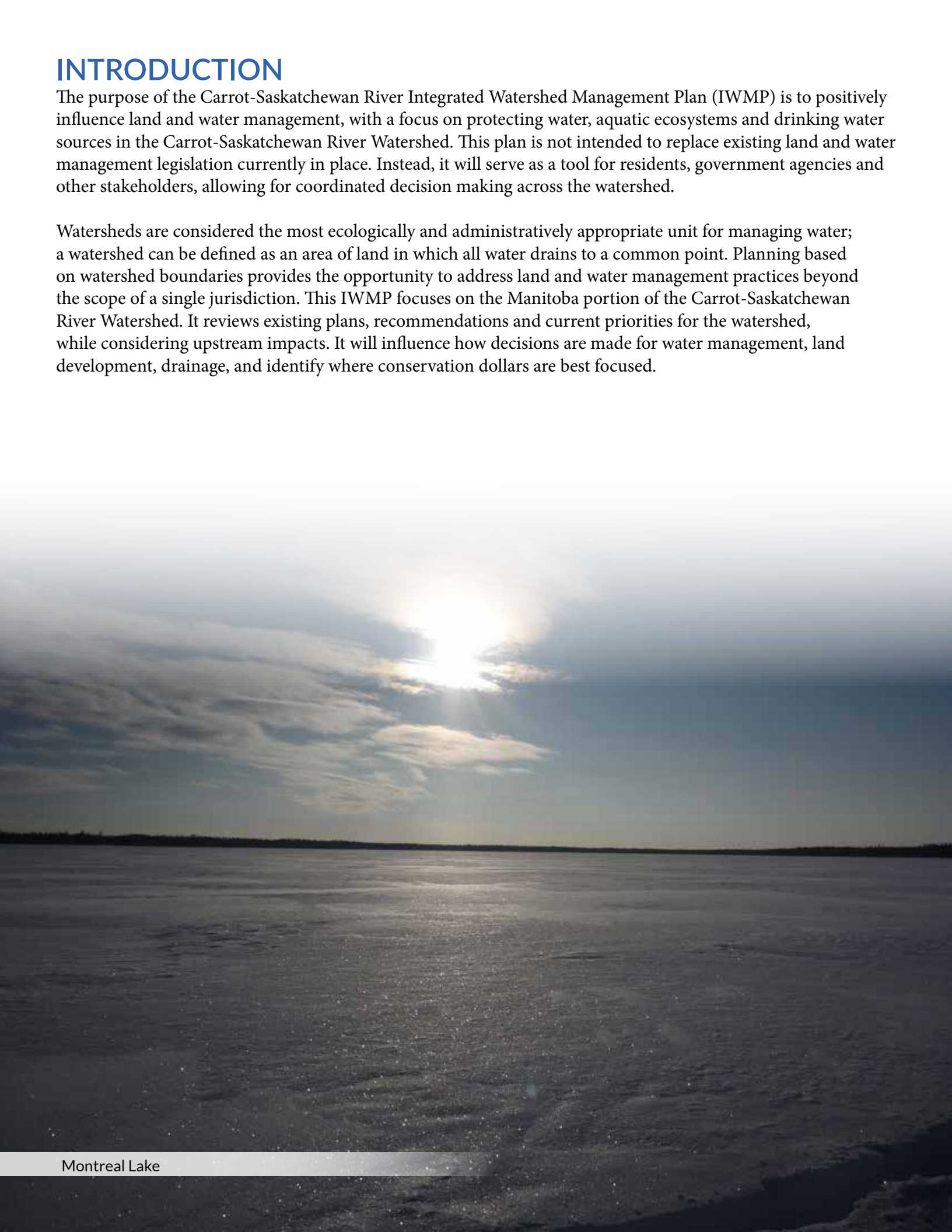
Carrot - Saskatchewan River

Integrated Watershed Management Plan

INTRODUCTION

The purpose of the Carrot-Saskatchewan River Integrated Watershed Management Plan (IWMP) is to positively influence land and water management, with a focus on protecting water, aquatic ecosystems and drinking water sources in the Carrot-Saskatchewan River Watershed. This plan is not intended to replace existing land and water management legislation currently in place. Instead, it will serve as a tool for residents, government agencies and other stakeholders, allowing for coordinated decision making across the watershed.

Watersheds are considered the most ecologically and administratively appropriate unit for managing water; a watershed can be defined as an area of land in which all water drains to a common point. Planning based on watershed boundaries provides the opportunity to address land and water management practices beyond the scope of a single jurisdiction. This IWMP focuses on the Manitoba portion of the Carrot-Saskatchewan River Watershed. It reviews existing plans, recommendations and current priorities for the watershed, while considering upstream impacts. It will influence how decisions are made for water management, land development, drainage, and identify where conservation dollars are best focused.



Montreal Lake

TABLE OF CONTENTS

KEY PLAYERS

Watershed residents, community leaders, and technical experts were invited to provide input and guidance in developing this plan.

Watershed residents are the most important group of individuals in the creation and implementation of the plan. The Carrot-Saskatchewan River IWMP is a reflection of collective local knowledge, values, and concerns of watershed residents.

The **Water Planning Authority (WPA)** is designated under the *Water Protection Act* with the responsibility of developing an integrated watershed management plan. Through a Memorandum of Understanding the Province of Manitoba designated the Kelsey Conservation District as the Water Planning Authority for the Carrot-Saskatchewan River Watershed.

The **Project Management Team (PMT)** is the key decision maker during the development of the IWMP. The PMT met regularly through development of the plan, developed communication materials, hosted public and stakeholder meetings, and finalized content of the watershed plan.

Project Management Team

Vincent Anderson, PMT Chair	Manitoba Infrastructure and Transportation
Paul Chapman, PMT Vice Chair	Tolko Industries Ltd.
Jerry Hlady	RM of Kelsey
Chris McTaggart	Town of The Pas
Diane Ballantyne	Opaskwayak Cree Nation Natural Resources
Shaun Greer	Ducks Unlimited Canada
Marnie McCracken	Manitoba Agriculture, Food and Rural Development
Jarret Berezowecki	Kelsey Conservation District
Debbie McLauchlan	Kelsey Conservation District
Ron Campbell	Manitoba Conservation and Water Stewardship
Mike Armstrong	Manitoba Conservation and Water Stewardship
Shawn Sexsmith	Kelsey Conservation District
Sharla Dillabough	Manitoba Conservation and Water Stewardship

The **Watershed Team** consists of community representatives and technical experts from stakeholder groups and government. The role of the Watershed Team is to provide technical knowledge and guidance to support direction and decisions throughout plan development.

Local **Aboriginal** people have been involved throughout development of this IWMP. Aboriginal representatives have provided valuable insight, traditional knowledge and a local perspective to support key actions and values in this plan.

Summerberry Marshes

PLAN AT A GLANCE

The Carrot-Saskatchewan River Integrated Watershed Management Plan was developed as a partnership between Kelsey Conservation District, Manitoba Conservation and Water Stewardship, Aboriginal communities, local government, community stakeholders and watershed residents.

Each stakeholder in the watershed has a role in ensuring this plan is successfully adopted and implemented. Key recommendations and actions were developed to address local concerns and values of the watershed and, a summary of some of the key actions is listed in Figure 1.

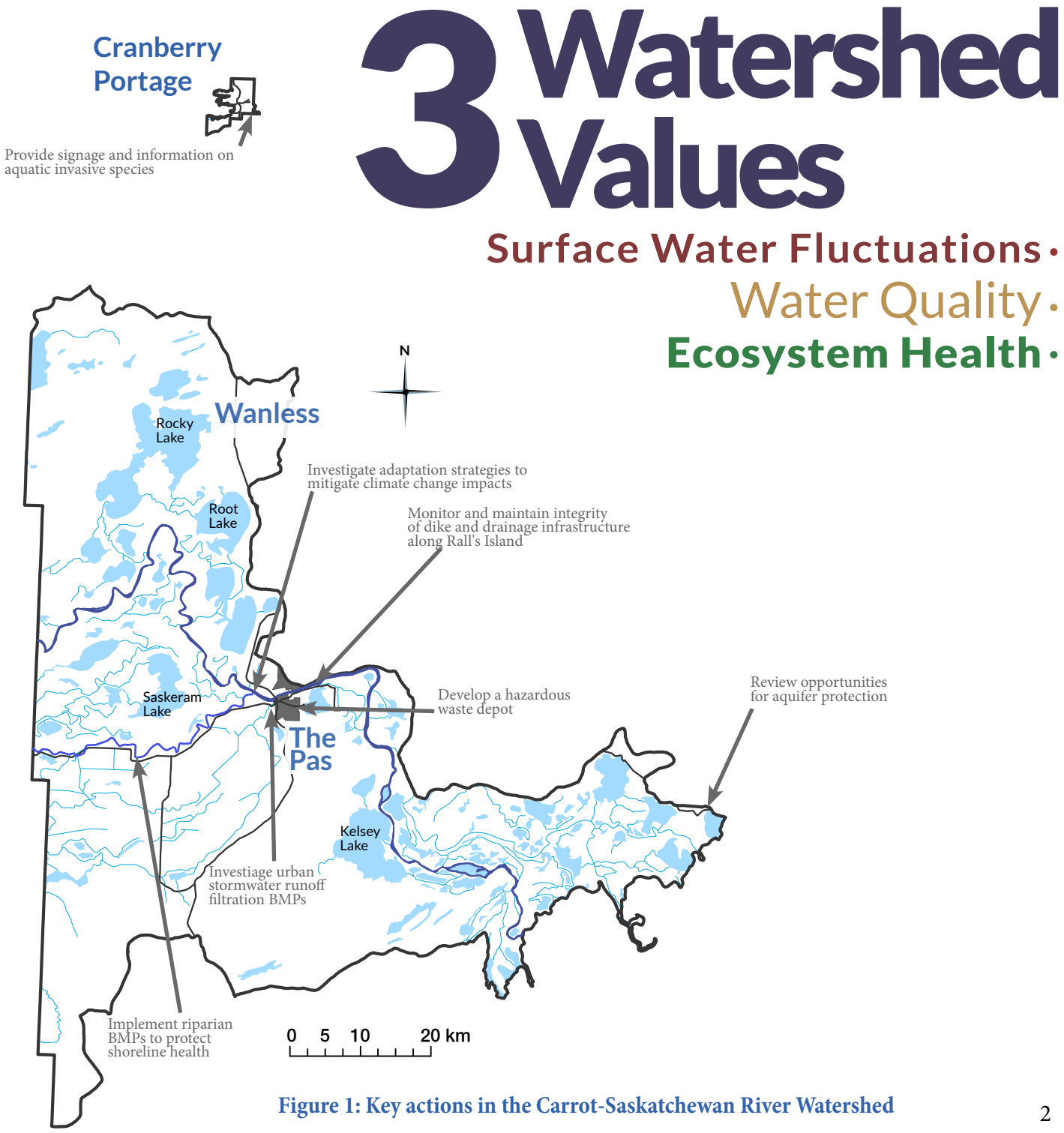


Figure 1: Key actions in the Carrot-Saskatchewan River Watershed

THE CARROT – SASKATCHEWAN RIVER WATERSHED

The Carrot- Saskatchewan River Watershed (Figure 2) covers 4,821 km^2 and is home to 11,000 people. This watershed is dominated by boreal forest, lakes, rivers, streams, bogs and marshes. It is part of the larger Saskatchewan River Basin (Figure 3, page 4), originating in the Rocky Mountains of Alberta and Montana, and extending across three provinces to Lake Winnipeg in Manitoba. The Saskatchewan River begins in Alberta and travels 1,940 km east where it enters Lake Winnipeg at Grand Rapids. From its tributaries the river drains an area of 340,000 km^2.

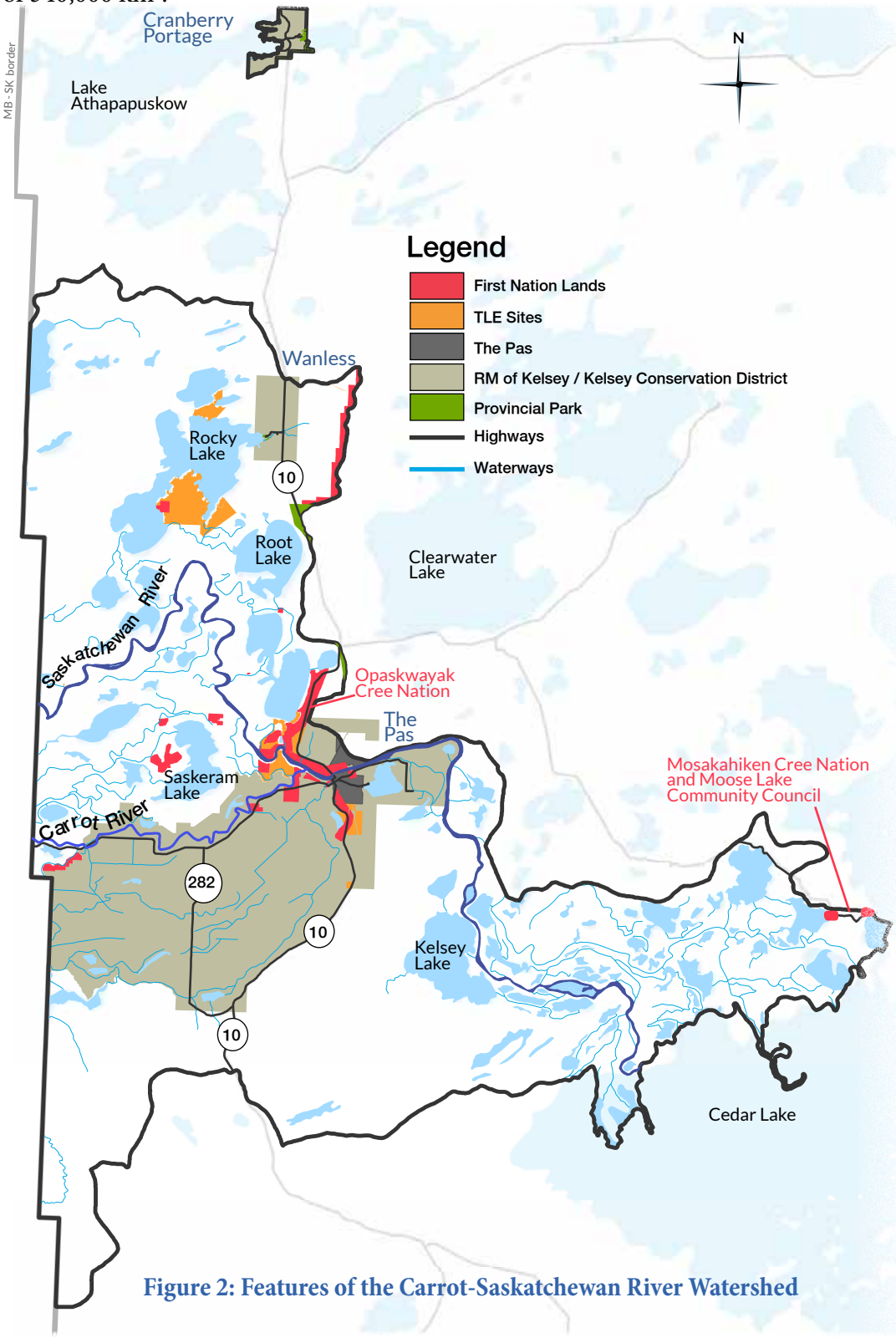


Figure 2: Features of the Carrot-Saskatchewan River Watershed

In the watershed, surface water generally flows in an eastward direction through two main rivers, the Carrot and the Saskatchewan Rivers. The Saskatchewan River travels through very flat topography and has changed its path a number of times, a process called avulsion. Locally, the Carrot River is the most significant tributary to the Saskatchewan River, and joins the Saskatchewan River near The Pas. The watershed is home to numerous lakes and wetlands - the largest lakes being Saskeram Lake, Rocky Lake, Root Lake and Kelsey Lake.

Although not part of the watershed, this IWMP includes the area surrounding Cranberry Portage, which rests along the eastern edge of Lake Athapapuskow. This area has been included because it is part of the Rural Municipality (RM) of Kelsey and Kelsey Conservation District. The conservation district has identified targeted incentive programming in this area to include as part of the IWMP.

