



Whitemud River

Integrated Watershed Management Plan

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Executive Summary

The Whitemud River Integrated Watershed Management Plan was developed in partnership with the Whitemud Watershed Conservation District, the Province of Manitoba, stakeholder organizations, and watershed residents. The purpose of the plan is to positively influence the stewardship of land, water, and aquatic ecosystems in the watershed over the next 10 years.

The plan represents a watershed area, beyond municipal and community boundaries, connected by shared land and water. This watershed connection is most obvious when activities and developments in the upstream area of the watershed cause negative impacts downstream such as flooding, riverbank erosion, and water quality degradation.

In the early stages of the planning process, four public consultation meetings were held in communities throughout the watershed. The purpose of the meetings was to openly discuss and document watershed issues and concerns. This formed the starting point for the plan and led to the establishment of three watershed goals.

Watershed Goals

1 Groundwater Protection

2 Soils and Natural Area Preservation

3 Surface Water Management

Actions were developed to meet each of the three watershed goals. The implementation of these actions through on-going partnerships, communication and cooperation over the next 10 years is crucial to protecting and enhancing the long-term health and sustainability of the Whitemud River Watershed.

Introduction

What is an Integrated Watershed Management Plan?

An Integrated Watershed Management Plan (IWMP) is a document prepared with input from the community that describes the actions needed over time to achieve a sustainable, healthy watershed. The plan can be thought of as a roadmap for the community that outlines watershed priorities and presents strategies to address these priorities.

Why watershed planning?

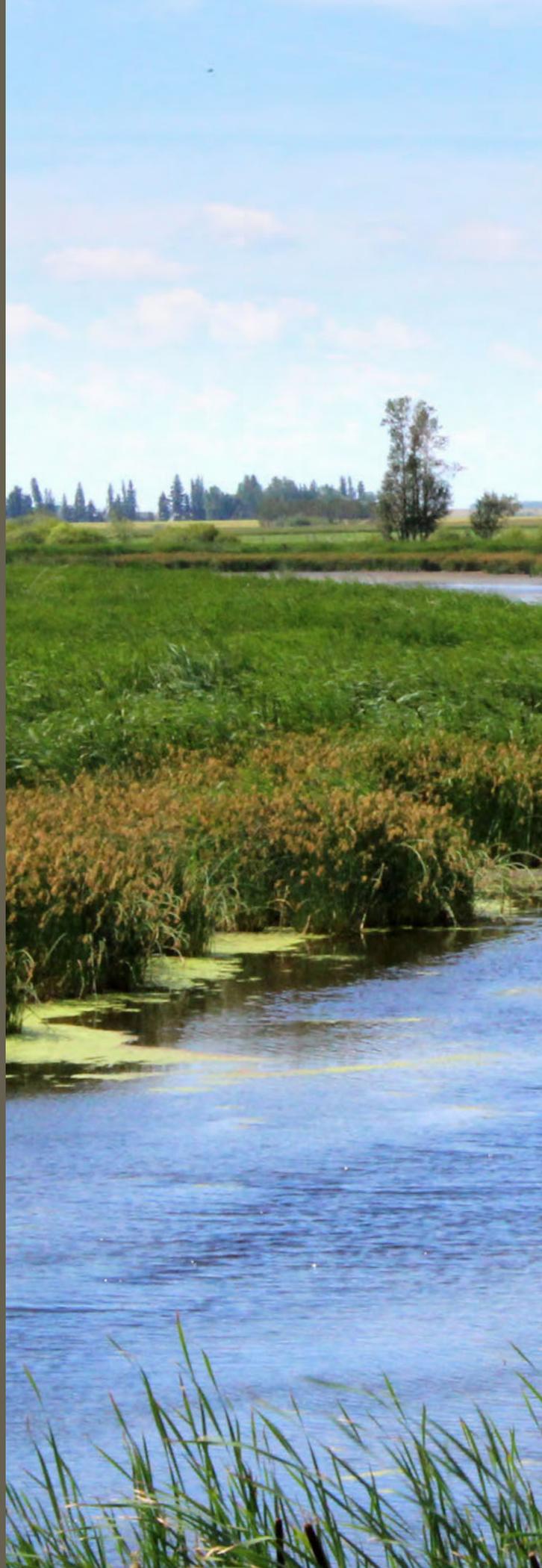
A watershed can be defined topographically as an area of land in which all water drains to a common point. Using a watershed as the planning unit provides opportunities to address water quality and quantity issues in both the upstream and downstream portions of a watershed. Working within a watershed gives people the opportunity to address water quality, quantity, community, and habitat issues beyond the scope of a single jurisdiction like towns or municipalities.

Why integrated planning?

An integrated watershed management plan uses an inclusive planning process to identify watershed issues and share knowledge. It is presented as a plan of action that combines the needs of people and diverse industries, while being supportive of ecosystems within the watershed.

Who will lead implementation?

The Whitemud Watershed Conservation District was established on the same boundaries as the Whitemud River Watershed. The Whitemud Watershed Conservation District's mission is to be a progressive community driven watershed organization dedicated to raising awareness about sustainable land and water stewardship practices and providing incentives for conservation programs to achieve a healthy diverse landscape and maintain a viable thriving community. Whitemud Watershed Conservation District is governed by a nine member board and is funded through a municipal-provincial partnership. The District offers incentive based programming aimed at improving soil, water and aquatic ecosystem health, and provides educational programs to schools and watershed residents. The District also maintains much of the crossing and waterway infrastructure within the watershed. The primary role of the District will be to carry out and coordinate the implementation of the actions within this plan.





The Whitemud River Watershed

Overview

The Whitemud River Watershed has one of the most diverse landscapes in Manitoba. From the protected forests of Riding Mountain National Park to the high value irrigated cropland of the Assiniboine Delta Aquifer to the valuable wildlife habitat of the Big Grass Marsh, this watershed has a lot to offer the economy, society and nature.

The Whitemud River Watershed is approximately 730,000 hectares (1.8 million acres) in size. This large area is bordered by Lake Manitoba to the east, Riding Mountain National Park to the northwest, and extends south to Carberry. The major communities within the watershed include Kelwood, Glenella, Riding Mountain, Plumas, Waldersee, Arden, Neepawa, Brookdale, Edrans, Sidney, Austin, Gladstone, MacGregor, Macdonald and Westbourne. Major waterways within the watershed are the Whitemud and Big Grass Rivers, and the Rat, Beaver, Squirrel, Pine, Boggy, Brookdale, and Spring Creeks. The major industry in the watershed is agriculture which predominates throughout the watershed.

Climate

Average annual precipitation in the watershed ranges from 460 mm to 530 mm with growing season accumulations ranging from 330 mm to 380 mm, which is typical of southwestern Manitoba. Annual precipitation can vary greatly year to year but the majority of the precipitation is received during summer rainstorms. The average number of frost free days ranges from 108 to 117 days. In the summer, the peak monthly average daytime high is 25°C in July. In the winter, the peak monthly average daytime high is - 12°C in January.

Land Geology and Elevation

The sloping topography of this area was shaped thousands of years ago by receding glaciers. To the northwest, the Manitoba Escarpment marks the old shoreline of Lake Agassiz. To the south, the sandy soils mark the Assiniboine Delta Aquifer which was created by a large glacial river depositing sediments into a bay of Lake Agassiz. Glacial till is noted in most areas outside of the Assiniboine Delta Aquifer. Near Lake Manitoba, till is overlain by a thick layer of clay and silty sand left by the retreat of glacial Lake Agassiz.

