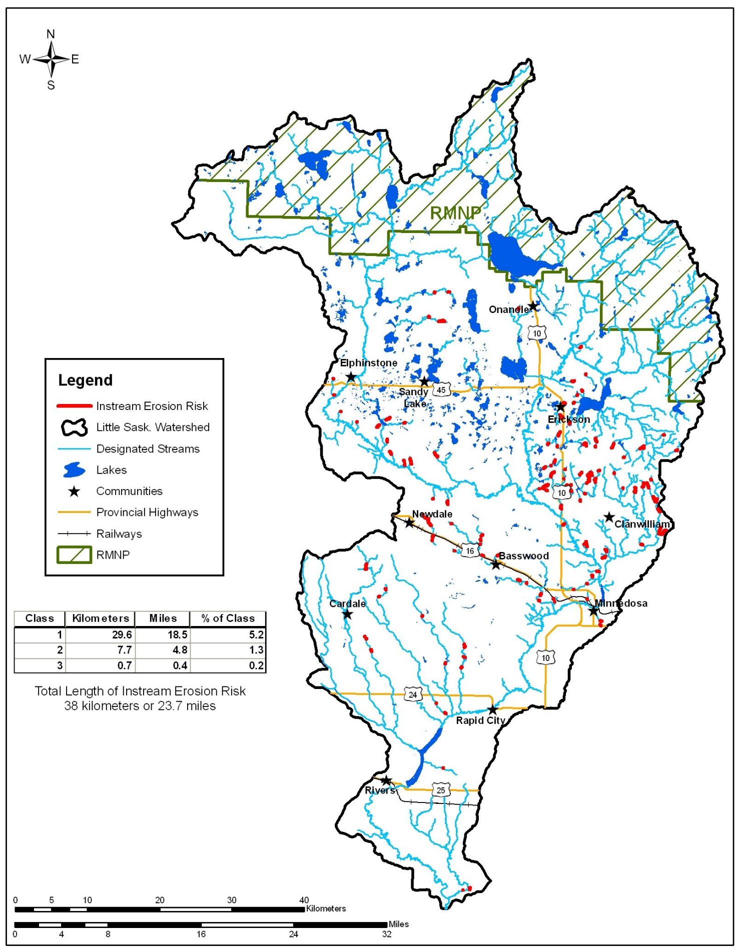
In our watershed, the vast majority of stream flow occurs during the spring freshet, and a large number of smaller streams are dry for the remainder of the year. This analysis captures the streams which are most at risk to in-stream erosion by highlighting streams which flow through cropland areas which are also subject to high/severe water erosion risk and do not have a riparian buffer in place.

Water laden with eroded soil or sediment has negative consequences for aquatic life and downstream infrastructure. Soil erosion will also contribute to nutrient loading in a watercourse. Currently there are approximately 24 miles of the waterways that have been identified as being at risk of in-stream erosion (Figure 18).

It should be noted that this analysis is a new approach to capture the convergence of land use, water erosion risk, streams, and riparian health; with the intent of identifying areas which most urgently require improvement to the riparian zone. These target areas were selected by first extracting the streams which flow through areas identified as "cropland" (initially using satellite imagery) and then further refined by selecting only stretches of streams that flow through areas identified as being at high or severe risk of water erosion. Finally, aerial photos were used to verify that the stream actually flowed through cropland and did not have any type of riparian buffer present. Since this is a new type of analysis, it should be utilized carefully and with adequate ground-truthing before making programming decisions.

Recommended Actions

- Ensure that all streams, including small intermittent streams, have sufficient vegetative cover in the waterways.
- Maintain and/or restore vegetated buffers that are appropriately sized according to the size of the stream.



Class	Kilometers	Miles	% of Class
1	29.6	18.5	5.2
2	7.7	4.8	1.3
3	0.7	0.4	0.2

Figure 18: Riparian areas most at risk of soil erosion

[7] This section ssubmitted by the Conservation District as a member of the Watershed Planning Advisory Team

Wind Erosion

Wind erosion is the removal of soil particles by wind; generally removing topsoil, the layer best fitted to support life. Evidence of wind erosion is visible during winter months when snow covers the ground and annual cropland is void of cover. Wind removes the snow from the hills and continues to remove the topsoil and deposits it in highway and road ditches. Wind erosion can also occur in the spring of the year, even in reduced tillage situations, when a seedbed is prepared prior to seeding and the wind removes the freshly tilled topsoil.