The Carrot-Saskatchewan River Watershed is characterized by:

- Boreal forest with numerous lakes and wetlands
- Very flat topography
- Rich biological diversity, particularly in the Saskatchewan River Delta
- Intensive agricultural production in the Carrot Valley, supported by highly modified surface water flows
- Hydroelectric development located upstream and downstream of the watershed

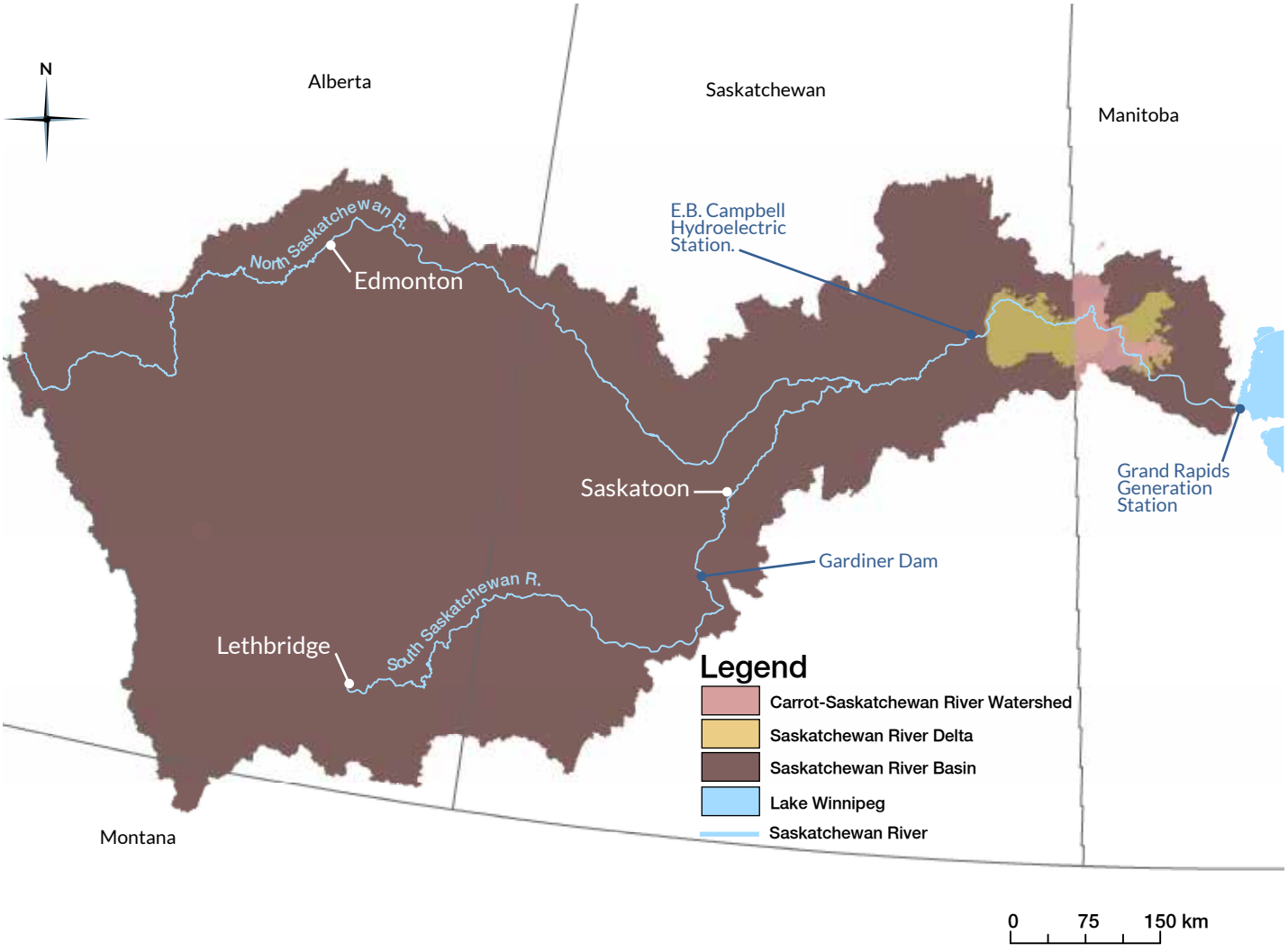


Figure 3: The Carrot-Saskatchewan River Watershed within the Saskatchewan River Basin

This is our watershed

The Saskatchewan River is the fourth largest river in Canada, and derives its name from the First Nation word *Kisiskatchewan*, meaning "swift current" (The State of the Saskatchewan River Basin, 2009).

WATER-RELATED PLANNING EFFORTS

In the Saskatchewan River Basin there have been a number of water-related planning initiatives completed,with two closely related planning efforts referenced specifically in developing the Carrot-Saskatchewan River IWMP. These include the Carrot River Watershed Source Water Protection Plan, and the Kelsey Conservation District Five Year Management Plan and Ten Year Vision. These linkages consider planning efforts upstream and allow for a coordinated effort in implementing watershed priorities across jurisdictional boundaries.

Linkages Upstream in the Province of Saskatchewan

The Carrot River Valley Watershed Association is located directly upstream of the IWMP area in Saskatchewan (Figure 4) and has published a source water protection plan outlining planning recommendations and actions for the upstream portion of the watershed. These recommendations include groundwater protection, wetland and riparian protection, water management and conservation, education, and communication initiatives. This indicates that similar planning goals have been identified in both the Manitoba and Saskatchewan portions of the Carrot River Watershed. Related planning goals recognizes the cross-jurisdictional movement of this river across the Saskatchewan to Manitoba; indicating that similar concerns and issues are likely present on both sides of the provincial border when considering the Carrot River. Watershed planning objectives identified by the Carrot River Valley Watershed Association and the Kelsey Conservation District include: implementation of beneficial management practices to improve soil and water health, identification of sensitive riparian habitat for livestock exclusion programming, a mandate to increase watershed awareness, and a desire to protect water quality along the Carrot River.

Linkages to the Carrot River Watershed Source Water Protection Plan have been discussed through the Carrot-Saskatchewan River IWMP planning process. Efforts to increase regular communication across the Manitoba-Saskatchewan border have been part of this planning process, and representatives from the Carrot River Valley Watershed Association have provided information for and reviewed actions of this IWMP.

To ensure water resources are shared fairly, the Provinces of Alberta, Saskatchewan, and Manitoba and the Government of Canada created the Prairie Province Water Board in 1948. In 1969, the four governments signed the Master Agreement on Apportionment. This Agreement established an intergovernmental framework to manage transboundary waters equitably, protect surface water and groundwater quality for the three prairie provinces.

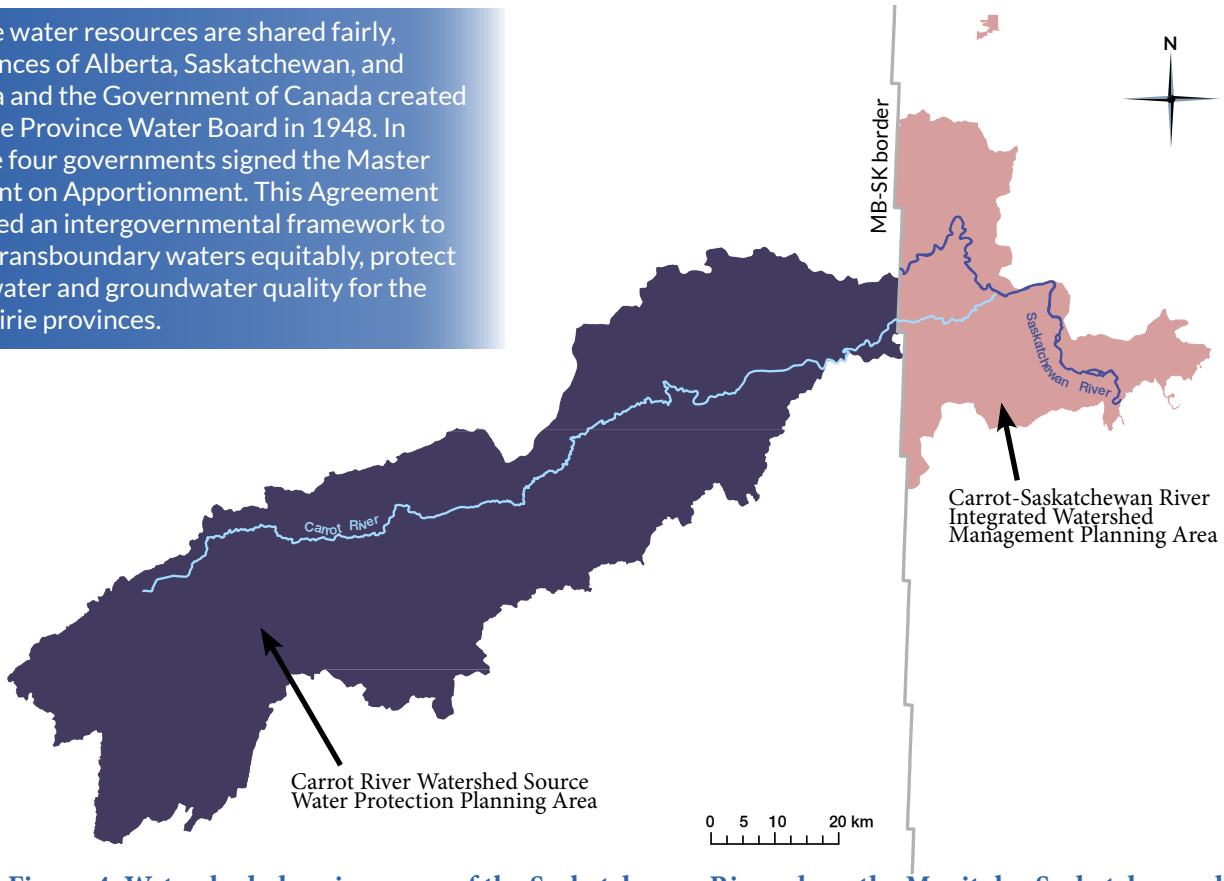


Figure 4: Watershed planning areas of the Saskatchewan River along the Manitoba-Saskatchewan border

Local Conservation Programming - Kelsey Conservation District

The Carrot-Saskatchewan River IWMP encompasses all of Kelsey Conservation District (KCD), a non-profit organization governed by a local board and funded through a provincial-municipal partnership. The district has a mandate to address watershed issues and offers incentive-based programming to improve soil and water quality, aquatic and riparian health, and provide educational programming. The primary mandate of the KCD will be to carry out and coordinate implementation of the actions within this plan.

In 2005 the KCD prepared a conservation management plan, *Practical and Sustainable Watershed Management – Five Year Management Plan and Ten Year Vision*. The plan focused on the following key areas:

Water

- Seal abandoned wells.
- Protect riparian areas and restrict livestock access to waterways.
- Address erosion issues along shorelines.

Tourism

- Review tourism potential and promote eco-tourism activities.

Public Education

- Host educational tours.
- Implement a watershed conservation curriculum.

Soils

- Identify severely saline sensitive areas and offer incentive programming for permanent cover.
- Plant shelterbelts.
- Implement soil testing incentives.

Fish and Wildlife

- Maintain or improve fish stock levels.
- Increase bird nesting opportunities with nesting boxes.

SUMMARY OF ACTIONS COMPLETED TO DATE

- The Pasquia River is now completely protected from livestock access through exclusion fencing and alternative water source programming. Approximately half of the Carrot River and the Birch River are restricted from direct livestock access.
- Due to soil testing incentives, many producers now conduct regular sampling on their farms at their own cost.
- All known abandoned wells have been sealed.
- Extended grazing practices have been implemented through swath or bale grazing beneficial management practices.
- Manure spreading options have been offered to producers to improve manure management practices.
- Historic manure piles have been removed from riparian areas along the Carrot River to reduce nutrient loading.

Solar powered alternate watering source project for cattle along the Carrot River

ABORIGINAL COMMUNITIES OF THE WATERSHED

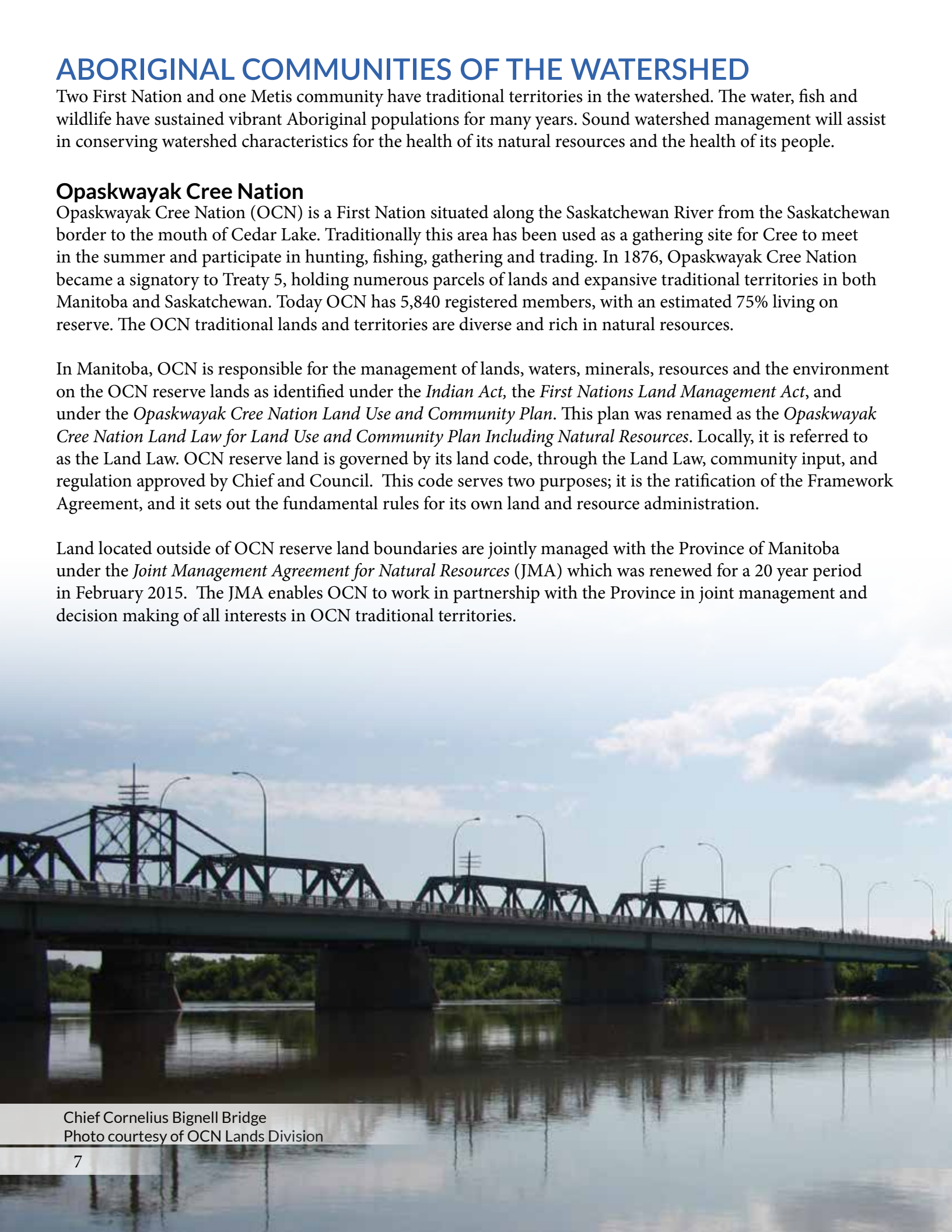
Two First Nation and one Metis community have traditional territories in the watershed. The water, fish and wildlife have sustained vibrant Aboriginal populations for many years. Sound watershed management will assist in conserving watershed characteristics for the health of its natural resources and the health of its people.

Opaskwayak Cree Nation

Opaskwayak Cree Nation (OCN) is a First Nation situated along the Saskatchewan River from the Saskatchewan border to the mouth of Cedar Lake. Traditionally this area has been used as a gathering site for Cree to meet in the summer and participate in hunting, fishing, gathering and trading. In 1876, Opaskwayak Cree Nation became a signatory to Treaty 5, holding numerous parcels of lands and expansive traditional territories in both Manitoba and Saskatchewan. Today OCN has 5,840 registered members, with an estimated 75% living on reserve. The OCN traditional lands and territories are diverse and rich in natural resources.

In Manitoba, OCN is responsible for the management of lands, waters, minerals, resources and the environment on the OCN reserve lands as identified under the *Indian Act,* the *First Nations Land Management Act*, and under the *Opaskwayak Cree Nation Land Use and Community Plan*. This plan was renamed as the *Opaskwayak Cree Nation Land Law for Land Use and Community Plan Including Natural Resources*. Locally, it is referred to as the Land Law. OCN reserve land is governed by its land code, through the Land Law, community input, and regulation approved by Chief and Council. This code serves two purposes; it is the ratification of the Framework Agreement, and it sets out the fundamental rules for its own land and resource administration.