Significant changes in elevation occur throughout the watershed, with values ranging from 721 metres above sea level (masl) in the Riding Mountain National Park, down to 250 masl in the eastern portion of the watershed near Whitemud River Delta at Lake Manitoba (Figure 1). There is a sharp change in elevation associated with the Manitoba Escarpment near Riding Mountain National Park. From there, there is a gradual decrease in elevation heading east across the watershed. The Manitoba Escarpment runs south and slightly east through the middle of the watershed. The area west of the escarpment is highlighted by numerous small lakes (potholes) and hills. East of the escarpment, the land slopes gently towards the western shore of Lake Manitoba.

The Manitoba Escarpment, including the eastern edge of Riding Mountain National Park, is the most erodible area of the Whitemud River Watershed. This is due to the steep slopes associated with the landscape as well as the shale soils that exist along this area.



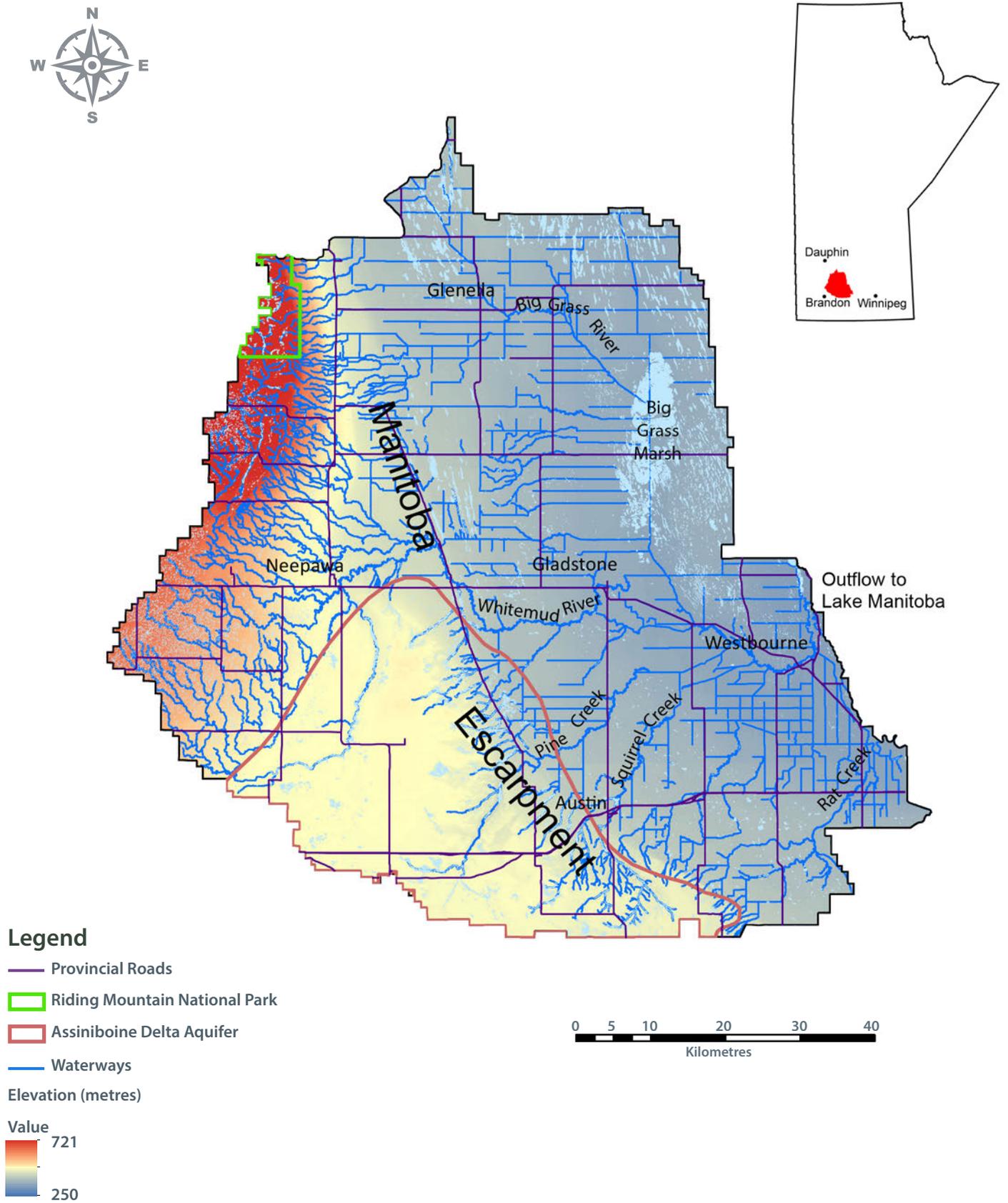


Figure 1: Topography in the Whitemud Watershed

Soils and erosion

The Whitemud River Watershed is mostly composed of fertile soils that support a strong agricultural economy. It is important to local residents to ensure and support continued productive agriculture on good quality soils. According to the Canada Land Inventory, approximately 59% of the soils are classified as Class 1 to 3 (Figure 2) with little to no limitations for crop production. Approximately 37% of the soils are considered Class 4 to 7. These classes have moderate to severe limitations for crop production and are often better suited to other land use activities such as pasture land. Just over 2% of the soils are organic; mostly concentrated around the Big Grass Marsh area (AESB and MAFRI, 2011).

Approximately 43% of the watershed is considered to have moderate to severe wind erosion risk (AESB and MAFRI, 2011), primarily light sandy soils of the Assiniboine Delta Aquifer. Water erosion is also a concern in the watershed. Areas with the greatest risk of water erosion are concentrated along the slopes of the Manitoba Escarpment (Figure 1).