There are approximately 23,073 acres of cropland that fall in the high or severe wind erosion risk category. These are divided between the northern and southern areas of the watershed where sandy soils exist (Figure 19). It is important to note that this wind erosion risk is based upon bare soil, management practices such as zero till, or conversion to permanent cover will significantly reduce the risk of erosion.

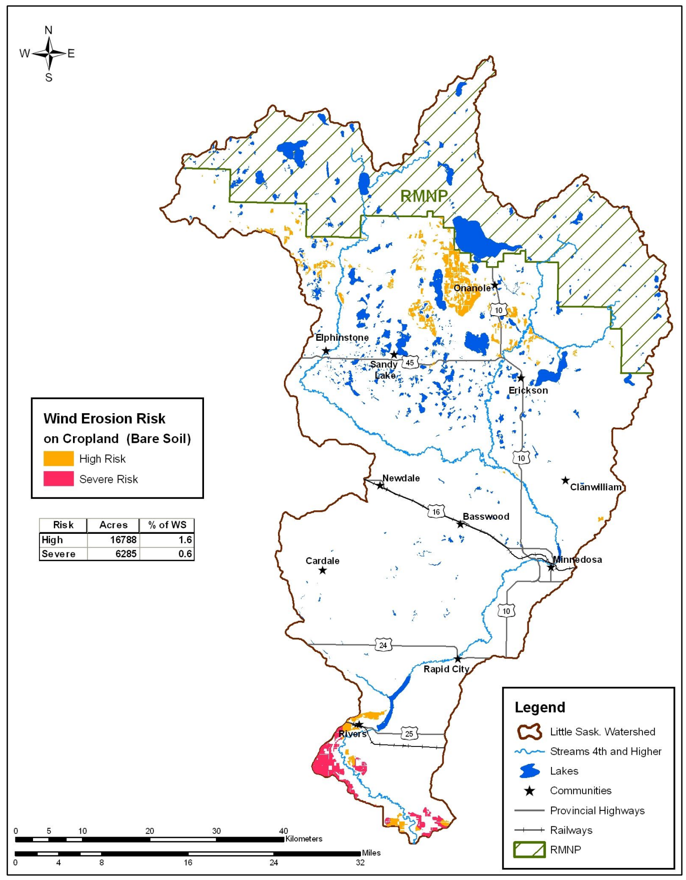


Figure 19: Cropland with High and Severe Wind Erosion Risk

Recommended Actions

- Maintain adequate crop residue cover (at least 35% cover just after seeding for most soils, and at least 65% cover for soils highly susceptible to erosion) – standing stubble is 1.6 times more effective at controlling wind erosion than flat stubble.
- Establish cover crops, such as fall rye. If it is not feasible to plant a cover crop on the entire field, plant on headlands (field perimeter), or on/beside the most susceptible areas.
- Establish shelterbelts to reduce wind erosion by reducing wind velocity in the area. Plant shelterbelts perpendicular to prevailing winds. If planting shelterbelts in the middle of a field is not feasible due to equipment access, consider planting shelterbelts on the north and west edges of the field perimeter to reduce the effects of prevailing winds.

Data Gap

- All maps are based upon reconnaissance level soil information published in the mid 1950s. Reconnaissance level data is not sufficient for site-specific analysis. When utilizing this existing data, ground-truthing is required before making programming decisions.

Summary of Resource Management Concerns & Recommended Actions

Water

1. Surface Water Management and Drainage

Water has largely been managed at an individual property scale, often without any form of comprehensive long-term planning in terms of the suitability of land for the intended use.

Recommended Actions

- Develop a surface water management plan through partnership with all stakeholders in the watershed.