Land located outside of OCN reserve land boundaries are jointly managed with the Province of Manitoba under the *Joint Management Agreement for Natural Resources* (JMA) which was renewed for a 20 year period in February 2015. The JMA enables OCN to work in partnership with the Province in joint management and decision making of all interests in OCN traditional territories.



Chief Cornelius Bignell Bridge
Photo courtesy of OCN Lands Division

Moose Lake

Moose Lake is located at the eastern edge of the watershed, along the northern edge of the Saskatchewan River Delta. It is home to two closely related communities known as Mosakahiken Cree Nation and the Northern Affairs community of Moose Lake. The communities are located on the southwest shore of Moose Lake, approximately 75 km east of The Pas. The Saskatchewan River Delta and adjoining lakes provide excellent habitat for fish and wildlife production. Presently the most notable economic activity has been through logging and commercial fishing.

Changes To Our Waterways

Land use and occupancy is located throughout the Saskatchewan River Delta and within the traditional territories. Traditional territories encompass various communities along the Saskatchewan River. The Delta and waterways provide valuable resources for fishing, hunting, trapping, and medicinal harvesting. More recently, these communities have been affected by influences of hydroelectric development. The E.B Campbell Hydroelectric Station upstream and the Grand Rapids Generating Station downstream have altered the local water regime, changing the natural flows through the Saskatchewan River Delta. This has created many challenges for the Delta and the people locally as a result of sedimentation, nutrient loading, erosion and habitat alteration.

Looking Forward

Aboriginal people throughout the watershed believe that an integrated watershed management plan is important to engage and fully inform those with an interest in the Carrot and Saskatchewan Rivers, and their tributaries. Integrated approaches foster information sharing, informed decision making and offer opportunity for the sustainable management of all land and water resources within the watershed, including reserve lands and traditional territories.

This IWMP engaged Aboriginal people in the project management and watershed team, at public meetings, and through traditional knowledge Elder interviews. A strong Aboriginal partnership throughout the development of the plan has been critical in identifying all aspects of this plan, leading to stronger and more effective actions to protect the watershed.

A traditional view of the watershed

The Saskatchewan River is one of the main waterways for Aboriginal people in this area and as such holds an important place in their traditional way of life. Aboriginal people of the watershed value water as it provides the source of all life and is critical for continuing local traditional practices. Historical knowledge passed down through Elders emphasizes the need to protect water quality as a source for clean drinking water, plentiful fishing resources, and other cultural and traditional uses.

Aboriginal people have fished and travelled the Saskatchewan River and its tributaries for many years. Elders cite concerns today of decreased natural flows due to dam development holding water and diminishing recharge, specifically in the Saskeram area. Disrupted natural flows can accelerate erosion and sedimentation, impacting fish habitat and spawning opportunities. Concerns are that fish populations may be further impacted if measures are not taken to maintain appropriate aquatic habitat in these areas.

Elders have fond memories of growing up along the Saskatchewan River; here they caught many species of fish, and drank water directly from local springs and the river. They remember using the ice beneath the muskeg into the late summer months as natural refrigerators. The Saskatchewan River and surrounding area is part of their traditional territory and they wish to preserve it for their children and future generations.

A MODIFIED WATERSHED

Portions of the Carrot-Saskatchewan River Watershed have been modified significantly since the 1960s. The area to the west of The Pas, known as the Carrot Valley, has been modified extensively through an intensive diking and pumping system that has changed the local flow regime. This area has largely been maintained for intensive, localized agricultural production.

The Pasquia Land Settlement Project

In the 1920s small family farms began to appear on both sides of the Carrot River and by the 1930s the majority of farm settlements were located west of The Pas. A veteran's resettlement package following the Second World War introduced a number of additional farmers to the area, specifically in the Carrot Valley. In 1948 a floodwater event covered most of these agricultural lands. The impacted area was surveyed by the former Prairie Farm Rehabilitation Administration (PFRA), resulting in the Canada-Manitoba Agreement of 1953. This Agreement authorized the engineering and construction of dikes, canals and water retention structures. In the 1960s the Province of Manitoba introduced the Pasquia Project, which included diversion of the Pasquia River into the Carrot River, construction of additional drainage canals and two pumping stations. The majority of present agricultural land in the watershed is in fact reclaimed marshland which was de-watered by the Pasquia Project.

For surface water management purposes, the area of the Pasquia Land Settlement Project was split into four polders. The term *polder* is adapted from the Netherlands and means an area of land reclaimed from water and protected by dikes. Plans were developed for dike construction and interior drainage to expand agricultural activities and protect existing agricultural lands. The original system was designed as a gravity flow system, but this was later revised following hydro dam construction in the 1960s. A pumping system was designed to accomodate the changes in hydrology from construction of the Grand Rapids Generating Station. This pumping system is now operated by Manitoba Infrastructure and Transportation (MIT), in conjunction with the Rural Municipality (RM) of Kelsey and local surface water management committees.

This is our *watershed*

Manitoba Infrastructure and Transportation operates five pumping stations in the polders. Since 1987, the annual average of pump operation has been 4,743 hours. In some years the pumps require minimal use, and in 1989 they were not turned on at all. However, in other years they have been used almost continually. In 2011 record precipitation and resulting flows required near continual pump use. Overall pumping costs amounted to $670,000 that year.

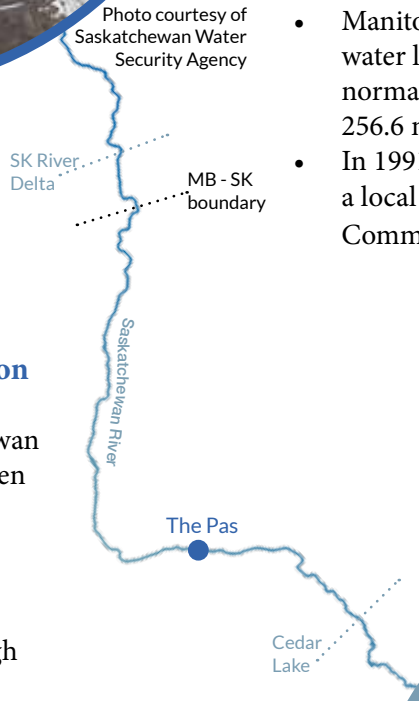
Along the Saskatchewan River, two large hydroelectric power dams impact water levels and flow within the watershed. The E.B. Campbell Hydroelectric Station is located upstream of the watershed in Saskatchewan, and the Grand Rapids Generating Station is located downstream of the watershed along the edge of Lake Winnipeg in Manitoba.

Photo courtesy of Saskatchewan Water Security Agency

DOWNSTREAM

Grand Rapids Generating Station

- Construction of the generating station began in 1960 and was completed in 1968. The station is owned and operated by Manitoba Hydro.
- The station has four turbine generators, eight intake gates and four spillway gates. The overall capacity is 479 MegaWatt (MW). Transmission lines run from the generating station to Thompson, The Pas, Dauphin and Winnipeg.
- Capacity of the generating station and the volume of storage in Cedar Lake is relatively large in relation to the average inflow to Cedar Lake. This means the station operates at high generation and discharge levels during the daytime peak load hours, and at low generation and discharge levels overnight.
- Cedar Lake storage and Grand Rapids generation are primarily used during high load periods of the winter and summer months.
- Manitoba Hydro provides information on forecasted water levels for Cedar Lake online monthly. The normal operating range for Cedar Lake is 253.0 m – 256.6 m.
- In 1991 OCN and Manitoba Hydro implemented a local Water Regime Review and Consultation Committee.



UPSTREAM

E.B. Campbell Hydroelectric Station

- The E.B. Campbell Hydroelectric Station is located on the Saskatchewan River near Nipawin, SK and has been in operation since 1963.
- It is owned by SaskPower and is the largest hydroelectric station in Saskatchewan. Water flow rates are recorded at 400 m^3 / second through its eight turbines.
- Water height levels are between 313.6 m - 311.5 m on Tobin Lake, the reservoir created by the dam.
- Stream flow and water level data is collected and posted online through the Saskatchewan Water Security Agency.

Photo courtesy of Manitoba Hydro

TOPOGRAPHY

The Carrot-Saskatchewan River Watershed encompasses a diverse landscape. It includes part of the Manitoba Lowlands natural region to the south, and Canadian Shield natural regions to the north at Cranberry Portage. The watershed experiences relatively little slope, particularly in the Carrot Valley and the Summerberry Marshes. Smaller pockets of elevation are seen in rolling hills north of the Carrot Valley and in the Pasquia Hills along the Manitoba-Saskatchewan boundary. Overall, elevations of the Carrot Valley exhibit very little relief; elevations reach 262 meters above sea level (masl) along the Saskatchewan boundary and 260 masl closer to The Pas. As the area surrounding The Pas slopes very gently, any amount of overland flow may travel a significant distance.

HYDROLOGY

Generally, water flows in an eastern and south-eastern direction in the watershed along the two main waterways; the Carrot and the Saskatchewan Rivers. These rivers flow east from the Saskatchewan border towards The Pas where they meet and continue east towards Cedar Lake as the Saskatchewan River. Near Cedar Lake the Saskatchewan River divides, flowing through the Summerberry marshes as the Summerberry and Saskatchewan Rivers. To the north, the Cranberry Portage portion of the watershed lies along the eastern edge of Athapapuskow Lake.

Hydrometric data provides information on the availability, variability and distribution of water resources. Stream flow and level data has been recorded since 1910 in the watershed and is used to support water rights licensing, water management activities, water quality modelling, ecosystem protection and operation of water control works. There are 10 stations with recorded stream flow and level data (Figure 5). Archived and real time data is available online through Environment Canada.

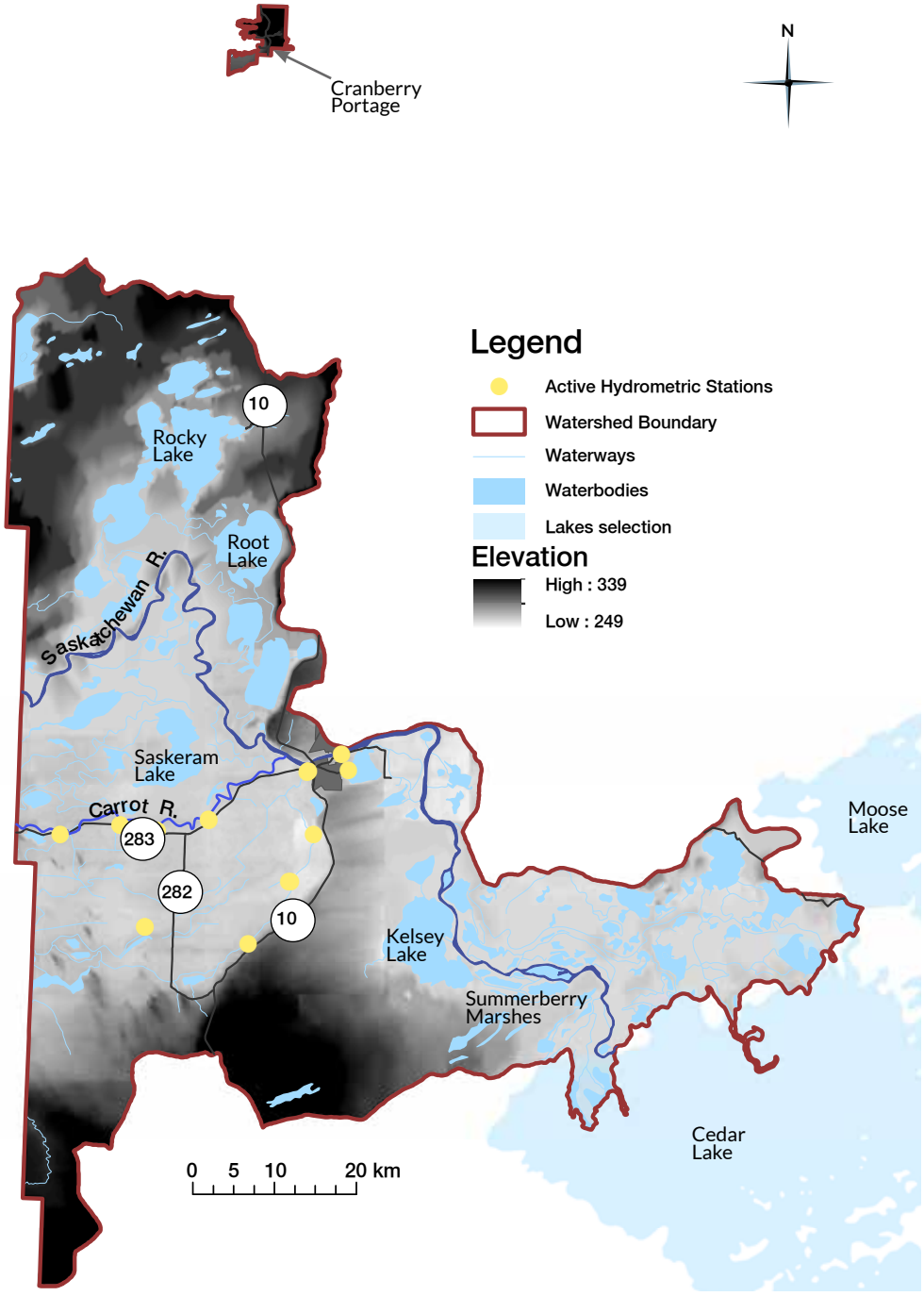


Figure 5: Hydrometric stations and waterways of the Carrot- Saskatchewan River Watershed

The Carrot and the Saskatchewan Rivers have been impacted by surface water management upstream that has altered flows and timing of spring runoff periods. Due to dam locations upstream, flows on the Carrot River are less impacted. Historical data from the monitoring station at Turnberry, SK illustrates sharp peak flows in early May on the Carrot River (Figure 6). During this time snowmelt and early spring rains transport water through the river and its tributaries while the watershed is still fairly saturated, resulting in fairly significant spring flows.

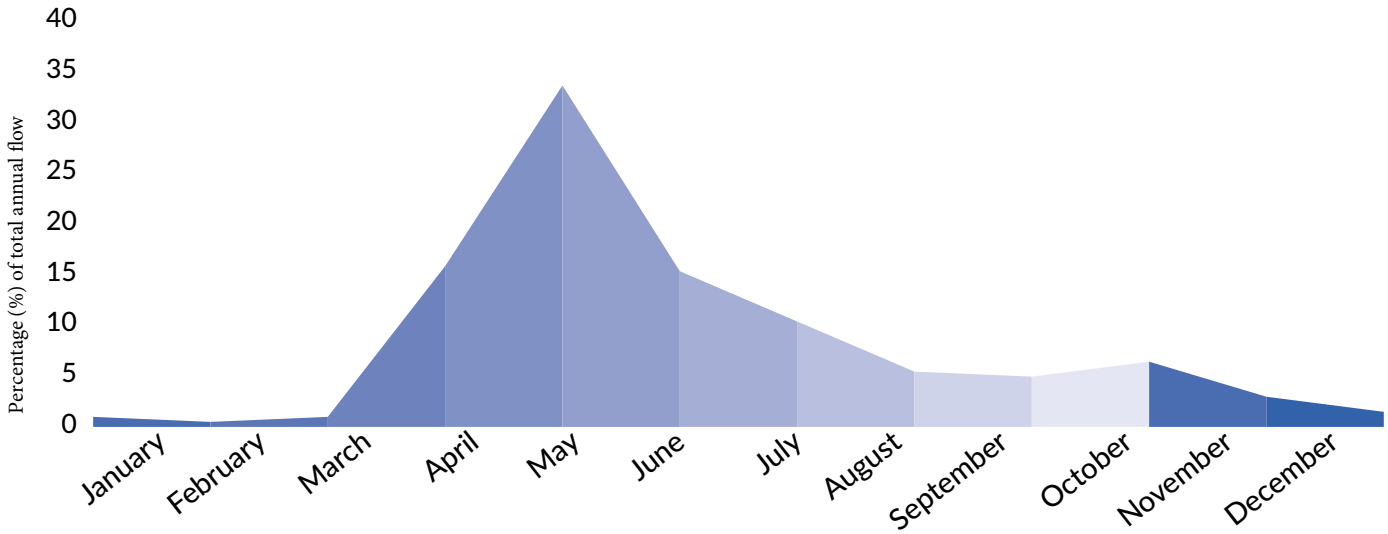


Figure 6: Distribution of annual runoff for the Carrot River (05KH007), 1966 - 2012

Historical flows on the Saskatchewan River show a much sharper peak of flow in the summer months of June and July, with a more dramatical drop in the fall (Figure 7). Today, flows on the river are much more evenly spread out through a longer period of time of April, May, June and July. This is because the Saskatchewan River is heavily influenced by upstream water management and regulation of the E.B. Campbell Hydroelectric Station in Saskatchewan, which became operational in 1963. Additional surface water considerations, such as increased consumptive use in Alberta and Saskatchewan, and construction of the Gardiner Dam on the South Saskatchewan River came into effect during this time period and may have additional impacts to the change in flow regime during this time.