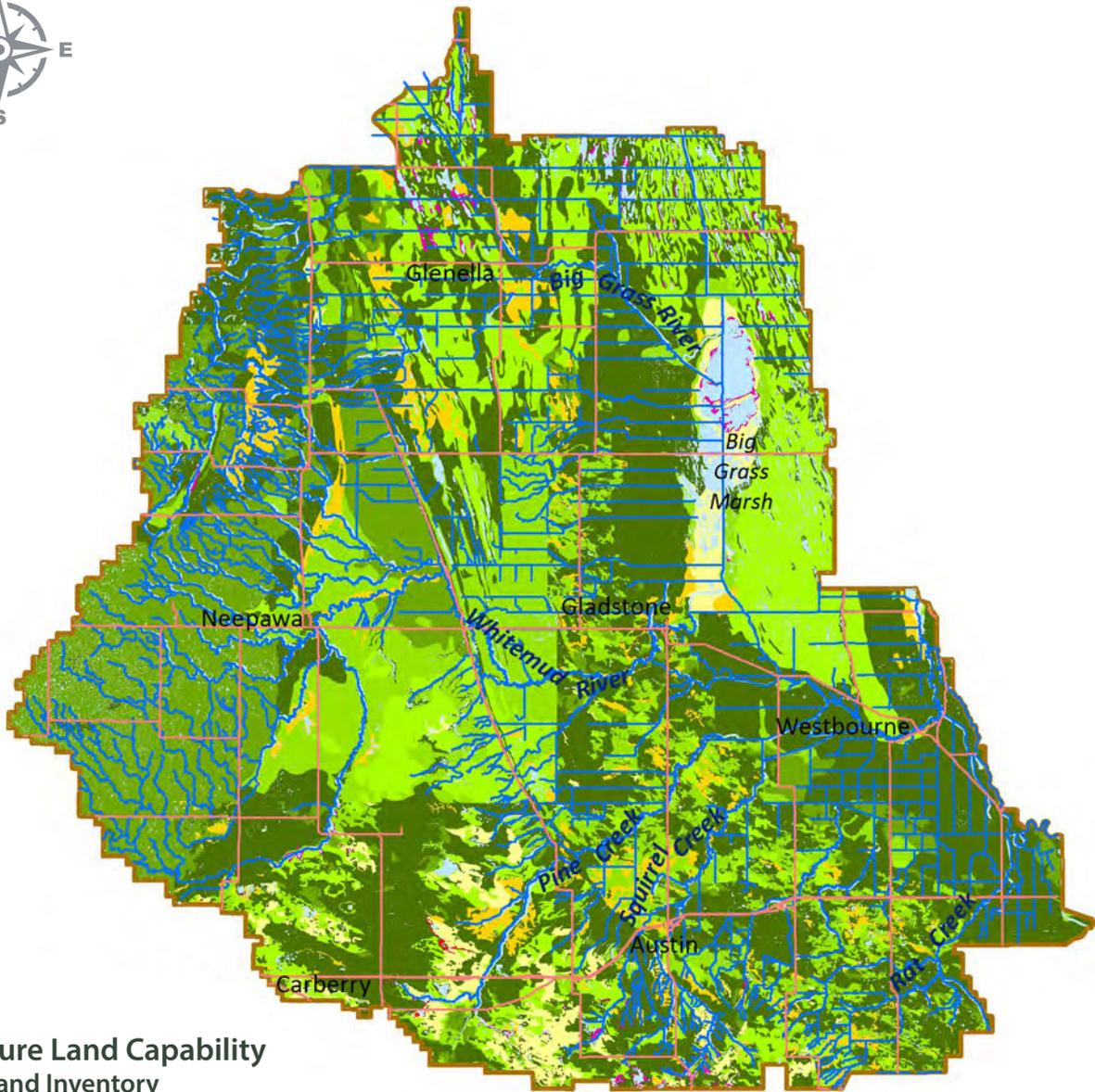
The Canada Land Inventory (CLI) is a comprehensive multi-disciplinary land inventory that identifies land capability for agriculture, forestry, wildlife, and recreation. The land capability for dry land agriculture is based on evaluation of soil characteristics that influence soil suitability and limitations for agricultural use. Class 1 lands have the highest and class 7 have the lowest capability to support agricultural land use activities.



Challenge: Soil Erosion by Wind and Water

Approximately 43% of soils in the Whitemud River Watershed have a moderate to severe risk of wind erosion. Intensive agricultural development has resulted in a significant loss of natural cover including the removal of shelterbelts and treed areas. This loss of natural cover combined with periods of minimal cover like those seen with annual cropping make the soils more vulnerable to significant soil erosion by wind (AESB and MAFRI, 2011).

Significant topographical changes from the Manitoba Escarpment to Lake Manitoba combined with the movement of surface water off of these areas contribute to water-based erosion and sediment deposition downstream. Erosion and sediment deposition downstream can negatively impact water quality, degrade aquatic habitat, and cause surface water management issues which increases the need for waterway maintenance in downstream waterways.



**Agriculture Land Capability
Canada Land Inventory**

-  Provincial Roads
-  Waterways
-  Waterbodies



-  1 - No Significant Limitations
-  2 - Moderate Limitations
-  3 - Moderately Severe Limitations
-  4 - Severe Limitations
-  5 - Very Severe Limitations (Improvement Possible)
-  6 - Very Severe Limitations (Improvement Not Possible)
-  7 - No Capability for cropping or feasible pasture
-  O - Organic Soils

Figure 2: Agriculture Land Capability of the Whitemud Watershed

Land Cover

The predominant land cover in the watershed is agriculture (Figure 3). The type of agriculture practiced is mostly annual crop production which accounts for about 50% of the land use in the watershed. Annual crop production impacts the watershed both negatively and positively. Annual crops grown on soils that are prone to wind or water erosion may have a negative impact on soil and water quality so efforts should be taken to minimize these risks. Conservation tillage and zero tillage are common in the Whitemud River Watershed, whereas conventional tillage practices account for less than 50% of tillage practice (AESB and MAFRI, 2011).

Pasture land and perennial crops are common, accounting for approximately 25% of the land use within the watershed (Figure 3). There are two large community pastures located in the watershed, as well as a third community pasture that is partially located in the watershed on the north side. Land use within the watershed changes as the agricultural markets change. Over recent years, there has been an increase in annual crops seeded because of a market shift away from beef production (AESB and MAFRI, 2011).

Potato production is an important industry in the southern portion of the watershed (as seen on page 7). The sandy soils in the Assiniboine Delta Aquifer region are well suited to irrigated potato production; however they also have higher potential for leaching of nutrients and pesticides through the soil profile. This risk, combined with the consumption of water by irrigators, is a concern to residents of the watershed.

The high return on potatoes has also motivated many farmers to increase irrigated potato acres, which has resulted in significant land clearing, especially in the southern part of the watershed.