2. Nutrient Enrichment

Nutrient enrichment is one of the most important water quality issues in Manitoba. Excessive levels of phosphorus and nitrogen fuel the production of algae and aquatic plants. Since the early 1970's, Lake Winnipeg phosphorus loading has increased by about 10% and nitrogen loading by about 13%. As part of the Lake Winnipeg Action Plan, the Province of Manitoba is committed to reducing nutrient loading to Lake Winnipeg to those levels that existed prior to the 1970s.

Recommended Actions

- There should be no net-loss of semi-permanent sloughs, wetlands, potholes, or other similar bodies of water in the watershed within which drainage is occurring. Wetlands act as nutrient sinks and help reduce nutrient input to waterways.
- Ensure that drainage maintenance, construction, and re-construction occurs in an environmentally friendly manner, following best available technologies, and best management practices (BMPs) aimed at reducing impacts to water quality and fish habitat. Some key BMPs for drainage include:
    - Surface drainage should be constructed as shallow depressions and removal of vegetation and soil should be minimized during construction.
    - Based on Canada Land Inventory Soil Capability Classification for Agriculture, Class six and seven soils should not be drained.
    - Removal of vegetation and soil should be kept to a minimum during the construction and placement of culverts.
    - Exposed areas along banks of surface drainage channels should be re-vegetated.
    - Erosion control methodologies outlined in the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat should be used where the surface drain intersects with another water body and on both sides of culverts.

    - Discharge from tile drainage should enter a holding pond or wetland prior to discharging into a drain, creek, or river.
- Maintain healthy, natural riparian vegetated buffers along waterways. A strip of vegetation one to three metres wide should be maintained along drainage channels as a buffer. This will reduce erosion of channels and aid in nutrient removal.
- As proposed in the Nutrient Management Regulation under *The Water Protection Act*, no nutrients can be applied to lands that are designated as zone N4 for nutrients or in nutrient buffer zones as defined in the Regulation.

Ground Water

3. Data Gaps

Current lack of data regarding the location of wells (active or abandoned), contribution of groundwater to stream base-flow, aquifer delineation, and groundwater quality pose challenges in the understanding and management of groundwater.

Recommended Actions/Actions Currently Underway

- A well inventory for the watershed should be completed. It should include GPS coordinates, information on well construction and water quality.
- Comprehensive groundwater chemistry should be completed on wells selected during the well inventorying process.
- The Groundwater Management Section is committed to completing new set of digital maps based on the watershed scale.
- The Groundwater Management Section is currently evaluating the provincial monitoring well network to determine where there are redundancies or areas that could benefit from new or additional monitoring locations. This watershed will be included in that evaluation.

4. Wellhead Protection

Well location, construction, and maintenance are important factors in man-made water quality problems; there are local impacts commonly measured in well water throughout the province.

Recommended Actions

- Owners of private wells should be encouraged to self-assess or have their well assessed for physical conditions that may affect water quality such as poor wellhead conditions, well construction, location or maintenance.
- Water testing should be encouraged for all drinking water sources on a regular basis.
- Well specific assessments should be conducted on community or municipal wells to determine the vulnerability during the development of well head protection policies. As a minimum the individual characteristics of each well, aquifer and geology should be considered to assess vulnerability.

5. Abandoned Wells

Wells have often been located in areas of convenience, often in the same general areas as potential contamination sources. Neglected, abandoned, or unused wells can act as a direct conduit for contaminants from the surface to our enter aquifers.

Recommended Action

- Abandoned wells should be sealed to lessen the potential spread of contaminants to an aquifer.

6. Sustainable Groundwater Development

Sustainable yield values have not been determined for aquifers in the watershed. Therefore, the amount that can be withdrawn from the aquifers without depleting them over time is unknown.

Recommended Action

- Assess all high use groundwater withdrawals on an individual project basis.

Source Water Protection

7. Drinking Waters Exceeding the Guidelines for Canadian Drinking Water Quality

Initial data collection indicates that Rivers and Rapid City may exceed the acceptable levels of trihalomethanes. Further sampling will be required to assess these levels.

Recommended Actions

- Rivers and Rapid City must continue to sample for trihalomethanes to establish an annual average.
- Removal of organic material in the source water is the best method of reducing THM levels in the drinking water.