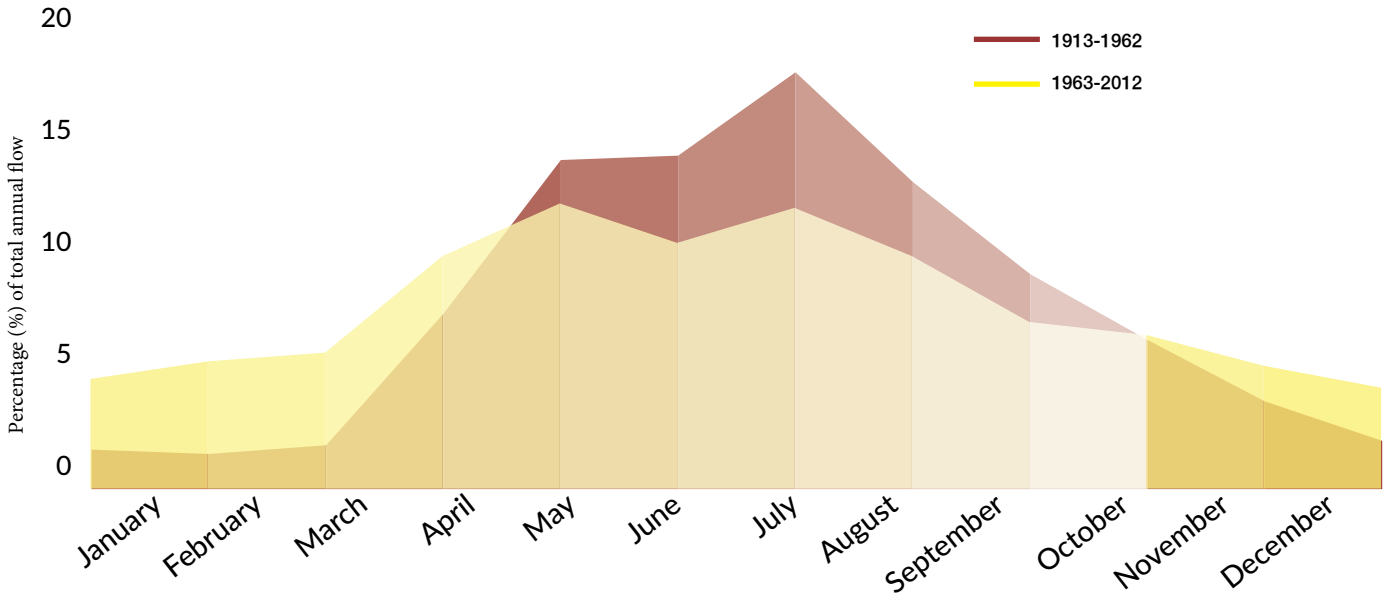


Figure 7: Annual runoff on the Saskatchewan River (05KJ001), comparing pre and post E.B. Campbell Hydroelectric Station development

GROUNDWATER

Glaciers of the last ice age played a prominent role in shaping the geology of this watershed. Large portions of the watershed are covered by geologically recent river deposits and materials deposited during the previous ice age. Geology of the watershed mostly consists of bedrock with overlying unconsolidated deposits of clay, silt, sand and gravel. There are four aquifer types found in the watershed (Figure 8).

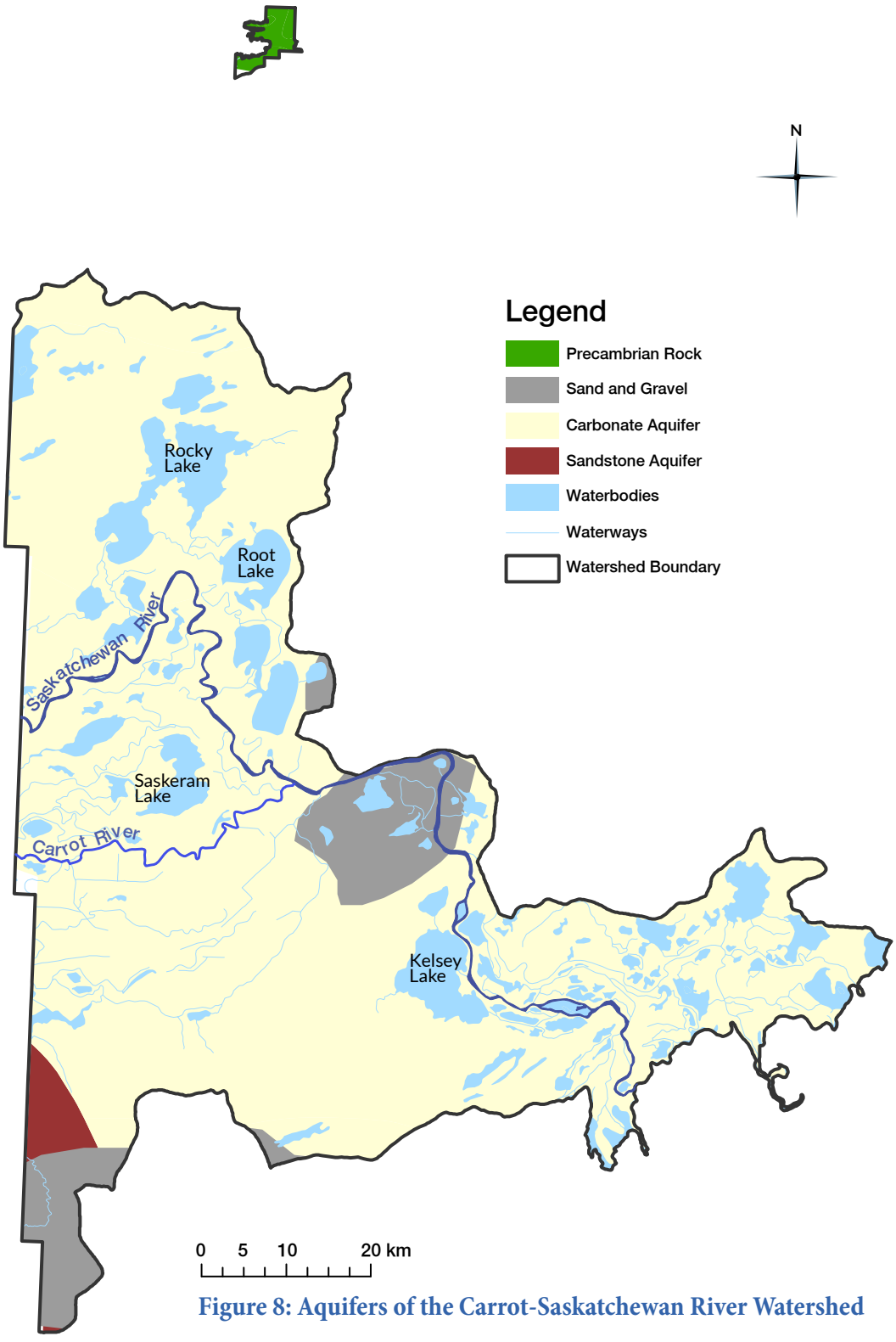


Figure 8: Aquifers of the Carrot-Saskatchewan River Watershed

Aquifer Types of the Watershed

Precambrian Rock

- Precambrian igneous and metamorphic crystalline rock (granite) is found at or near the surface in the Cranberry Portage area.
- Due to its near surface exposure, the rock contains fractured or weathered zones, which are water-bearing, though not highly productive. Well depth in granite is 2 to 20 m.

Carbonate Aquifer

- This aquifer reaches 17-100 m deep and consists of limestone and dolomite bedrock in a wedge shape.
- Fractures and cavities found in the bedrock provide a reliable water source to 80% of the wells in the watershed.
- Water quality is a primary constraint, particularly in the Carrot Valley. High salinity and hardiness often require treatment prior to use. Wells located in the Saskatchewan River Delta and around Wanless receive locally sourced recharge and may have better water quality.

Sand and Gravel Aquifer

- Sand and gravel aquifers may be found in many parts of the region, but are usually shallow deposits of river gravel, beach ridges or glacial sands within clay.
- They tend to be small in extent and may have limited water supply. Their shallow depth makes them vulnerable to surface contamination. Wells exhibit a depth range of 3-40 m.

Sandstone Aquifer

- The aquifer consists of occasional sandy beds within the Carbonate aquifer and sandstone filled into sinkholes and crevasses along the top of the Carbonate aquifer.
- Due to its depth beneath the thicker portions of the Carbonate aquifer it is a poor candidate for water supply and only occasionally wells are completed in this aquifer.

To monitor aquifer recharge and discharge, Manitoba Conservation and Water Stewardship maintains an active provincial monitoring well system through the Groundwater Management Section. One monitoring well has been recording continuous water levels since 1998. Locally, groundwater levels typically rise in spring and early summer, and then decline in fall and winter. In the longer term, they will generally increase over several wet years and decrease over a period of dry years. Data indicates groundwater levels are within two metres of the surface which means water levels may rise to or above the surface and is prone to freezing in the winter.

This is our watershed

There are eight licensed surface and groundwater water use projects in the watershed, collectively allocating 20,018 dam^3 of water annually. The majority of this water is allocated from the Saskatchewan River to the Town of The Pas for municipal use and Tolko Industries Ltd. for industrial use. Current allocations are believed to be well below sustainable aquifer limits and surface water use.

SURFACE WATER QUALITY

Water quality data is collected for monitoring purposes by Environment Canada and Manitoba Conservation and Water Stewardship within and in close proximity to the watershed. This data is used to review changes or trends in water quality over time, and identify any water quality concerns.

The Water Quality Index (WQI) is used for reporting technical information in a consistent, easy to understand manner. It incorporates 25 variables to calculate the rating. Examples of variables include: pH, dissolved oxygen, total phosphorus, and nitrate-nitrite. The index ranges from 0 to 100 and summarizes data into categories of excellent, good, fair, marginal and poor. According to recent analysis for 2003 to 2011 data, the WQI for the Saskatchewan River was typically 'good' and occasionally 'fair'.

Adequate dissolved oxygen is necessary for healthy aquatic life. Dissolved oxygen levels on the Saskatchewan River have typically been above the 5.0 mg/L objective, indicating adequate oxygen is available, with exceptions occurring in 1996 and 2006. Low oxygen levels may develop under thick ice conditions or following a summer of intense algal blooms. Both instances consume available oxygen from the water column.

With the exception of data collected at Turnberry, SK, analysis of total phosphorus data collected from the Saskatchewan River did not detect a significant trend in flow-adjusted concentrations for the period of record (1974-1999). This may indicate that artificial loading of total phosphorus from sources within the watershed has not resulted in increased total phosphorous concentrations during the period of record. Data for total nitrogen illustrate concentrations for the Saskatchewan River, Carrot River and Cedar Lake are below the chronic guideline during the period of record (1973-2013). There is one exception at the site of Turnberry, SK where data from 1990 to present for total nitrogen concentrations on the Carrot River show a significant increasing trend with concentrations well above the chronic guideline. At Cedar Lake the total nitrogen concentrations are still below the guideline but collected data suggest an increasing trend with 2013 data marginally below the 1.0 mg/L guideline.

Spatially, concentrations of total phosphorus and total nitrogen tend to decrease from upstream to downstream in the Saskatchewan River. The Carrot River site near Turnberry illustrates comparatively high levels for both total phosphorus and total nitrogen. This trend may be due to efficient riparian zones and associated nutrient uptake. Efforts should be directed at reducing nutrients from entering the watershed where possible. Beneficial management practices may also be directed at maintaining healthy riparian and wetland areas.

Sites such as these are becoming less common in the watershed since the adoption of riparian beneficial management practices

Healthy riparian habitat as a result of livestock exclusion fencing

Climate Change Adaptation

There is a consensus among scientists that climate change is occurring, and in some cases effects are already being felt. Although changes to date may seem relatively small, long term impacts may be much more significant. Climate change projections for this region generally indicate an increase in temperature and more extreme weather events. Overall, climate change projections for Manitoba illustrate a greater impact in the northern parts of the province. Impacts include more extreme weather and precipitation events, an increased average temperature and a higher likelihood of drought. Temperatures are also projected to rise more in the winter, affecting snowpack levels. Periods of extended drought may negatively impact wildlife habitat and alter migration patterns for sensitive species. Drought will create an environment more susceptible to erosion, forest fires, disease, and invasive species.

In terms of agriculture, warmer and longer growing seasons could be beneficial for crop growth, and subsequently shorter and milder winters may be positive for livestock. However, extreme rainfall events and drought occurrences could significantly decrease agricultural productivity, resulting in significant economic losses. Water storage and drainage systems may not be suited to handle future climatic conditions. The Carrot-Saskatchewan River Watershed may appear very different from its now water-rich state. Adaptive techniques and water conservation strategies, such as those applied in a Water Soft Paths approach, may be required to instill climate change resilience in the watershed. Aboriginal communities and traditional knowledge of Elders should be included in any climate change adaptive strategies.

BIODIVERSITY

The Saskatchewan River Delta

Formed by the last ice age, the Saskatchewan River Delta is a significant feature of the watershed (Figure 9). The delta was created when glacial Lake Agassiz melted and the Saskatchewan River deposited sediment into the standing water. The Delta is located along the Manitoba-Saskatchewan border and at 9,500 km^2 in size it is the largest inland freshwater delta in North America. The Delta consists of a complex series of abandoned and active river channels, lakes and wetlands. The Saskatchewan River Delta wetlands boast biodiversity second only to the world's rainforests, supporting very diverse populations of plant and animal species. It is recognized as an important waterfowl breeding area and has been identified as a Canadian Important Bird Area of global significance.

Saskatchewan River Delta Wetland Ecosystem Benefits:

- Wildlife and waterfowl habitat
- Flood and drought moderation
- Climate change mitigation
- Groundwater recharge
- Nutrient reduction
- Filtration and improved water quality

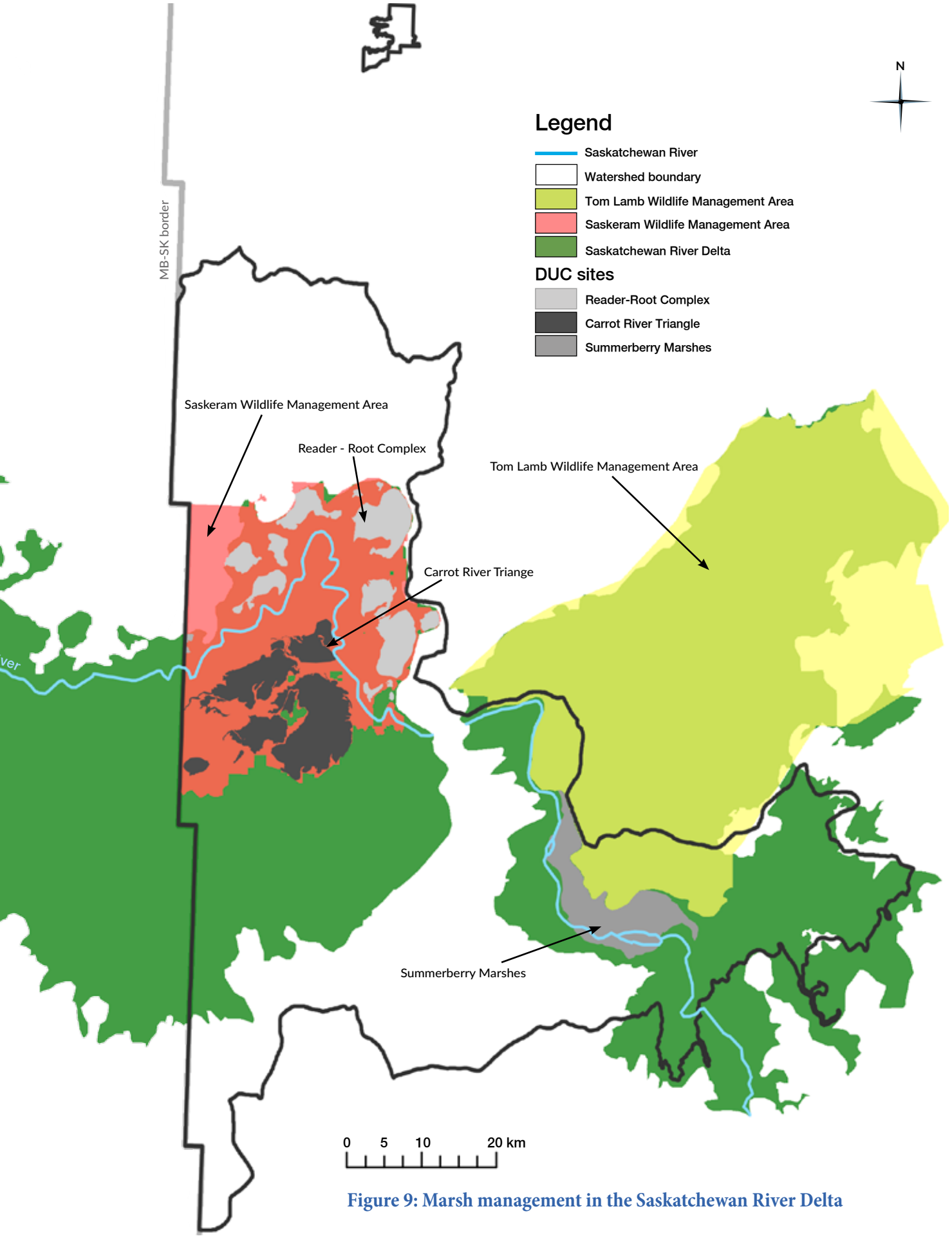


Figure 9: Marsh management in the Saskatchewan River Delta

Wetlands

Wetlands provide significant ecological goods and services for the watershed. They capture and store water, contributing to water availability, filtration, and water purification. They also provide valuable wildlife habitat, protect shoreline integrity, recharge groundwater, and moderate flood and drought events. Wetlands are vital for recharging groundwater aquifers and serve as surface water storage during periods of drought. Wetlands account for approximately 80% of the Saskatchewan River Delta and support many activities, including hunting, fishing, trapping, tourism, recreation and traditional Aboriginal uses. The wetland complexes and natural habitat support many species of wildlife.