Land Cover Changes

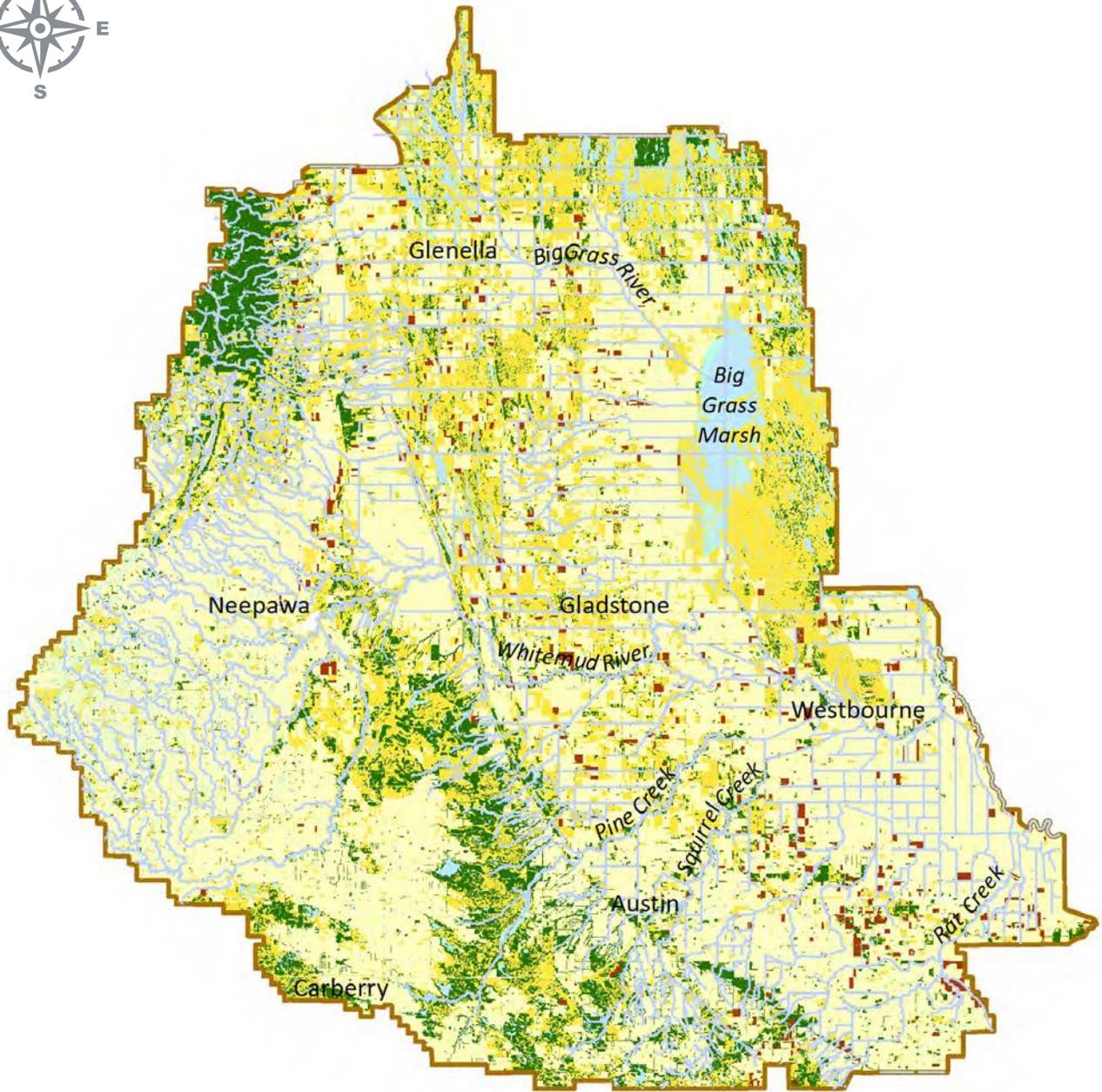
Land cover has changed over the years in the Whitemud River Watershed. A large drop in the amount of grass cover has occurred with a loss of approximately 46,700 ha of grasslands between 1993 and 2006. One reason for this decrease was land conversion from grasslands to forage and annual crops; however, the largest factor is the natural succession from grasslands to forested areas. Woody cover has stayed similar in quantity even though there has been significant work done to clear land for crop production. Annual crops have increased by 12,391 ha between 1993 and 2006 (AESB and MAFRI, 2011).

A reduction in the amount of wetlands within the Whitemud River Watershed has also been seen, however analysis of wetland trends is not as accurate due to natural climate variability and its affect on the size of wetlands. A decrease of 4,000 ha was seen in wetlands between 1993 and 2006, likely partially due to wetland drainage and partly from natural climate variability. This would mean less holding capacity on the landscape for water resulting in an increase in peak flows for small to relatively large floods (AESB and MAFRI, 2011).

Rosedale Farm

In 1966, the Rosedale Farm was purchased for the purpose of being used as a demonstration site for soil erosion control. The farm was a prime example of a highly eroded area due to poor farming practices, coupled with steep slopes and shale based soils with numerous creeks. These creeks experience a fast flow of water during runoff events due to the steep topography. The most severely eroded areas were planted to tree cover and the farmable areas were seeded to perennial cover. Later, dams were built and shelterbelts were planted on the property. Rosedale Farm works to showcase sustainable land management while remaining profitable in the farming community. Whitemud Watershed Conservation District took over the management of the farm in 1977.





Land Cover

-  Waterways
-  Agriculture Crop Land
-  Trees
-  Water
-  Grassland/Rangeland
-  Wetlands
-  Forage



Figure 3: Land Cover in the Whitemud Watershed

Water

Surface Water Quantity

Hydrology

The Whitemud River originates near Neepawa and flows in an easterly direction through Arden, Gladstone and Westbourne and then turns north towards Lake Manitoba. In the reach from Gladstone to Lake Manitoba, the river flattens out which results in an area where flood waters can commonly spread beyond the banks of the river during a flood event.

The Whitemud River travels a distance of 90 km but after adding all the twists and turns in the river the total distance the water travels is closer to 190km. The watershed has a drainage area of 730,000 hectares (1.8 million acres), with the entire drainage area originating within the watershed. This means there isn't any surface flow from areas outside of the watershed. All the water flows into the Whitemud River and then enters Lake Manitoba.

The entire Whitemud River Watershed flows through a single point in the Whitemud River to enter Lake Manitoba.

The average annual runoff volume for the Whitemud River at Westbourne is 200,000 dam³ (250,000 acre-feet). The majority of flow in the Whitemud River happens during the months of April and May during spring melt. This accounts for approximately 70% of the annual flow of the river. There is a lot of variability between the amount of flow each year dependant on high water events.

The Assiniboine Delta Aquifer is located in the southern region of the watershed under a thick layer of sandy soils. Around the margins of the aquifer, and along incised stream channels, the ground surface drops to meet the groundwater level. Here the water in the aquifer flows out to surface waterways. The reliable supply of baseflow supplied from the aquifer provides a more continuous flow of water in the Whitemud River than other waterways, which are more dependent on snowmelt or rain.

Waterway History

A watershed drainage system is a series of creeks, rivers, wetlands, drains, and ditches that work together to move water off the landscape. The Province of Manitoba began to expand the Whitemud River Watershed's drainage system in 1880. At this time, much of the watershed was covered by vast wetlands. Drainage districts were formed in an attempt to convert some of the large wetlands into farmland, as well as to alleviate flooding issues. Major wetlands such as the Big Grass Marsh and the Westbourne Marsh were completely drained. Early drainage works were not planned