8. Drinking Water Susceptibility

There are ten drinking water sources in the watershed: Minnedosa (3), Otter Lake, Rapid City (3), Rivers, Rivers Provincial Park, and Sportsman's Park that have been identified as being highly susceptible to potential pollution.

Recommended Actions

- Conduct a detailed assessment for the ten high risk water sources.
- Manage or mitigate the potential pollutant sources for each water source.
- Obtain more detailed data on the identified potential pollutant sources.

Habitat

9. Habitat Loss, Degradation, and Fragmentation

Habitat loss continues at a rate greater than preservation and restoration efforts.

Recommended Action

- Preserve and restore native habitats throughout the watershed. Priority should be given to key fish, waterfowl, and wildlife habitats, as well as those habitats that support rare, threatened, and endangered species.
- Efforts should be made to ensure that corridors are available and that habitat is not preserved in isolated blocks.
- Create a fair trade market for landowners who wish to receive market value for the ecological goods and services they provide.

10. Loss and draining of wetlands

Draining wetlands has ecological impacts. Uncoordinated drainage activities have negative impacts to wildlife habitat, water quality and quantity.

Recommended Action

- Adopt a no net-loss of wetlands policy in the watershed – A majority of the naturally occurring wetlands in our watershed have already been lost and existing wetlands continue to see losses due to drainage and in-filling. Preventing further loss of wetlands is important to maintain ecological and hydrological function in the watershed.

11. Riparian Management

Riparian areas are being lost through encroachment by human activity.

Recommended Actions

- Conduct a watershed-wide riparian assessment, to identify areas in need of restoration or management. Priorities should be given to source water areas, important recreational water bodies, and key fish habitat.
- Establish, maintain, or improve vegetative cover in riparian areas. Priority should be given to source waters, key fish, waterfowl, and wildlife areas, areas which support rare, threatened, and endangered species, as well as areas identified in the riparian impact assessment study outlined above.

12. Aquatic Ecosystem Health

There is concern that natural and human induced changes to the quantity and timing of water flow are altering and impairing the health and sustainability of aquatic and riparian ecosystems. Specifically, some of the streams in our watershed are suffering from periods of low water flow which fall below the historical flows for the stream at specific times of year.

Recommended Action

- In-stream flow needs assessments should be done on all major watercourses in the watershed – the Little Saskatchewan River assessment is currently in progress and the Rolling River is also a priority stream. These assessments should go beyond providing single annual targets for in-stream flow needs and instead provide targets on a seasonal or monthly basis so that use of the water resources can more closely mimic a natural system.

Soils

13. Soil Salinity

74,841 acres of cropland are currently in moderately saline to saline prone areas. Salinity is a limitation to plant growth.

Recommended Actions

- Convert of saline areas to permanent cover.
- Use saline tolerant species that will gradually reduce salt levels in soil in identified saline areas.
- Offer incentive type programs that reduce drainage of the prairie potholes, encourage the development of buffer establishment around wetlands, and maintain wetland complexes.
- Promote adoption of zero-till or conservation tillage practices.

14. Water Erosion

Approximately 186,743 acres of cropland in the watershed is classified as having a high to severe water erosion risk. Water erosion removes the top soil layer, which supports vegetative growth. Another 76,121 acres of forested land in the watershed is classified as having a high to severe water erosion risk. Removal of forest vegetation affects precipitation runoff.

Recommended Actions

- Adopt conservation tillage practices to protect the soil surface.
- Convert and/or maintain areas with high and severe risk to permanent cover, pasture or set aside for non-agricultural use.

15. Riparian Areas Most at Risk of Soil Erosion

Approximately 24 miles of waterways in the watershed were found to have no riparian buffer and pass through cropland subject to high or severe water erosion risk. Although this analysis is based on reconnaissance level data, these areas should be targeted for further investigation and erosion control measures where appropriate.

Recommended Actions

- Establish grassed runways
- Manage riparian areas to minimize erosion.

16. Wind Erosion

Approximately 23,000 acres of cropland are in areas of high or severe wind erosion risk. The removal of topsoil reduces the soils ability to support vegetative growth.

Recommended Actions

- Maintain adequate crop residue cover.
- Establish cover crops.
- Establish shelterbelts.