Marsh Management History

The Saskatchewan River Delta has an extensive history of marsh management activities dating back to the 1930s when the Hudson Bay Company initiated the development of the Cumberland marshes. In the 1940s Ducks Unlimited Canada (DUC) developed several individual projects and marsh complexes, additional major developments occurred in the 1960s and 1970s. In 1967 the Province of Manitoba and DUC entered into an agreement regarding management of the area for waterfowl. Projects were originally designed to hold water by reducing excess local runoff and stabilizing water levels during the summer months to enhance waterfowl production. In recent years, developments and management activities have focused on restoring some of the hydrologic events lost due to the altered flow regimes caused by hydroelectric dam development. Marsh management areas of the watershed include the Carrot River Triangle, the Reader-Root Complex, the Summerberry Marshes, and the Tom Lamb Wildlife Management Area (Figure 9, page 18).

Parks and Protected Areas

Ecological reserves protect areas of unique and rare biological and geological features. They are established under the *Ecological Reserves Act* and may only be established on Crown land. The Red Rock Ecological Reserve is located just below the southern tip of the Tom Lamb Wildlife Management Area (WMA) and includes a beach ridge of white spruce. It also protects the most northern stand of bur oak in Manitoba.

There are two existing WMAs designated within the watershed; the Saskeram WMA and the Tom Lamb WMA. These sites have been identified as areas of special interest for study by the Protected Areas Initiative for many years.

During the 1940s-1960s, the provincial government constructed three large water control structures and two dikes in an effort to regulate water levels and increase wildlife and fur production in the southern half of the Tom Lamb WMA. To mitigate back water effects of the Grand Rapids Generating Station, external diking was put in place by Manitoba Hydro, and internal diking by the provincial government and DUC. Today, natural ebb and flow wetland conditions are no longer present and management objectives are now focused on preventing further deterioration of wetlands and upland habitat. The Saskeram WMA encompasses a large portion of the Saskatchewan River Delta between the Saskatchewan border and the Provincial Trunk Highway 10. It includes a large portion of the upper Saskatchewan River Delta and is an important breeding area for waterfowl. The marshes in this WMA are managed in cooperation with DUC.

Clearwater Lake Provincial Park

A small part of Clearwater Lake Provincial Park is included in the Carrot-Saskatchewan River Watershed. Classified as a natural park, its purpose is to preserve areas representative of the mid-boreal portion of the Manitoba Lowlands natural region. The park helps to preserve the high water quality designation of Clearwater Lake and accommodate a diversity of recreational opportunities and resource uses. Cottage development and recreational camping opportunities are focused along the south shore of the lake.

The *Provincial Parks Act* requires that a management plan be prepared for each of Manitoba's provincial parks. The Clearwater Lake Provincial Park Management Plan was completed in 2013. The plan establishes long term direction for the park, while addressing issues specific to resource protection, land use and development. The plan is used in conjunction with park regulations, provincial policy and legislation to guide the work of Manitoba Conservation and Water Stewardship for the next 10 to 15 years. The treaty and Aboriginal rights to pursue traditional uses and activities within Clearwater Lake Provincial Park are acknowledged and respected in the park.

Clearwater Lake exhibits outstanding water quality and was given high quality surface water designation in 1989. This designation directs policy, planning and development to ensure the intrinsic water quality characteristics of Clearwater Lake are protected.

WILDLIFE

The Carrot-Saskatchewan River Watershed is rich in biodiversity and natural areas, resulting in very productive wildlife habitat. The watershed stretches across the Boreal Shield and the Boreal Plains ecozones. Endangered species of concern in the watershed include Lake Sturgeon, Yellow Rail, Boreal Woodland Caribou, Eastern Whip-Poor-Whills, Chimney Swift, Common Nighthawk, and the Canada Warbler.

Declining Moose Population Trends

Moose populations have become a concern in the watershed and Manitoba Conservation and Water Stewardship is closely monitoring population trends to ensure the continued local presence of moose. Current management activities include enforcement efforts, disease monitoring, and modifications to hunting seasons. The Wildlife Enhancement Initiative and Aboriginal and Northern Affairs have provided funding to support aerial moose surveys to assess moose populations and monitor the effectiveness of current management activities.

Boreal Caribou Challenges

Boreal caribou were listed as threatened under the federal *Species at Risk Act* in 2003 and Manitoba's *Endangered Species Act* in 2006. Boreal caribou have specific habitat requirements and therefore are very sensitive to human and natural disturbances. The biggest threats to boreal caribou are habitat loss and fragmentation due to industry and development. There are 15 identified boreal caribou ranges in Manitoba, two of which are located in this watershed; the Naosap-Reed range and the Bog range. Caribou ranges are areas with consistent habitat which support populations of woodland caribou. Conservation status indicates a high risk for the Naosap-Reed range and medium risk for The Bog range.

In 2005, Manitoba developed the *Boreal Woodland Caribou Recovery Strategy*, the updated strategy was released in 2015. The strategy defines recovery goals and objectives for self-sustaining Boreal Woodland Caribou populations. Caribou of the Naosap-Reed and the Bog ranges have been collared and monitored extensively since 2010. This research indicates some new areas of use for the Naosap Reed and illustrates regular movement across the Manitoba-Saskatchewan border for the Bog range. Plans to collar these ranges will continue until 2017.

Habitat Requirements

- Relatively large, intact boreal forest stands
- Mature boreal forest stands (60-80 years)
- Lichen-rich habitat as a primary food source
- Sufficient space to carry low-density caribou populations

Challenges

- Development leading to habitat loss and fragmentation
- Populations sensitive to disturbance and increased predation
- Parasites and disease
- Climate change impacts causing an increase in forest fires, ungulate diseases and parasites
- Low population densities

HEALTHY AQUATIC ECOSYSTEMS

The wetlands, lakes and rivers of the Carrot-Saskatchewan River Watershed are home to many aquatic and fish species. Common fish species include walleye, northern pike, lake whitefish, perch and cisco. These fish species are important for the local economy as they support recreational and commercial fishing opportunities, as well as First Nations fisheries interests.

Aquatic Invasive Species

Aquatic invasive species are non-native and may cause damage to an ecosystem and its native species. As their native predators are not present, invasive species often thrive in new ecosystems. In the Carrot-Saskatchewan River Watershed, common carp have been noted near The Pas. Other aquatic invasive species which have not yet been documented in the watershed but are considered a threat include rainbow smelt, spiny waterflea and the movement of zebra mussels north through Lake Winnipeg.

Lake Sturgeon

Lake Sturgeon is Canada's largest freshwater fish species and has a history dating back 100 million years. This species can grow to two meters in length and may live beyond 100 years of age. Lake Sturgeon exhibit a number of characteristics which make it a unique, yet sensitive species; they mature at a relatively late age and spawning takes places over a large time extent once every three to five years.

The Saskatchewan River provides important spawning habitat for Lake Sturgeon. Lake Sturgeon populations in the Saskatchewan River have been fragmented due to hydroelectric development upstream and downstream of the watershed. Despite efforts to reduce harvesting pressures, and the creation of the Saskatchewan River Sturgeon Management Board, Lake Sturgeon in the watershed have seen an 80% population decline in the past 40 years.

This is our watershed

Saskatchewan River Lake Sturgeon populations have been assessed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are currently being considered for listing under the federal *Species at Risk Act* (SARA). Sturgeon migrate up to 100 km between their breeding and non-breeding grounds, so they are threatened by habitat fragmentation. The sturgeon fishery is of great importance to local First Nations.

Student assisting with
Lake Sturgeon research tagging.

AGRICULTURE

Agricultural production in the watershed is primarily concentrated in the Carrot Valley, west of the Town of The Pas and in a small pocket east of The Pas along Ralls Island. The Carrot Valley is intensively managed for crop and livestock production and the Ralls Island area supports a few smaller market gardens and farms. Overall, agricultural production in the watershed is quite similar to elsewhere in Manitoba, except productivity is directly dependent on artificial drainage and continued pumping in the polders. The more northern location and longer summer daylight hours allow for an additional 10 growing days in comparison to agricultural production in southern Manitoba. Growing days are referred to as "growing degree-days" and are measured from a base temperature - below this temperature no plant growth will occur. Located north of the 53rd parallel, the watershed boasts the most northern agricultural area in the province and includes approximately 30,000 ha of arable agricultural land.

Prior to surface water improvements, water was often found covering vast low areas for extended periods of time. Drainage improvements to the Carrot Valley have produced productive soils for agriculture. Land is classified in terms of agricultural productivity according to the Canada Land Inventory System (Figure 10). Lands are progressively classified from Class 1 to Class 7; Class 1 is rated the highest, with no limitations to annual crop production and Class 7 soils have severe limitations and are not suitable for agriculture. Agricultural producers continue to improve land through crop rotations and soil management, increasing yields over time. Soils of Classes 2 to 3 are used for annual crop production, and soils of 4 to 6 are used for grazing and forage production. Crops grown locally include wheat, canola, barley, canary seed, timothy, oats and a small amount of flax. Recently soybeans have been introduced to the area on an experimental basis.

Agricultural Census data indicates a trend of fewer and larger farms. From 2001 to 2011, there has been a 36% reduction in the number of farm operators, along with a 33% increase in farm size. Livestock production has decreased, but cattle numbers are still considered significant for the size of the area. This poses management considerations for maintaining healthy riparian areas along the Carrot River and its tributaries. Agricultural lands are a finite resource in this watershed and are protected accordingly. Strong policies in development plans protect agricultural lands from encroaching residential or industrial devlopment. Continued strong political support is required to maintain agricultural lands in production as the area experiences growing urban pressures.

This is our *watershed*

Western Canadian agriculture dates back to 1754 when Captain Louis de la Corne St. Luc seeded a few acres of wheat and barley next to Fort Paskoyac on the Saskatchewan River, predating the Selkirk settlement farming ventures by 58 years.

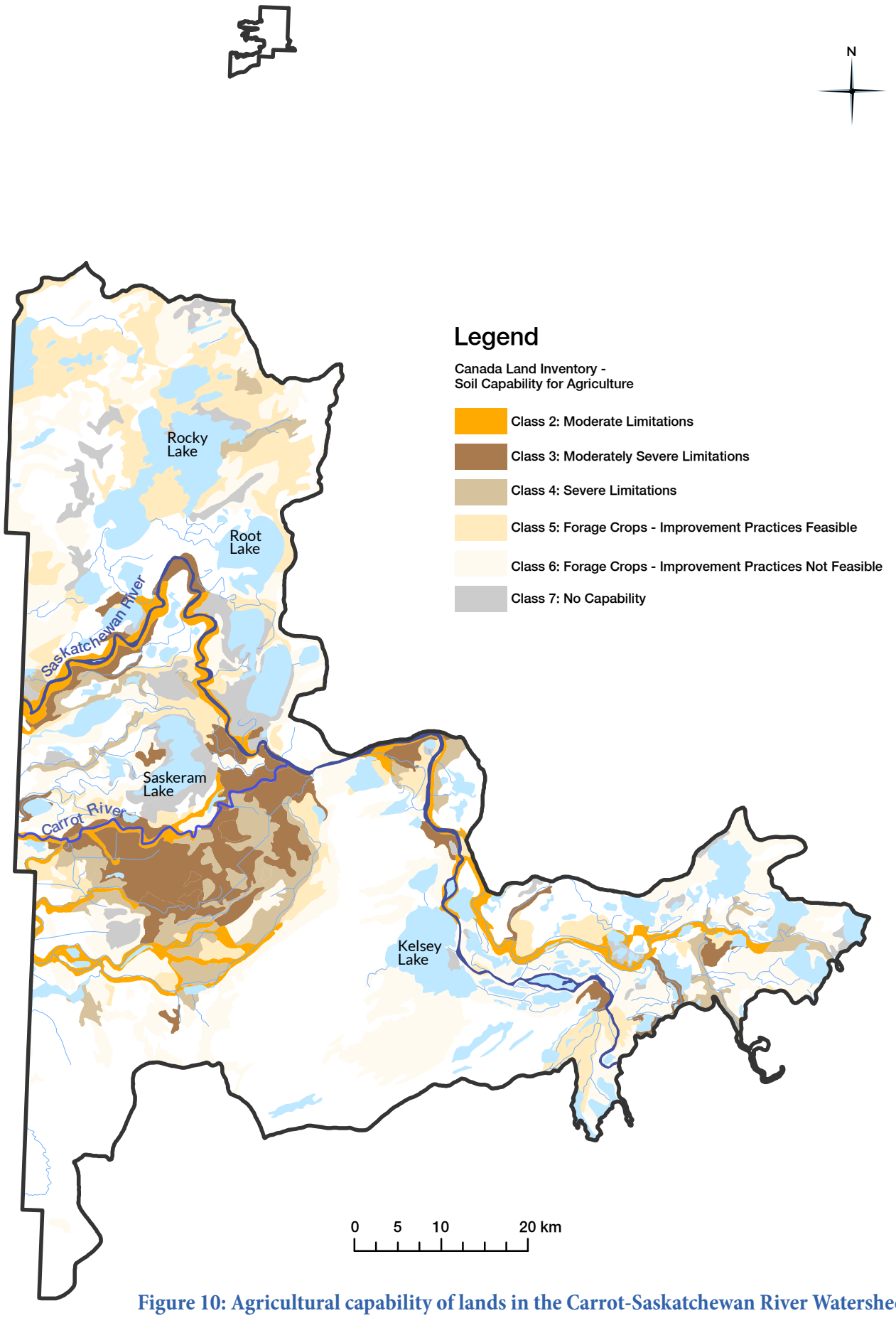


Figure 10: Agricultural capability of lands in the Carrot-Saskatchewan River Watershed

SOILS

Soil types of the watershed are primarily peaty, calcareous and loamy to clay. Occurrence of any soil, wind and water erosion risk is considered very low. Generally, soils of the Carrot Valley are rich, fertile, and stone free. They are also imperfectly drained, meaning water drains off the land relatively slowly. Salinity is a localized problem due to the extreme flatness and lack of natural drainage. Approximately 850 ha of agricultural land is considered moderately to very saline. Incentives have been provided to assist producers in implementing beneficial management practices for severely saline soils, including crop rotation using perennial forages and deep-rooted crops to facilitate salt movement into the lower soil profile.

Soils of the Saskatchewan River Delta are generally a silt, sand and clay mixture. They are often saturated and considered to have unstable soil structure, contributing to the constant change of river flows in the Saskatchewan River. Frequent flooding and river course changes have created an underlying river bed of peat, sand, silt and clay layers. North of the Saskatchewan River Delta new Cranberry Portage, soils are generally quite thin, with the Canadian Shield rock exposed.

CROWN LANDS

Crown lands make up a significant portion of the Carrot-Saskatchewan River Watershed. These lands are rich in natural resources and are managed by the Province of Manitoba. The *Crown Lands Act* allows the provincial government to code or designate Crown lands for specific purposes. All land use coding is reviewed by the block planning committee and coded based on their available resources. The committee considers agricultural potential, public use, resource management, sensitive sites, flooding and development potential in their designation. Crown land coding may allow development, specify multiple use requirements, identify length of commitments or outline the nature of permissions required. Crown land permits are issued annually for specific purposes, each proposal is unique and considered individually.