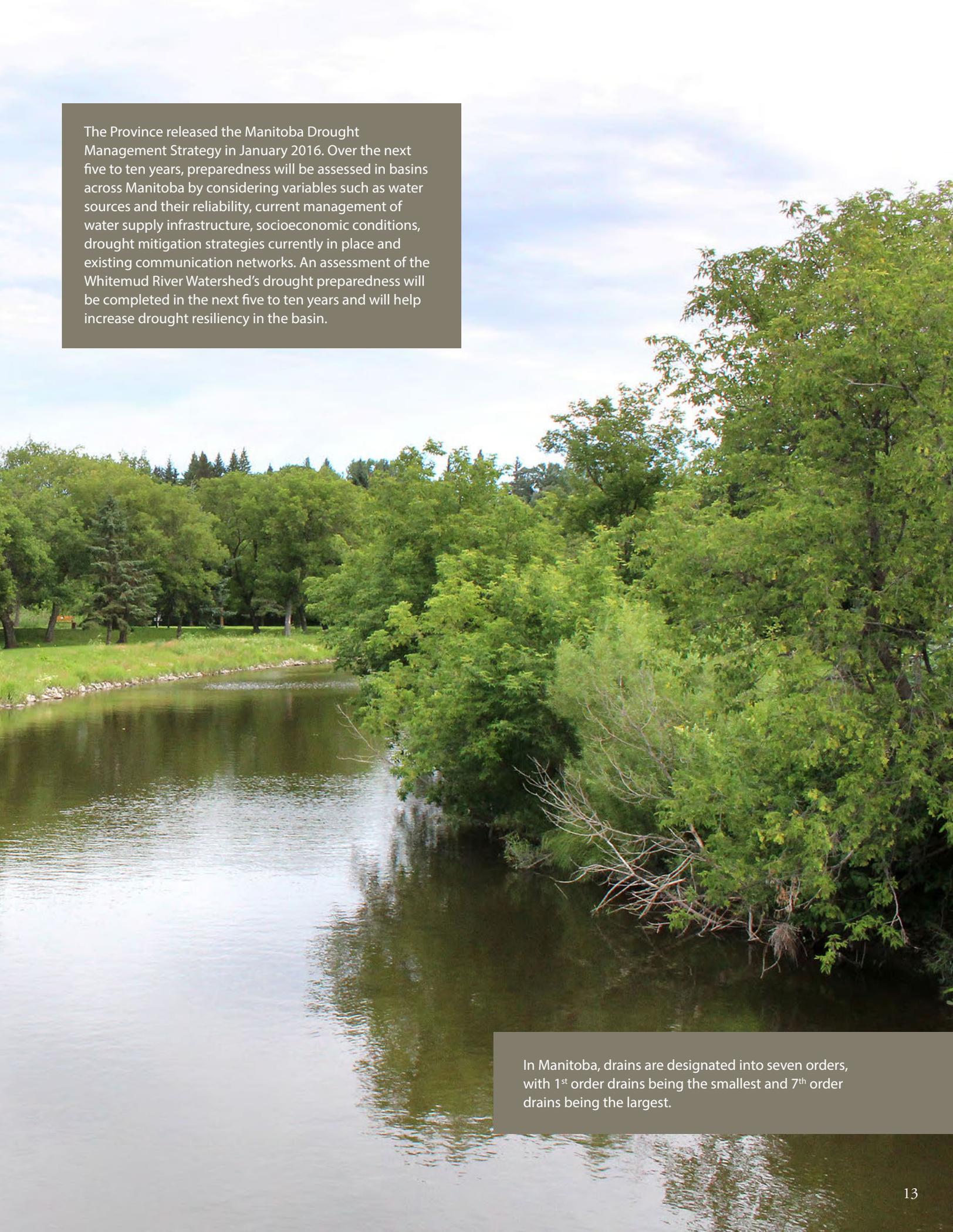
based on watershed principles, and as a result, some natural sub-watershed boundaries were significantly altered. The alteration of these sub-watersheds resulted in the flooding of many downstream landowners during periodic heavy runoff events. During this time period, wetlands were considered waste land and all efforts were made to increase the amount of farmable acres on the landscape (Golden Memories, 1980).

In 1965 the Province instituted the drain order system and assumed jurisdiction over the larger drains, which were of order 3 and higher; these drains were called Provincial Waterways. The local governments assumed jurisdiction of the order 1 and 2 drains. In 1972, the Whitemud Watershed Conservation District was established as a partnership between the Province, local municipalities, and local landowners to facilitate drainage using the watershed model. The Whitemud Watershed Conservation District began managing the existing drainage system and added many kilometres of small capacity drainage channels, mainly 1st and 2nd order drains. Between 1972 and 1985, the number of kilometres of drains within the District had almost doubled to approximately 1,770 km. In 1985, the Province of Manitoba passed the jurisdiction of the Provincial Waterways within the watershed to the Whitemud Watershed Conservation District. At this time, the maintenance of these waterways and the associated crossings and structures became the responsibility of the Whitemud Watershed Conservation District.

The watershed experiences high flow volumes during spring runoff and after extreme summer rainstorms causing flooding of agriculture land. Yet the majority of the lands are water deficient for most of the year. The Conservation District has used a combination of water retention structures, the protection of natural storage areas and drainage management to aid in addressing this issue.



In 1972, the Whitemud Watershed Conservation District became the first conservation district to be formed in Manitoba. One of the major responsibilities of the conservation district is to maintain and manage the designated waterways and associated crossings on a watershed basis.



The Province released the Manitoba Drought Management Strategy in January 2016. Over the next five to ten years, preparedness will be assessed in basins across Manitoba by considering variables such as water sources and their reliability, current management of water supply infrastructure, socioeconomic conditions, drought mitigation strategies currently in place and existing communication networks. An assessment of the Whitemud River Watershed's drought preparedness will be completed in the next five to ten years and will help increase drought resiliency in the basin.

In Manitoba, drains are designated into seven orders, with 1st order drains being the smallest and 7th order drains being the largest.

Surface Water Management Zones

In 1991, the Whitemud Watershed Conservation District developed a water management strategy for the Whitemud River Watershed to improve management of surface water management. As part of the water management strategy, 10 zones were created based on soil types, topography and land use. The Strategy was updated in 2007. A detailed surface water management plan is included starting on page 34.