Crown lands are currently utilized for agriculture, wild rice, forestry, mineral exploration, commercial fishing, hunting, trapping, traditional land uses, residential use and recreation. Areas west of The Pas in the Carrot Valley have significant agricultural Crown lands and much of the unimproved land is leased out for native pasture and hay. Several water bodies located north of The Pas are on Crown lands areas and contain wild rice. Wild rice is not naturally occurring in northern Manitoba, it was seeded locally in the 1980s for economic purposes. Wild rice production is highly dependent on favourable weather conditions and yield may be directly impacted if weather conditions are cooler or wetter than average.

INDUSTRY

Forestry

The forested area of the watershed is situated along the boundary of the Boreal Plain Ecozone to the south and the Boreal Shield Ecozone along the Cranberry Lakes to the north. Forest stands are dominated by softwood species of black and white spruce and jack pine, with smaller components of balsam fir and tamarack. The smaller hardwood component is primarily trembling aspen, with lesser portions of balsam poplar and white birch.

Forest harvesting activities in Manitoba are regulated by a series of provincial acts, regulations and guidelines, as well as industry directed forest management plans, policies, procedures and standard operating guidelines. The provincial guidebook - *Manitoba Conservation Forest Practices Guidebook: Forest Management Guidelines for Riparian Management Areas* sets standards for sustainable forest management practices adjacent to riparian and aquatic systems in permitted zones. Harvesting practices are permitted, restricted or prohibited in the zones, depending on site conditions and distance to riparian areas. Social and traditional values, water quality, fish habitat, soils, wildlife and forest health are taken into consideration in the development of a zone. The guidebook outlines a number of beneficial management practices that can be used by forest planners and logging supervisors when working around sensitive water features to mitigate impacts.

In the Carrot-Saskatchewan River Watershed much of the forest harvesting is managed by Tolko Industries Ltd. As part of the company's forest management responsibilities, a Forest Management Plan and a voluntary Sustainable Management Plan is in place to meet provincial requirements and develop long-term forest management strategies. These plans include annual targets for limiting the disturbance of productive forest land on a watershed basis, post harvest replanting objectives, and modelling for sustainability and limiting disturbance of wildlife habitat, specifically for key indicator species such as the Boreal Woodland Caribou. Standards and procedures have been developed to govern fuel storage, spill remediation, soil disturbance, and the construction and maintenance of roads and bridges.

This is **our** *watershed*

Tolko's Sustainable Forest Management plan meets the CSA Z-809 standard, an internationally recognized sustainable forest management standard developed by the Canadian Standards Association and based on criteria selected by the Canadian Council of Forest Ministers.

Mining History and Potential

Currently no mining operations exist in the watershed, however in recent years there has been an expanded interest in mineral exploration. Maps produced by Manitoba Geological Survey document portions of the Saskatchewan River Delta underlain by the greenstone belt, and subsequently have a high potential for mineral exploration. A number of mineral and quarry leases are present in the watershed. Activities on mining claims may include prospecting, diamond drilling and field exploration.

WATERSHED PARTNERSHIPS AND STAKEHOLDERS

Identifying Concerns and Values

To clearly identify values and concerns of the watershed, the PMT met with stakeholders groups throughout the development of this plan. Watershed residents and stakeholders were asked to identify and prioritize local land and water issues of importance to them. Input was provided through public and stakeholder meetings, individual comment forms, and technical submissions. This has been reflected in the development of the three watershed values of the Carrot-Saskatchewan River IWMP.

WATERSHED VALUES

1 Surface Water Fluctuations

We value the management of surface water and its associated infrastructure for flood and drought protection and successful agriculture locally.

2 Water Quality

We value clean water for drinking water needs and recreational purposes. Clean water sustains healthy communities and our natural ecosystem.

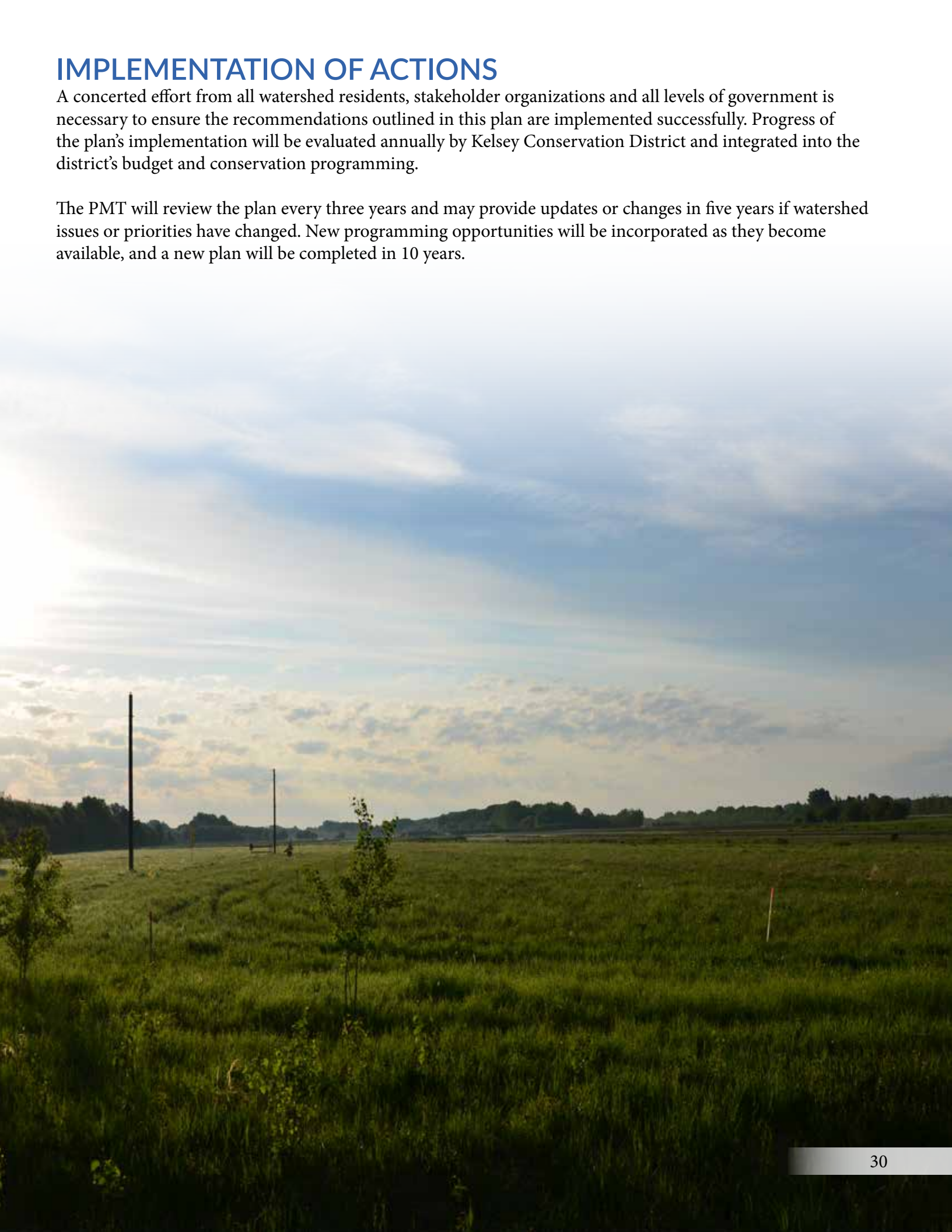
3 Ecosystem Health

We value natural habitat sustainability and biodiverse areas. Strong programming and initiatives protect the integrity of these areas and mitigate against impacts of development and industry.

IMPLEMENTATION OF ACTIONS

A concerted effort from all watershed residents, stakeholder organizations and all levels of government is necessary to ensure the recommendations outlined in this plan are implemented successfully. Progress of the plan's implementation will be evaluated annually by Kelsey Conservation District and integrated into the district's budget and conservation programming.

The PMT will review the plan every three years and may provide updates or changes in five years if watershed issues or priorities have changed. New programming opportunities will be incorporated as they become available, and a new plan will be completed in 10 years.



1 WATERSHED VALUE

SURFACE WATER FLUCTUATIONS

Key Challenges

- The watershed is highly modified and certain areas are dependent on the operation of water control structures.
- Water control structures require regular maintenance.
- Flooding impacts residential and agricultural areas.
- Poor drainage due to very little slope.
- Jurisdictional differences exist in the management of water flows between provincial boundaries.
- Flooding occurrences stretch later into the year and last longer than previously.

Recommended Action	Targeted Area	Measures of Success
Action 1.1: Improve inter-provincial communication and cooperation between the non-profit watershed associations in MB and SK. **Lead:** KCD **Support:** Carrot River Valley Watershed Association	Watershed wide, including the upstream portion of the Carrot-Saskatchewan River Watershed in Saskatchewan	Implement BMPs which improve riparian health along the Carrot River in Manitoba and Saskatchewan.
Action 1.2: Encourage identified stakeholders to meet annually and discuss water control structure objectives and goals. Identify where synergies in water level management and communication could be developed. **Lead:** RM of Kelsey **Support:** MIT, MB Hydro, Sask Power, Saskatchewan Water Security Agency, DUC, KCD, MCWS - Surface Water, Prairie Provinces Water Board	Watershed wide, including the upstream portion of the Carrot-Saskatchewan River Watershed in Saskatchewan	Develop an operational plan, meet annually and discuss timely forecast information where necessary.
Action 1.3: Encourage improved coordination of water level and flow projections between MB and SK during critical periods, specifically during periods of flooding. **Lead:** RM of Kelsey, MIT **Support:** MB Hydro, MCWS - Surface Water, Prairie Provinces Water Board, Sask Power, Saskatchewan Water Security Agency	Saskatchewan River	Exchange information to assist in preparation for flood conditions.

Forecasting and stream flow information can be viewed online for
The Grand Rapids Generation Station: hydro.mb.ca/corporate/water_regimes/cedar.shtml
The E.B. Campbell Hydroelectric Station: wsask.ca/Lakes-and-Rivers/Stream-Flows-and-Lake-Levels/

Recommended Action	Targeted Area	Measures of Success
Action 1.4: Monitor and maintain integrity of dike and drainage infrastructure on Ralls Island. **Lead:** RM of Kelsey **Support:** MIT	Ralls Island, along the Saskatchewan River	Provide adequate flood protection.
Action 1.5: Improve local feedback and communications through a stakeholder committee for DUC water control structures and operations in the watershed. **Lead:** DUC **Support:** Local residents	DUC water control structures	Form a team of local stakeholders by 2017 to assist DUC in identifying key maintenance concerns on water control structures.
Action 1.6: Investigate cost-effective drainage improvements from Big Lake to the Cul du Sac River. **Lead:** RM of Kelsey **Support:** MIT	Big Lake	Identify and implement cost-effective drainage improvements to reduce pumping requirements at the Jory Pump Station and enhance storage capacity of Big Lake.
Action 1.7: Investigate adaptation strategies to mitigate potential climate change impacts, including more extreme weather events, increased flows, agricultural impacts and infrastructure considerations. **Lead:** RM of Kelsey, Town of The Pas, OCN **Support:** MCWS, MIT, DUC, Manitoba Hydro, Sask Power, MAFRD	Watershed wide	Review emergency plans to mitigate against major flooding and drought occurrences.

Construction of a permanent dike along the Saskatchewan River

SURFACE WATER MANGEMENT PLAN

In Manitoba, surface water management typically refers to the management of water to reduce or prevent flooding of agricultural, industrial and residential land. It also affects water quality and the function of aquatic ecosystems. Currently surface water is largely managed in the Carrot–Saskatchewan River Watershed for agricultural production and flood protection. The natural drainage system of the watershed has been altered significantly through the construction of dikes, water control structures, and drainage (Figure 11, page 33). Although water fluctuations are a natural process, surface water drainage and hydroelectric dam development has altered the hydrology of the Saskatchewan River and impacted localized annual high water events. Wetland management projects and activities have been implemented to assist in restoring recharge events critical for wetland health.

Incorporating a more holistic approach to surface water management considers aquatic health, water quality, potential climate change impacts, recreational opportunities and flood mitigation protection measures. In recognizing common challenges and landscape features, four surface water management areas were designated for the watershed (Figure 12, page 34). Management strategies and actions have been developed to guide surface water management locally.

Surface Water Infrastructure

Various water control structures are operated by DUC, MIT and the RM of Kelsey in the watershed (Figure 11, page 33). The watershed has 14 designated provincial waterways (100 km total) and 68 km of provincial dikes. A provincial waterway is artificially made and is a third order drain or higher. Three provincial dams are located in the watershed: Big Bend Dam, Grace Lake Dam and Knapp (Pasquia Control) Dam. Provincial dikes are built for protection along the Carrot River Valley, the Pasquia River and Ralls Island. In total, 39 km of the Carrot and Saskatchewan Rivers are between The Pas to the Saskatchewan border are protected by dikes. The Salt Channel dike protects 34 km of the western boundary of the Carrot Valley area, and 11 km of Ralls Island is protected by a dike along the Saskatchewan River. The Pasquia River dike is 20 km long and protects both sides of the river. Together, these dikes and pumping stations protect 570 km^2 of residential and agricultural land.

Emergency sand bagging during threat of overland flooding along the Carrot and Saskatchewan Rivers

Bracken Dam

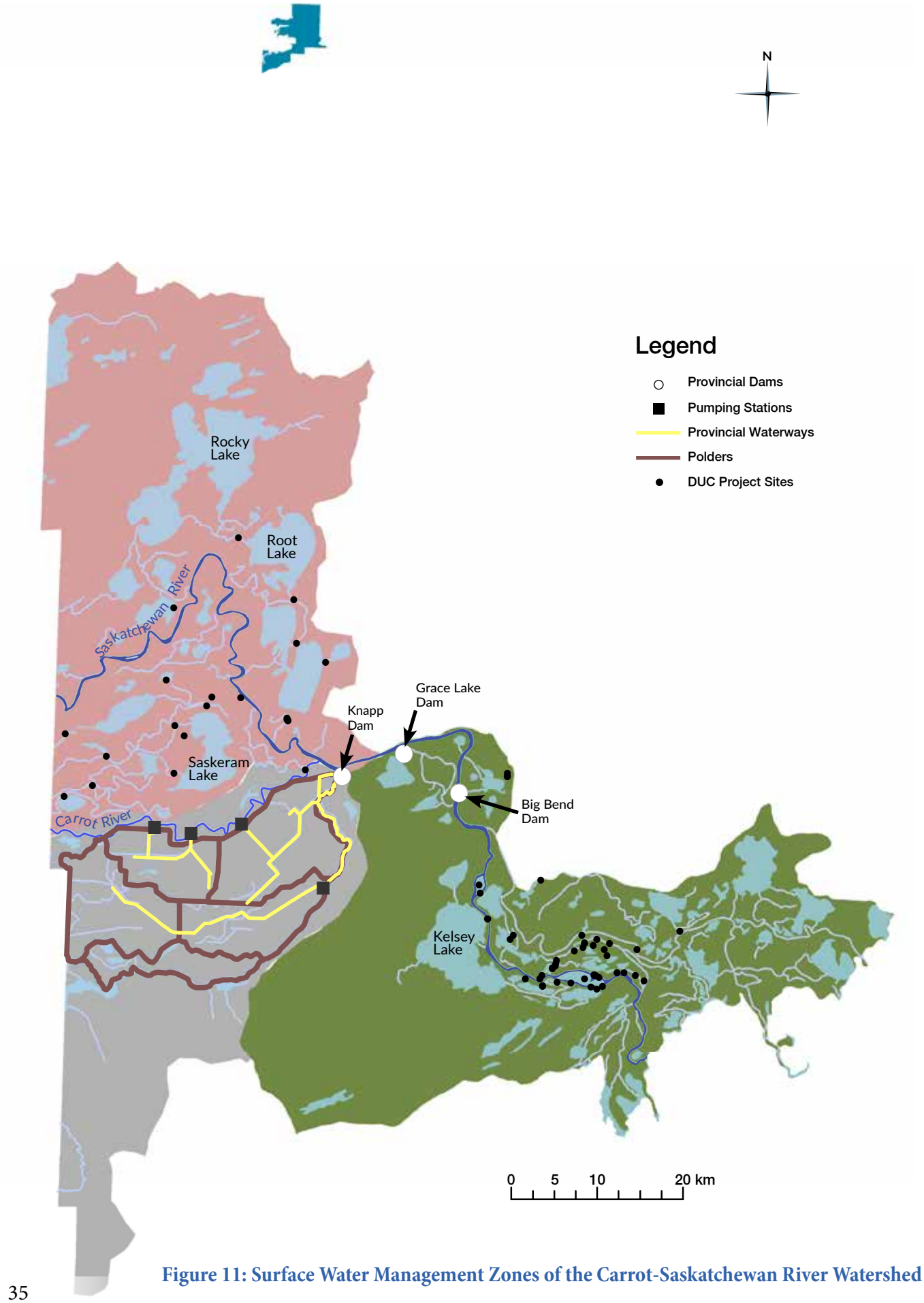


Figure 11: Surface Water Management Zones of the Carrot-Saskatchewan River Watershed

Surface Water Management Zones

Cranberry Portage

Characteristics	Priority Issues	Goals
• Located along the eastern edge of Athapapuskow Lake and west of First Cranberry Lake. • Includes an active recreation and tourism industry.	• Water quality concerns due to tourism pressures and cottage development along Athapapuskow Lake and First Cranberry Lake. • Surface water fluctuations and resulting shoreline erosion along Athapapuskow Lake. • Lagoon discharge into First Cranberry Lake.	• Maintain pristine aquatic health and surface water quality. • Manage development to mitigate negative surface water quality impacts.