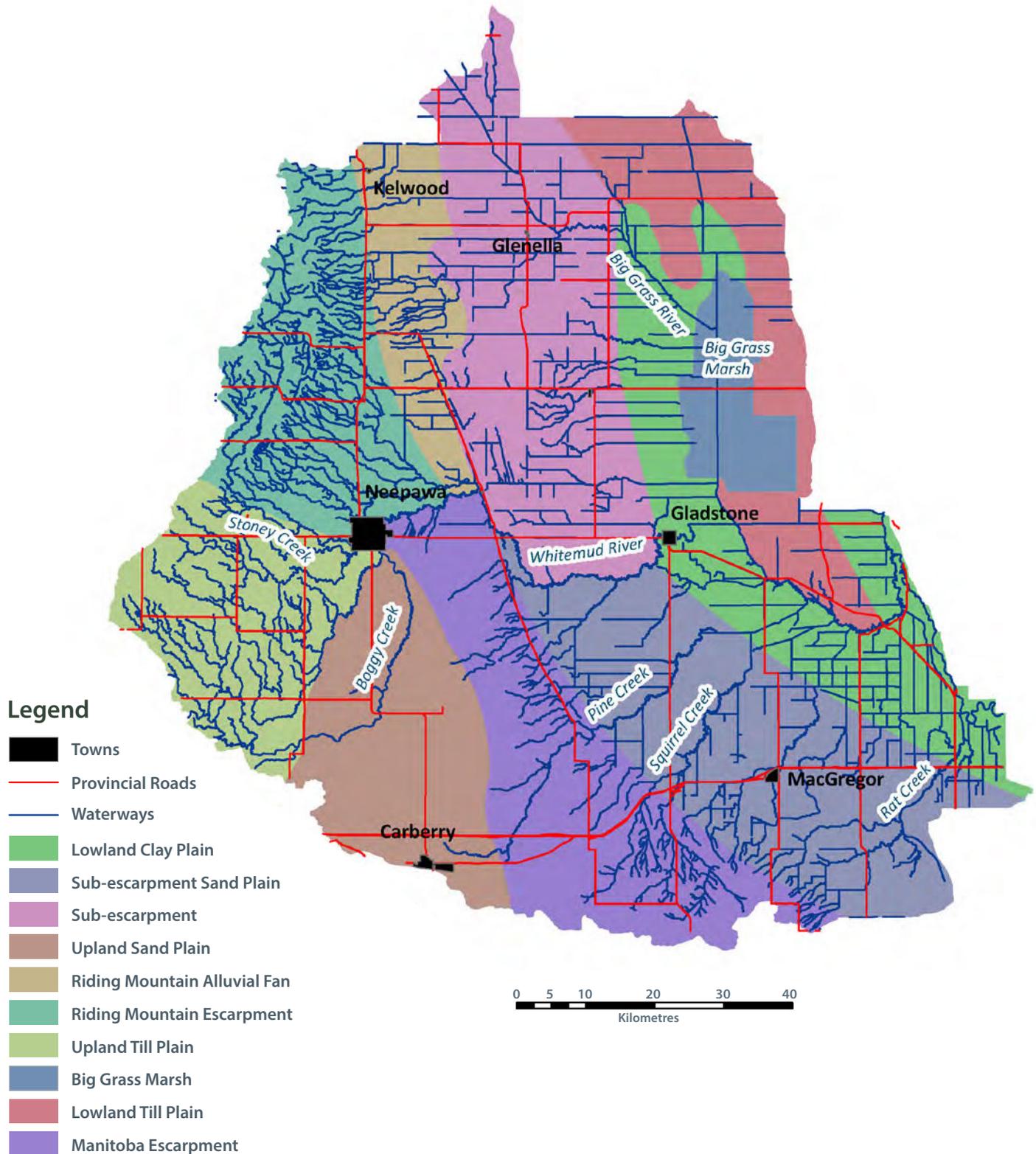


Figure 4: Whitemud River Surface Water Management Zones

Surface Water Quality

Water quality data in the Whitemud River Watershed has been collected since 1973. The Province of Manitoba has 11 monitoring sites, of which two are long term monitoring sites. These two long term monitoring sites are located on Boggy Creek at Neepawa and the Whitemud River at Westbourne. Upon analysis of water quality data, the following conclusions have been reached:

- The Water Quality Index for the Whitemud River Watershed is classified as “good” in most years.
- A slow and steady increase in nitrogen concentrations over time has been observed.
- Total phosphorus concentrations were consistently high and above recommended water quality objectives. Phosphorus levels are often high in prairie streams due to naturally occurring sources of phosphorus in the soils as well as human activities such as the application of artificial fertilizer and manure on farmland and sewage effluent discharges from wastewater plants, lagoons, and private septic systems. Phosphorus levels have increased significantly since the late 1990s in the Whitemud River Watershed. The current trend is an increase in phosphorous each year.

- Fecal coliform concentrations have decreased significantly since records began in 1973. This is likely due to improved manure application practices and better wastewater management.
- *E. Coli* densities are typically below both the recreational and irrigation water quality objectives.
- Overall, the trend in annual mean total dissolved solids has remained relatively constant from 1973 to present, although seasonal variability has slightly increased since 1998. Notably the autumn and winter periods tend to show elevated concentrations of total dissolved solids as compared to the spring and summer seasons.

Drainage of wetlands is of great concern especially in the western portion of the watershed, where there is a high concentration of wetlands commonly referred to as potholes. These wetlands act as natural filters by absorbing chemicals, nutrients, sediments and other impurities while at the same time providing water storage. However, the market trend has been for agriculture production to outweigh the importance of these wetlands. Therefore, many wetlands have been drained causing a decrease in water quality and an increase in peak flows for small to moderately large floods.





Aquatic Ecosystems and Fisheries

The Whitemud River Watershed is a very unique and diverse watershed because of the varying water bodies and stream types. Aquatic ecosystems vary from long, wide boggy waterways, deeply down cut steep natural waterways, and manmade trapezoidal drainage ditches. Each type of waterway has their own unique characteristics that can be beneficial or harmful to aquatic ecosystem health. Generally, the waterways that are left in their natural state with meanders, down cutting, and abundant vegetation provide the highest quality ecosystems for aquatic life. Riparian areas along these natural waterways generally have more woody cover with natural contours. This type of cover allows for better nutrient uptake and can significantly slow water from travelling to downstream areas. Manmade drainage channels speed up water velocities and contain water flows from flooding adjacent lands. These generally straight drains are created to be kept clear of trees and shrubs with mild sloping dykes. This allows them to be easy to maintain from debris and can quickly move water from one area to another but the lack of woody vegetation makes for poor aquatic habitat as the sun heats the water.



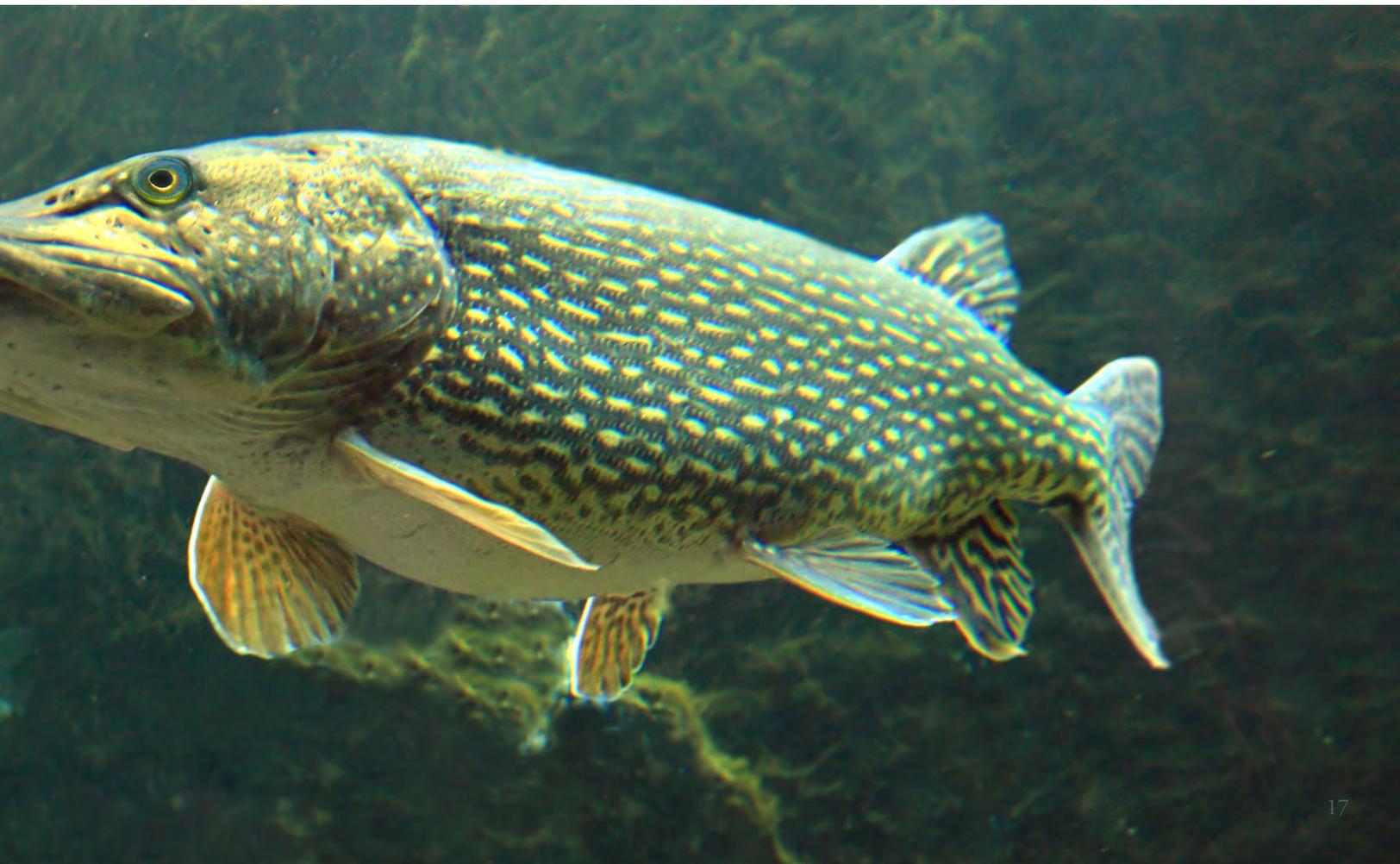
The Whitemud River provides passage for a variety of fish types from Lake Manitoba. This access to important habitat types, includes spawning grounds, at different times of the year. Improvements are possible at various water control structures across the watershed where fish passage is limited.



The Whitemud River Watershed supports a variety of fish species and is a major contributor to the Lake Manitoba fishery. Unfortunately, the Whitemud River has some fish passage challenges with numerous water control structures along its route which can impede fish movement and passage during low water flow events.

In the east escarpment region of the Riding Mountain National Park, the Kinch, Snake, and Stoney creeks have been stocked with brook trout biannually and now have self sustaining populations. These brook trout streams are the furthest south naturally occurring brook trout areas in Manitoba.

Lake Irwin is the largest recreational fishery in the watershed. It's an aerated water body with a dam at the downstream end and is managed as a stocked northern pike fishery. The lower reaches of the Whitemud River system support many species of large bodied fish such as northern pike, yellow perch, freshwater drum, walleye, white suckers, common carp, as well as, numerous small bodied fish species. At the Big Grass Marsh, there is a large population of northern pike. At one point in time, there was a commercial fishery for northern pike, but presently, the Big Grass Marsh is only used for recreational fishing. The lower reaches of the Whitemud River have been identified as an important walleye spawning area for Lake Manitoba walleye. There was a walleye hatchery operation that opened in 1947 at the mouth of the Whitemud River but operation ceased due to lack of funding in 1959.



Groundwater

Aquifers

Groundwater is the major source of water for private domestic use, as well as for municipal, industrial, commercial and agricultural purposes within the Whitemud River Watershed. Groundwater discharge also provides base flow to rivers and streams, and contributes water to marshes and wetlands. There are a number of aquifers in the watershed. The Assiniboine Delta Aquifer is located in the southern region of the watershed, while many other smaller aquifers are scattered across the watershed. Most of these scattered aquifers are shallow, small, and low yielding.

Deep bedrock and overburden aquifers are present, but the water quality is rarely conducive to development. These bedrock aquifers contain salty water, which leaves only the overburden aquifers for drinking water sources within the watershed. The bedrock aquifers include Devonian and Jurassic aged limestone and dolomite (carbonate) bedrock, Cretaceous sandstone bedrock and fractured shale bedrock. Fractured shale along the Manitoba Escarpment accounts for a small number of wells and is the most common bedrock found in the watershed.

Wells drilled into deep overburden or bedrock aquifers are likely to encounter saline water. As a consequence, most wells in the watershed are relatively shallow, generally less than 30 metres. This low overburden thickness allows for contaminants to reach groundwater supplies much easier than deeper groundwater supplies. Large diameter bored wells are commonly used in areas where aquifer yields are low or unreliable, such as in silt or silty sands. The large diameter of the well bore compensates for this by adding additional storage capacity.

Public Drinking Water Systems

In Manitoba, the Office of Drinking Water defines a public water system as a potable supply of drinking water with 15 or more connections. The Whitemud River Watershed contains nine public drinking water systems, all of which withdraw their water from a groundwater source as seen in Figure 5. Some public drinking water systems use multiple wells to withdraw water for a single community as seen in the Whitemud River Watershed where these nine public systems are serviced by 15 wells. There are also many semi-public systems (i.e. schools, hospitals, restaurants and other businesses) and a large number of private wells in this watershed. All known semi-public systems withdraw their water from a groundwater source, as do the vast majority of private systems.

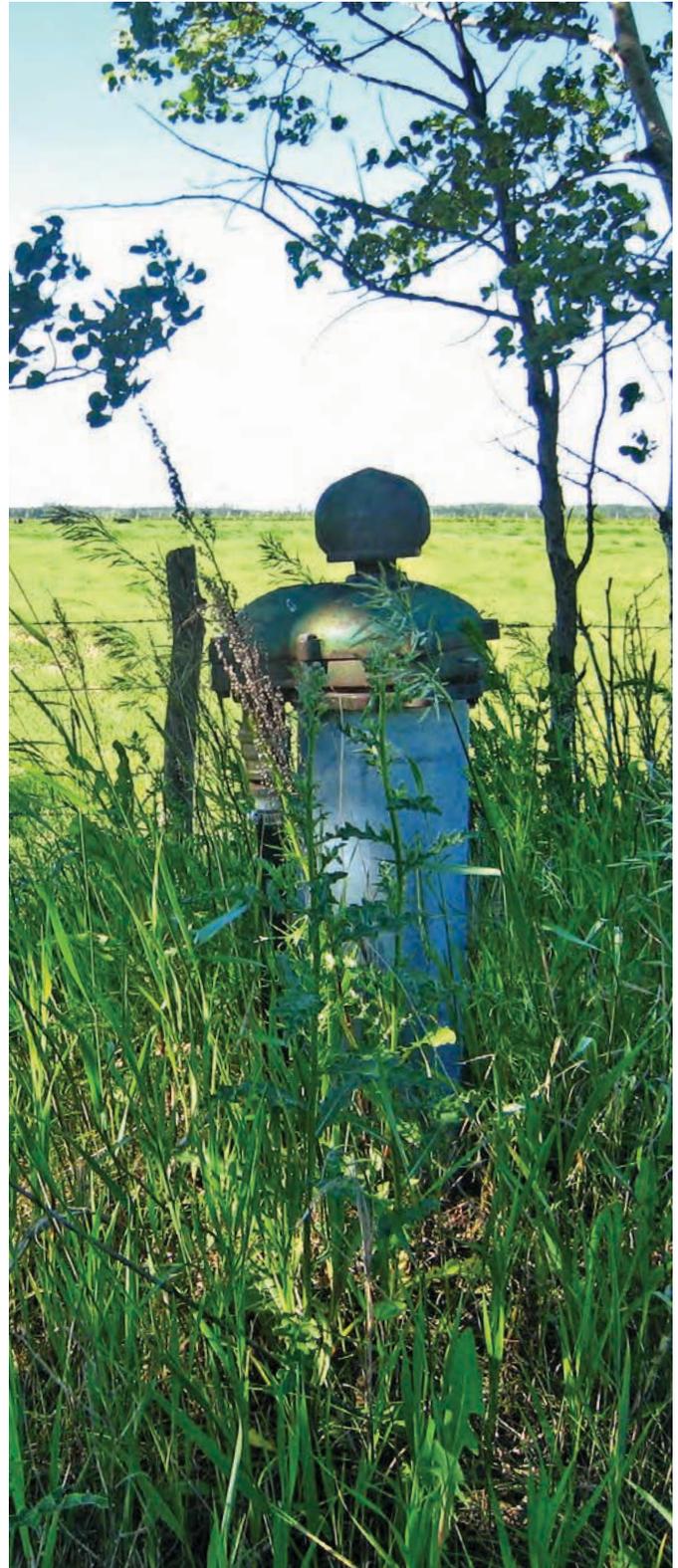




Figure 5: Aquifers and Drinking Water Sources in the Whitemud River Watershed

Water Licensing and Allocation

Water Right Licences are issued under *The Manitoba Water Rights Act* with the intention of protecting the interests of the licensees, domestic users, the general public and the environment. Provincial Allocation Limits are established for major streams and aquifers. For aquifers, the allocation limits take into consideration the annual recharge rates. This is the quantity of water that the aquifer can lose each year while maintaining the current water level regime. In general, one half of this recharge is reserved to maintain the surface environment such as stream flows, lakes and wetland levels, water supply for vegetation that can access the water table, and for domestic use. The balance of the recharge is the allocation limit available for licensing by Manitoba Sustainable Development Groundwater Section.