Wanless / Saskeram

Characteristics	Priority Issues	Goals
• Part of the Saskatchewan River Delta. • Numerous lakes and wetlands. • Includes an active recreation and tourism industry. • Includes approximately 20 DUC water management project sites.	• Overland flooding near Wanless. Private wells were flooded and compromised in July 2013. • Surface water fluctuations and resulting shoreline erosion. • Hydroelectric development impacting flow regime and aquatic health. • Cottage development impacting shoreline health. • Forestry development impacting riparian areas.	• Maintain and manage water control structures for improved aquatic health. • Manage development to mitigate negative surface water quality impacts. • Increase communication efforts between stakeholders and local residents regarding fluctuations in surface water flows to address priority issues.

Carrot Valley

Characteristics	Priority Issues	Goals
• Very flat landscape, with the Pasquia Hills bordering the valley to the west, along the Manitoba-Saskatchewan border. • Intensive agriculture. • Landscape drainage is maintained through a network of water control structures, dikes and drains. • Includes Knapp Dam, 84 km of provincial waterways and 68 km of provincial dikes. • The Salt Channel dike protects 34 km of the western boundary of the Carrot Valley area.	• Agriculture is directly dependent on extensive pumping and an intensive water diversion network. • Shoreline erosion along the Carrot River. • Flooding of cropland during heavy rains is a major concern. Maintenance of the drainage network is essential to minimize crop loss.	• Manage surface water to support agriculture and mitigate against flooding. • Conserve and restore riparian areas.

Summerberry / Lower Saskatchewan River Delta

Characteristics	Priority Issues	Goals
• Includes the community of Moose Lake. • The Saskatchewan River flows through the Summerberry marshes, creating many wetlands prior to entering into Cedar Lake. • Includes Grace Lake Dam and Big Bend Dam. • Ralls Island is protected by 11 km of dike along the Saskatchewan River • Includes approximately 40 DUC water management project sites.	• Maintenance of flood protection at Ralls Island. • Erosion along the Saskatchewan River. • Back water effects along the Saskatchewan River due to the hydroelectric development.	• Maintain ecosystem health. • Upgrade and maintain current dams.

Figure 12: Surface Water Management Zone characteristics, priority issues and goals in the Carrot-Saskatchewan River Watershed

WATER QUALITY

Key Challenges

- Residents value and depend on the exceptional water quality of their lakes, wetlands and waterways in the watershed for recreational and drinking water purposes.
- Land use activities, including industry, development and agricultural activities may impact surface water quality.
- Sewage systems may contaminate drinking water sources if not properly managed.

Recommended Action	Targeted Area	Measures of Success
Action 2.1: Develop targeted education materials to assist residents in improving shoreline health along their property. **Lead:** KCD **Support:** Town of The Pas, MCWS	Residential properties along riparian areas	Distribute educational materials to residents with riparian areas along their property.
Action 2.2: Increase drinking water awareness through educational resources and outreach media. **Lead:** KCD **Support:** MCWS – Groundwater Management	Watershed wide	Distribute *Well Aware* brochures and encourage safe well maintenance practices.
Action 2.3: Ensure wells within flood prone areas have adequate well head protection so flood waters may not enter directly into the well. **Lead:** Well owners **Support:** KCD, MCWS - Groundwater Management	Within flood prone areas and on Ralls Island	Contact landowners regarding well protection, provide information and a site inspection.
Action 2.4: Seal abandoned wells in the watershed. **Lead:** KCD, OCN, Mosakahiken Cree Nation, Moose Lake Community Council **Support:** Well owners, MCWS - Groundwater Management	Watershed wide, target source water protection zones first	Seal abandoned wells and update the well inventory.
Action 2.5: Encourage residents to test their private wells annually to ensure they meet the Guidelines for Canadian Drinking Water Quality. **Lead:** KCD **Support:**Well owners, MCWS – Groundwater Management, and Office of Drinking Water	Watershed wide	Provide information and water quality testing to well owners.

Recommended Action	Targeted Area	Measures of Success
Action 2.6: Review opportunities for aquifer protection around Moose Lake. **Lead:** Moose Lake **Support:** Cree Nation Tribal Health, KCD	Moose Lake	Complete a comprehensive list of threats and list of mitigating measures by 2016.
Action 2.7: Review opportunities for aquifer protection around OCN. **Lead:** OCN **Support:** Cree Nation Tribal Health, KCD	OCN	Complete a comprehensive list of threats and list of mitigating measures by 2016.
Action 2.8: Inspect new sub-division sites within five years of development to ensure all installed systems are registered and in compliance. **Lead:** MCWS – Environment **Support:** KCD	Lake Athapapuskow, Rocky Lake	Enforce unregistered or noncompliant systems.
Action 2.9: Ensure that onsite wastewater management systems not in compliance with current standards be replaced to meet MR 83 / 2003 standards. **Lead:** Residents **Support:** MCWS – Environmental Enforcement	Lake Athapapuskow, Rocky Lake	Inspect areas and ensure compliance is met by replacing all systems to meet current standards.
Action 2.10: Develop a hazardous waste depot in the watershed. **Lead:** Town of The Pas, the RM of Kelsey **Support:** KCD, MCWS - Environmental Enforcement	At the location of the new regional land fill site.	Establish a hazardous waste depot for residential use by 2017.

Recommended Action	Targeted Area	Measures of Success
Action 2.11: Ensure provincial and federal compliance within existing effluent and relevant regulations. **Lead:** Town of The Pas, RM of Kelsey, OCN **Support:** MCWS - Environment	Watershed wide	All effluent related regulations are met.
Action 2.12: Hire a third party engineering consulting firm to determine waste water treatment deficiencies and provide cost-effective solutions. **Lead:** Town of The Pas, RM of Kelsey, OCN **Support:** MCWS – Environmental Enforcement	Town of The Pas	Upgrade the waste water treatment facility to comply with hydraulic and nutrient loading as per the operating license and federal regulations.
Action 2.13: Assess urban storm water runoff concerns in the Town of The Pas and prepare a list of storm water filtration options, including rain gardens and urban wetlands. **Lead:** Town of The Pas **Support:** KCD	Along the Saskatchewan River in the Town of The Pas	Identify solutions for slowing flows where the Saskatchewan River is directly impacted by storm water runoff. Complete one project by 2018.

Urban wetland in the Town of The Pas

Recommended Action	Targeted Area	Measures of Success
Action 2.14: Implement BMPs (beneficial management practices) such as buffer strips, erosion control, riparian fencing, and off-site watering to exclude livestock access to improve riparian health. **Lead:** KCD, MAFRD **Support:** Landowner	Carrot Valley	Restrict livestock from accessing riparian areas of the Carrot River by 2025.
Action 2.15: Implement BMPs that improve manure management and fertilizer application to reduce nutrient loading. **Lead:** KCD, MAFRD **Support:** Landowners	Carrot Valley	Implement 20 BMP projects by 2025 to reduce phosphorous and nitrogen loading in the watershed to the targeted 10% reduction as outlined in the *Lake Winnipeg Action Plan*.
Action 2.16: Implement BMPs that alleviate pressure on riparian areas and increase efficiency of pastures. **Lead:** KCD **Support:** Landowners, MAFRD	Carrot Valley	Provide alternative options for livestock watering, resulting in healthier riparian areas.
Action 2.17: Seed severely saline areas to provide cover on these sensitive sites. **Lead:** KCD **Support:** Landowners	Carrot Valley	Establish good management practices on saline areas, diminishing saline areas in the watershed over time.
Action 2.18: Conduct ongoing field trials to identify new agricultural crops and practices for the area. **Lead:** KCD **Support:** Landowners, MAFRD	Carrot Valley	Establish new agricultural practices to decrease nutrient loading, providing water quality benefits.
Action 2.19: Restrict livestock access to sensitive riparian habitat in agricultural areas along the Carrot and Birch Rivers. **Lead:** KCD **Support:** Landowners, MAFRD	Carrot and Birch Rivers	Fence the agricultural portions of the Carrot River and all of the Birch River through incentive BMP programming.
Action 2.20: Monitor and inspect regulated reported spills to mitigate groundwater contamination. **Lead:** MCWS - Environmental Enforcement	Watershed Wide	Spills are monitored and managed appropriately.

SOURCE WATER PROTECTION PLAN

Protecting our Drinking Water

Drinking water is sourced from surface water and groundwater in the watershed. The watershed contains three municipal and two federal drinking water sources (Figure 11). An assessment of the municipal public systems was conducted in 2011 in preparation for the development of a Source Water Protection Plan for the Carrot-Saskatchewan River Watershed. The federal sites were assessed individually in 2015 and recommendations for well operators are detailed on pages 36 and 37.

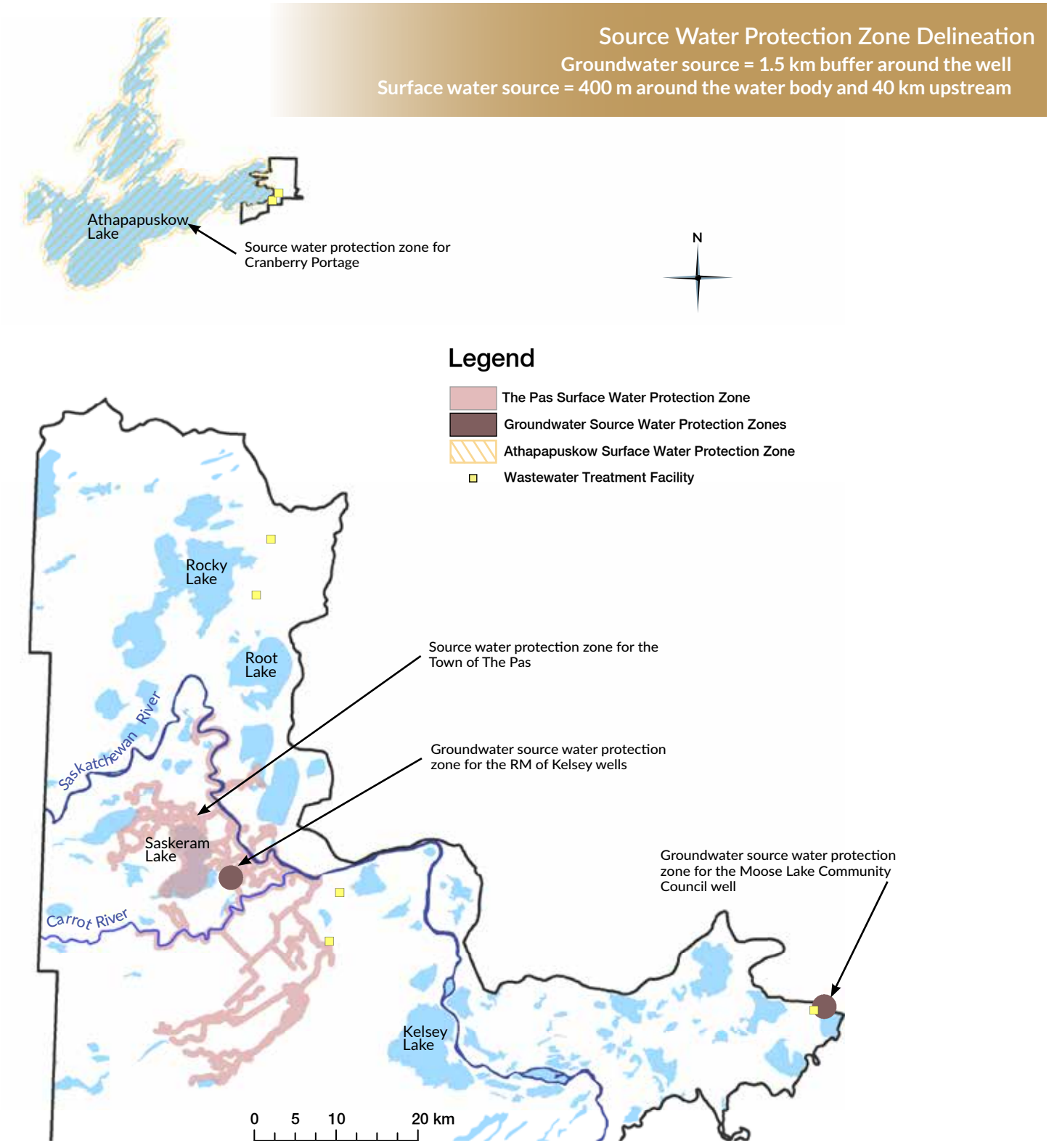


Figure 11: Source Water Protection Zones of the Carrot-Saskatchewan River Watershed

RM of Kelsey

Public System	• Groundwater source with two wells and one monitoring well. • Serves 2,520 people.
Regulatory Jurisdiction	• RM of Kelsey, Province of Manitoba.
Site-Specific Recommendations	• Improve dike protection and reshape berms around the wells to ensure runoff flows away from the wells. • Extend the two well casings to at least 40.6 cm above the mounded surface. • Add soil to protect the insulation over the reservoir. • Upgrade the overflow pipe located on the west side of the plant. • Add protective posts around the propane tank located next to the water treatment plant to meet fuel storage regulations. • Seal all abandoned wells in the source water protection zone.

Town of The Pas

Public System	• Surface water source from the Saskatchewan River. • Serves 5,795 people.
Regulatory Jurisdiction	• Town of The Pas, Province of Manitoba.
Site-Specific Recommendations	• Filter runoff from the storm water drain located at First Street West and Fischer Avenue through a vegetated wetland to reduce runoff prior to entering into the Saskatchewan River. • Replace the intake screen.

Cranberry Portage

Public System	• Surface water source from Athapapuskow Lake. • Serves 615 people.
Regulatory Jurisdiction	• Cranberry Portage LUD, Province of Manitoba.
Site-Specific Recommendations	• Educate residents on inspecting and properly maintaining their septic system holding tanks so they do not impact the public drinking water source.

Moose Lake Community Council

Public System	• Groundwater source with one well. • Serves 300 people.
Regulatory Jurisdiction	• Moose Lake Community Council, Province of Manitoba
Site-Specific Recommendations	• Remove the existing wellhead cover and install a proper wellhead casing with a removable top which can be accessed by lock and key only. • Check the sanitary seal on the wellhead when installing the new wellhead casing. • Review records of abandoned well located directly adjacent to the existing well to ensure it has been sealed properly. Seal adjacent abandoned well if it has not been sealed to date. • Seal abandoned well located along junction of Martin Road and Pine Street to reduce groundwater contamination concerns. • Install a water consumption meter to ensure groundwater use is within sustainable levels.

Mosakahiken Cree Nation

Public System	• Groundwater source with two wells serving Mosakahiken Cree Nation. • Serves 1,400 people on reserve by municipal hookup or truck delivery to cisterns. • Most homes in the townsite are connected to the water and sewage systems. • Water is delivered by truck from the plant to the small hamlets of Traders Lake and Crossing Bay.
Regulatory Jurisdiction	• Mosakahiken Cree Nation, Government of Canada
Site-Specific Recommendations	• Fractured limestone with little overburden is the focus of source protection of these wells. • Delineate a 1.5 km source water protection zone to ensure integrity of groundwater resources. • Conduct a source water assessment for the Mosakahiken Cree Nation public drinking water source. • Identify any threats (fuel storage, solid waste, etc.) to groundwater as part of the assessment. • Seal all abandoned wells in the source water protection zone.

Opaskwayak Cree Nation

Public System	• Groundwater source with three wells serving the OCN. • Serves 5,700 people. • OCN consists of several parcels of Reserve Land where the population live. The largest area is the OCN townsite. • Other parcels include Bracken Dam, Young Point, and White Bridge. These locations are connected to the municipal treated water from the RM of Kelsey. • OCNs Timberland Trailer Court is located within the Town of The Pas. Water here is provided by The Town of The Pas municipal water supply. • Watchi Bay and Cemetary Road parcels are on private wells or cisterns. Cemetary Road will be connected to the RM of Kelsey water supply through the water pipeline expansion project.
Regulatory Jurisdiction	• Opaskwayak Cree Nation, Government of Canada
Site-Specific Recommendations	• Delineate a 1.5 km source water protection zone to ensure integrity of groundwater resources for OCN. • Conduct a source water assessment for the OCN public drinking water sources. • Identify any threats (fuel storage, solid wastes, etc.) to groundwater. • Seal all abandoned wells in the source water protection zone.

More detailed information regarding well location, depth and water treatment operation specifications for sources under municipal or provincial jurisdiction were collected and recorded in the *Carrot-Saskatchewan River Source Water Assessment Plan*.

The Pas Water Treatment Plant

RM of Kelsey Groundwater Well

Athapapuskow Lake: source water for Cranberry Portage

ECOSYSTEM HEALTH

Key Challenges

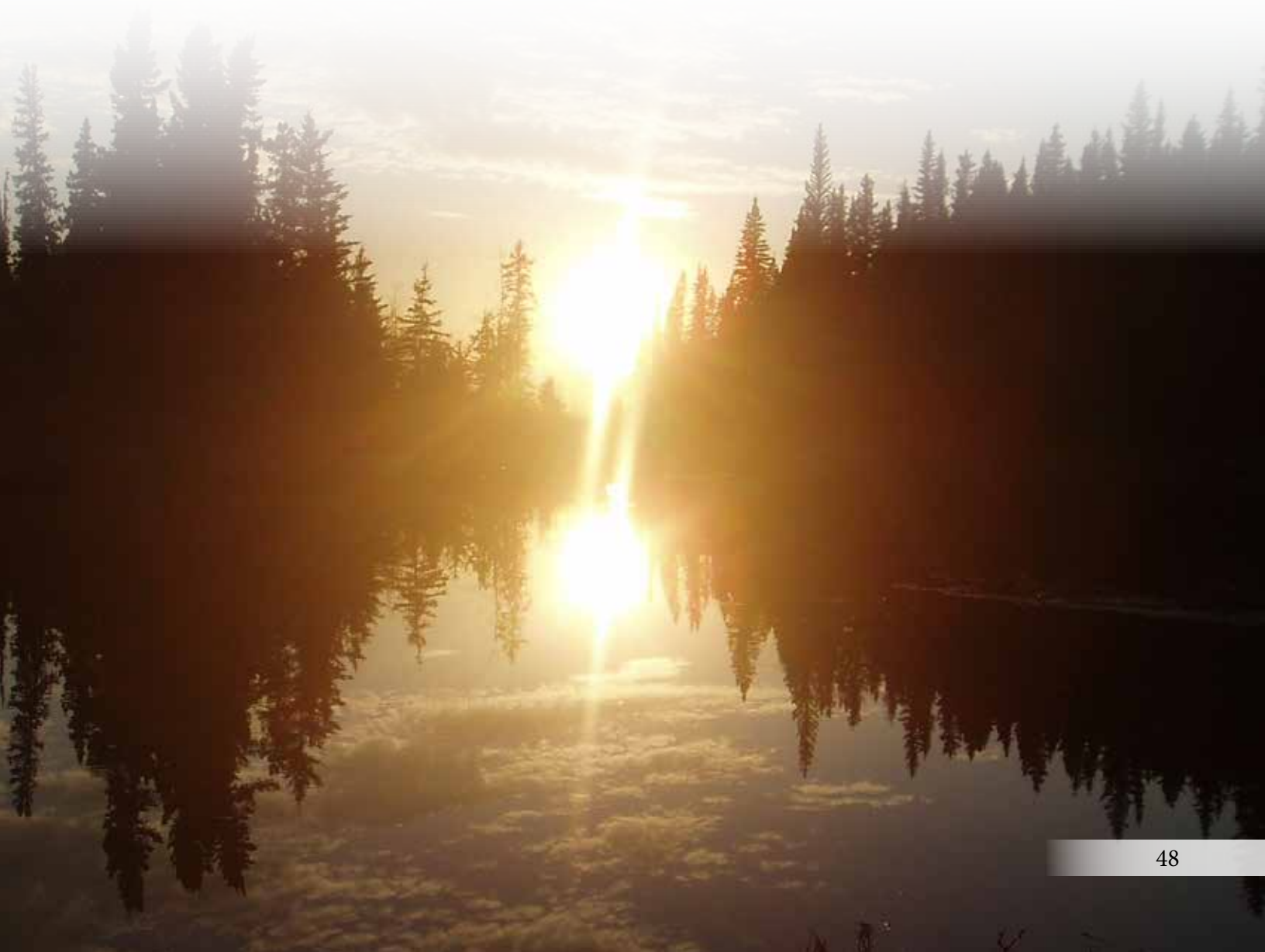
- The Saskatchewan River Delta is home to North America's largest freshwater inland delta.
- Surface water flows in the Delta have been altered by water control structures, impacting the aquatic health.
- Movement of aquatic invasive species, specifically through the Grand Rapids point of entry or by transfer from boats from water bodies outside of the watershed.
- Development, recreation and tourism pressures.

Recommended Action	Targeted Area	Measures of Success
Action 3.1: Investigate invasive species (rainbow smelt, zebra mussels) threats. **Lead:** MCWS – Fisheries **Support:** KCD	All points of entry to the watershed, specifically at the Grand Rapids Generating Station and along highways through movement of boats	Prepare a report with identified points of entry for invasive species into the watershed and provide specific measures to prevent the spread of invasive species.
Action 3.2: Provide information and education to the public regarding invasive species within the watershed (i.e. loostrife, zebra mussels, wild rice, rainbow smelt). Engage the public in controlling invasive species. **Lead:** MCWS – Fisheries, MAFRD **Support:** KCD	Watershed wide	Provide educational materials to watershed residents.
Action 3.3: Recommend a boat wash station at the junction of highway 6 and 60 and at the junction of highway 10 and 60. **Lead:** MCWS - Fisheries **Support:** KCD	The junction of PTH 6 and 60, as well as the junction of PTH 10 and 60	Establish boat wash stations at the two major intersections leading into the watershed.
Action 3.4: Provide signage at boat launches on aquatic invasive species and indicate their destructive behaviours. **Lead:** MCWS – Fisheries **Support:** KCD	Rocky Lake, Lake Athapap, Cranberry Lakes and the Saskatchewan River	Place a sign at 10 prominent boat launches.

Recommended Action	Targeted Area	Measures of Success
Action 3.5: Support the *Manitoba Boreal Woodland Caribou Recovery Strategy* for long term viability of the Bog and Naosap-Reed caribou ranges, as indicator of ecosystem health. **Lead:** MCWS – Biodiversity, Habitat and Endangered Species Section **Support:** Industry, MCWS – Protected Areas Initiative	Watershed wide	Implement the recovery strategy for self-sustaining populations of the Bog and Naosap-Reed caribou ranges.
Action 3.6: Review proposed commercial, recreational and industrial disturbances to the Bog and Naosap-Reed range boreal woodland caribou. **Lead:** MCWS – Biodiversity, Habitat and Endangered Species Section **Support:** Industry, MCWS – Protected Areas Initiative	Watershed wide	Make recommendations to mitigate against commercial, recreational and industrial disturbances.
Action 3.7: Support the Lake Sturgeon management board in long-term recovery planning for sturgeon in the Saskatchewan River. **Lead:** Saskatchewan River Sturgeon Management Board **Support:** MCWS – Fisheries	Saskatchewan River	Prevent further decline of Lake Sturgeon populations in the watershed.
Action 3.8: Facilitate tree planting for reforestation and biodiversity purposes. **Lead:** KCD **Support:** Landowners and Stakeholders	Watershed wide	Plant 100,000 trees by 2025.
Action 3.9: Develop a new regional waste management regional site with an appropriate liner so pollution by leechate will not percolate down, impacting groundwater. **Lead:** Town of The Pas **Support:** RM of Kelsey, OCN, MCWS - Environmental Enforcement	Watershed wide	Establish an operational site built to current standards by 2020.

Recommended Action	Targeted Area	Measures of Success
Action 3.10: Create a drop-off site for farm chemical containers as a means of controlling chemical leaching and soil contamination at the location of the new regional waste management site. **Lead:** Town of The Pas **Support:** RM of Kelsey, OCN	Watershed wide	Develop the drop-off site to restrict chemical leaching and soil contamination.
Action 3.11: Implement and promote a composting program. **Lead:** KCD **Support:** Residents	Watershed wide	Reduce landfill volume and increase fertility of garden soils through the use of composted organic waste materials as natural fertilizers.
Action 3.12: Prevent the spread of burdock within the watershed. **Lead:** KCD **Support:** Landowners , MAFRD	Riparian areas, especially along the Carrot River	Promote use of the KCD burdock sprayer to landowners, restricting the spread of burdock in the watershed.
Action 3.13: Establish a native grass plot for demonstration purposes by KCD. **Lead:** KCD **Support:** Landowners, MAFRD	Carrot Valley	Establish a two hectare native grass plot by 2017.
Action 3.14: Promote and encourage sustainable eco-tourism activities within the watershed. **Lead:** The Pas Community Development Corporation **Support:** KCD, Residents	Watershed wide	Eco-tourism activities are supported, as noted in *Tomorrow Now - Manitoba's Green Plan.*
Action 3.15: Identify educational initiatives through annual tours and provide opportunities to view district programming. **Lead:** KCD **Support:** Landowners	Watershed wide	Host an annual educational tour of the area.

Recommended Action	Targeted Area	Measures of Success
Action 3.16: Disseminate information to watershed residents via educational materials and update the KCD website. **Lead:** KCD **Support:** Watershed stakeholders	Watershed wide	Increase resident awareness and ownership of the watershed.



DEVELOPMENT PLANNING LINKAGES

Development plans are local policy documents which incorporate provincial land use policies and local policies for organized development of local land resources. Development plans, including zoning by-laws, identify where certain types of development can or cannot occur. This includes development regarding residential, commercial, recreational and industrial uses.

The RM of Kelsey is currently in the process of completing an in depth review of its existing plan and policies in regards to the RM development plan and zoning by-laws. Through cooperative planning and the consideration of respective planning processes, the Carrot–Saskatchewan River Integrated Watershed Management Plan and local planning authorities can work together to improve the health and sustainability of the watershed in an economically viable manner.

Watershed Wide Considerations

The following recommendations should be considered by development planning authorities when creating or amending their development plans.

Recommendations for new development

1. Recommend that environmental mitigation measures are carried out to offset impacts of new development within RM or town boundaries.
2. Adopt policies for future development projects to incorporate low-impact, environmentally conscientious concepts into planning and development to minimize pollution loads and improve water-use efficiency, such as storm water retention, environmentally friendly drainage construction, grey-water recycling, low-flow water fixtures and water-saving appliances.
3. Adopt policies for a minimum set-back distance of 30 m for new development or buildings along shorelines to protect natural vegetation along shorelines.
4. Adopt policies to limit the removal or degradation of riparian habitat within 30 m of a natural waterway for all new developments.
5. Strengthen development plan policies for protection of agricultural lands, to prevent loss of productive lands and to support a strong agricultural economy.

Recommendations for all public drinking water sources

6. Intensive and high-pollution risk development activities should be restricted in public drinking water source zones. Activities may include land uses and structures that have a high risk of causing pollution, including chemical fertilizer storage, disposal fields, fuel tanks, waste disposal grounds, and waste water treatment facilities. Where restriction is not possible, development may be considered in public drinking water source zones provided:
   a. the proponent can prove by adequate engineering or hydro-geological investigation that the proposed activity will not cause pollution of the public drinking water supply or;
   b. appropriate precautionary measures have been taken to sufficiently mitigate the risk of endangering the quality of the water supply for public drinking water supply purposes.
6. To prevent significant surface water quality and drinking water quality deterioration, developments in or near surface waters and riparian areas will be restricted, or limited, if they:
   a. lead to the contribution of nutrients, pathogenic organisms, deleterious chemicals or materials to these waters;
   b. accelerate erosion and bank instability;
   c. cause the removal of natural vegetative cover; and/or
   d. have an impact on in-stream flows required to maintain healthy aquatic ecosystems.

7. Adopt policies for the mandatory sealing of wells in areas that become serviced by public water systems:
   a. seal unused, abandoned wells that not do meet standards within a source water protection zone;
   b. ensure an emergency response plan is developed for each public water system.

Ecological considerations

8. Install barriers and signs to restrict snowmobile and ATV traffic in ecologically sensitive areas.

Traditional Knowledge considerations

9. Identify and restrict development on ecologically sensitive areas.
10. Incorporate Traditional Knowledge into development plans throughout the watershed. Local Aboriginal input will outline traditional uses and integrate sustainability for future developments in the watershed.

The following groups are responsible for development planning within the Carrot-Saskatchewan River Watershed:

Municipal Planning Authorities:

- The Rural Municipality of Kelsey
- The Town of The Pas

First Nations:

- Mosakahiken Cree Nation
- Opaskwayak Cree Nation

Aboriginal and Northern Affairs Communities:

- Moose Lake Community Council

Crown Lands:

- The Province of Manitoba

Painting of Edwards Street, The Pas
Photo courtesy of James Dean

PROVINCIAL LEGISLATION

The Province of Manitoba has established the following legislation related to environmental management and water protection in Manitoba. These legislations and regulations support the Carrot-Saskatchewan River Integrated Watershed Management Plan.

The *Water Protection Act* and Regulations

- Manitoba Water Quality Standards, Objectives and Guidelines Regulation
- Nutrient Management Regulation
- Phosphorus Reduction Regulation

The *Ground Water and Water Well Act* and Well Drilling Regulation

The *Water Rights Act* and Water Rights Regulation

The *Water Resources Administration Act* and Regulations

- Designated Flood Area Regulation
- Designated Reservoir Areas Regulation
- Establishment of Designated Diking Systems Regulation

The *Water Resources Conservation Act*

The *Drinking Water Safety Act* and Regulations

- Drinking Water Safety Regulation
- Drinking Water Quality Standards Regulation

The *Indian Act*

The *First Nations Land Management Act*

The *Environment Act* and Regulations

- Livestock Manure and Mortalities Management Regulation
- Onsite Wastewater Management Systems Regulation
- Pesticides Regulation
- Waste Disposal Grounds Regulation
- Water and Wastewater Facility Operators Regulation
- Classes of Development Regulation

The *Dangerous Goods Handling and Transportation Act* and Storage and Handling of Petroleum Products and Allied Products Regulation

The *Mines and Minerals Act* and Quarry Minerals Regulation

The *Planning Act* and the Provincial Planning Regulation

The *Public Health Act* and Protection of Water Sources Regulation

REFERENCES

- Carrot River Watershed Source Water Protection Plan, Saskatchewan Watershed Authority, 2012 http://www.crwatershed.ca/crvwa/pdf/CarrotRiverWatershedPlan.pdf
- Clearwater Lake Provincial Park Management Plan http://www.gov.mb.ca/conservation/parks/pdf/planning/2013/clearwater_lake_management_plan.pdf
- Environment Canada archived and real time hydrometric data
- Archived: http://wateroffice.ec.gc.ca/search/search_e.html?sType=h2oArc
- Real Time: http://wateroffice.ec.gc.ca/index_e.html
- Manitoba's Conservation and Recovery Strategy for Boreal Woodland Caribou, 2005 http://www.gov.mb.ca/conservation/wildlife/sar/pdf/bw_caribou_strategy.pdf
- Manitoba Hydro Grand Rapids Generating Station https://www.hydro.mb.ca/corporate/facilities/brochures/grand_rapids_1107.pdf
- Manitoba Lake Sturgeon Management Strategy, Conservation and Water Stewardship Fisheries Branch, 2015. https://www.gov.mb.ca/waterstewardship/fish/pdf/mb_sturgeon_mgmt_2012.pdf
- Practical and Sustainable Watershed Management, Five Year Management Plan and Ten Year Vision of Kelsey Conservation District
- Research Report on the Summerberry Marsh, Ducks Unlimited Canada, 2011
- SaskPower E.B. Campbell Hydro Station www.scs.sk.ca
- The Second Five Years, Kelsey Conservation District, Practical and Sustainable Watershed Management
- The State of the Saskatchewan River Basin, Partners FOR the Saskatchewan River Basin, 2009 http://www.saskriverbasin.ca/page.php?page_id=70

Lake Athapapaskow