In this watershed, 18,275 dam³ has already been allocated under licence for both groundwater and surface water sourced projects. There were 221 Water Rights Licences within the Whitemud River Watershed as of 2016. Residents are more reliant on groundwater sources than surface water as 80% of all licensed projects are groundwater sourced. The majority of licensed projects, 89%, are using the water for irrigation of crops. The remaining projects are for municipal distribution systems and the watering of livestock.

Assiniboine Delta Aquifer

The Assiniboine Delta Aquifer (ADA) is an unconfined sand and gravel aquifer. The aquifer lies below a 3,885 km² area centered on Carberry. About one third of the ADA falls within the Whitemud River Watershed. The aquifer is located under a large area of sand deposits on the southern side of the Whitemud River Watershed and continues south beyond the watershed boundary.

Historically, the Assiniboine River carried these sediments into a bay of the glacial Lake Agassiz. As the river entered the lake and the water velocity decreased, sediments were deposited creating a large river delta where today, you will find the ADA. Saturated thickness is the vertical thickness of the aquifer that the soil is filled with water. The ADA has an average saturated thickness of 14 metres. The maximum depth of saturated thickness is in excess of 30 metres. The waterways in this area are located at the aquifer level or below. This means that these waterways are fed directly from the aquifer.

The water quality that is found in the ADA is considered to be fair to excellent. However, the permeable nature of the sandy soils and exposure of the aquifer at the land surface makes it highly vulnerable to groundwater contamination.

Constructing surface water impoundments along streams for recharge purposes may be beneficial and feasible in some areas of the Assiniboine Delta Aquifer. Wetlands and riparian zones could be protected to enhance infiltration while reducing soil erosion and enhancing wildlife habitat and biodiversity (ADA, 2005).





Potential sources of contamination include sewage, petroleum products and agricultural fertilizers and pesticides. Concentrations of naturally occurring arsenic and barium have been found above the drinking water quality guidelines in some wells within the ADA, with arsenic more common in deeper parts of the aquifer. In fact, there have been some natural arsenic levels found in wells deeper than 46 m (150 ft). Hardness, iron, and manganese are common aesthetic water quality problems.

Management considerations for the ADA are made from the Assiniboine Delta Aquifer Management Plan which was completed in 2005. The plan was completed by a roundtable of stakeholders with interests in the ADA and guidance from a technical advisory group. The goals of the management plan are aquifer protection, sustainable use, and sustainable economic development. The ADA Management Board meets once or twice a year.

The ADA contains approximately 14,802,000 dam³ (12,000,000 acre-feet) of water. The amount of water that is

pumped out of the aquifer for human and agricultural uses is restricted by the provincial water licensing process to ensure the aquifer remains sustainable and is not depleted over time. The current amount of allocation for the ADA is outlined in Table 1. Only half of the annual recharge rate is available for licensing, whereas the other half is unallocated to support the surface environment such as stream flows, lakes and wetland levels, water supply for vegetation that can access the water table, and for domestic use. Upper Whitemud East and Upper Whitemud West is only thirty percent available allocation limit. Please note that not all of the aquifer allocations listed in the table below fall within the Whitemud River Watershed. The remainder of the ADA falls within the Central Assiniboine and Lower Souris River watershed. It is important to note that three of the ADA sub-basins within the Whitemud River Watershed have completely filled their available allocation – Upper Whitemud West, Upper Whitemud East, and Lower Whitemud East. Monitoring stations are spread throughout the aquifer to monitor water levels.

Sub-basin	Available Yield (dam ³)	Allocation Limit (dam ³)	Annual Allocation (dam ³)	Available Allocation (dam ³)
Upper Whitemud West	8,041	2,412	2,433	0
Upper Whitemud East	5,225	1,568	1,565	3
Lower Whitemud East	10,510	5,254	3,926	0
Pine Creek North	13,568	6,784	6,909	0
Pine Creek South	7,020	3,510	3,469	0
Squirrel Creek North	3,718	1,858	287	1,508
Squirrel Creek South	8,789	4,394	428	2,586
Subtotal	56,871	25,780	19,017	4,097

Ecological Characteristics

Parks and Conservation Lands

The Whitemud River Watershed contains a number of ecologically important sites, some of which are legally protected areas (Figure 6). These areas include Riding Mountain National Park, Wildlife Management Areas, and some property owned by non profit organizations. Other lands with some conservation value include private property protected under conservation agreements, Crown lands, municipal property, as well as, municipal right of ways in the form of conservation corridors.

First designated as forest reserve in 1895, Riding Mountain National Park was officially designated as a national park in 1929 and opened on July 26, 1933, protecting an area representative of Canada's southern boreal plains and plateaux natural region. Encompassing approximately 3,000 km², Riding Mountain National Park's rolling hills, valleys, forests, meadows, lakes, streams, and wetlands are home to hundreds of bird species, insects, fish, small and large mammals. White-tailed deer, moose, elk, wolves, lynx, black bears and a captive bison herd are some of the large mammals that are recognizable by the over 250,000 visitors annually (Parks Canada, 2015). The southeastern corner of Riding Mountain National Park falls within the northwest corner of the Whitemud River Watershed. This area of the national park has steep eroded hillsides of shale and forested areas.

There are an abundance of wildlife management areas within the watershed (Figure 6). Most of these areas are located along

the sandy areas of the Manitoba Escarpment or scattered in the northern portion of the watershed. These locations generally have soils or terrain that are not sought after for agriculture, but provide habitat for local wildlife.

Also found within the Whitemud River Watershed is privately owned lands that are placed under conservation agreements. There are a number of conservation agreements located in the western portion of the district in the prairie pothole region, and scattered throughout the watershed. Two notable large conservation agreements have been established in the watershed. The majority of the lands at the Langford Community Pasture, Big Grass Marsh, and neighbouring community pasture are signed into conservation agreements to not allow the land to be cleared, broken up, or drained.

Over the years, the Whitemud Watershed Conservation District has been establishing and protecting existing conservation corridors around the watershed in cooperation with the local municipalities by protecting permanent cover on unused or minimally used road allowances. These conservation corridor sites reduce wind erosion and provide wildlife habitat in areas where it may not exist otherwise. The conservation ites may come in the form of grassed strips or natural wooded strips along road allowances or planted shelterbelts.



- ➔ As of 2015, there are 726 kilometers (451 miles) of conservation corridors in the Whitemud River Watershed.
- ➔ The Manitoba Habitat Heritage Corporation secured their two largest conservation agreements to-date in partnerships with the Whitemud Watershed Conservation District, Ducks Unlimited Canada, and local Municipalities within the Whitemud River Watershed. These include the Big Grass Marsh Conservation Agreement of 17,400 ha (43,000 ac) and the Langford Community Pasture Conservation Agreement of 3,975 ha (9,822 ac)



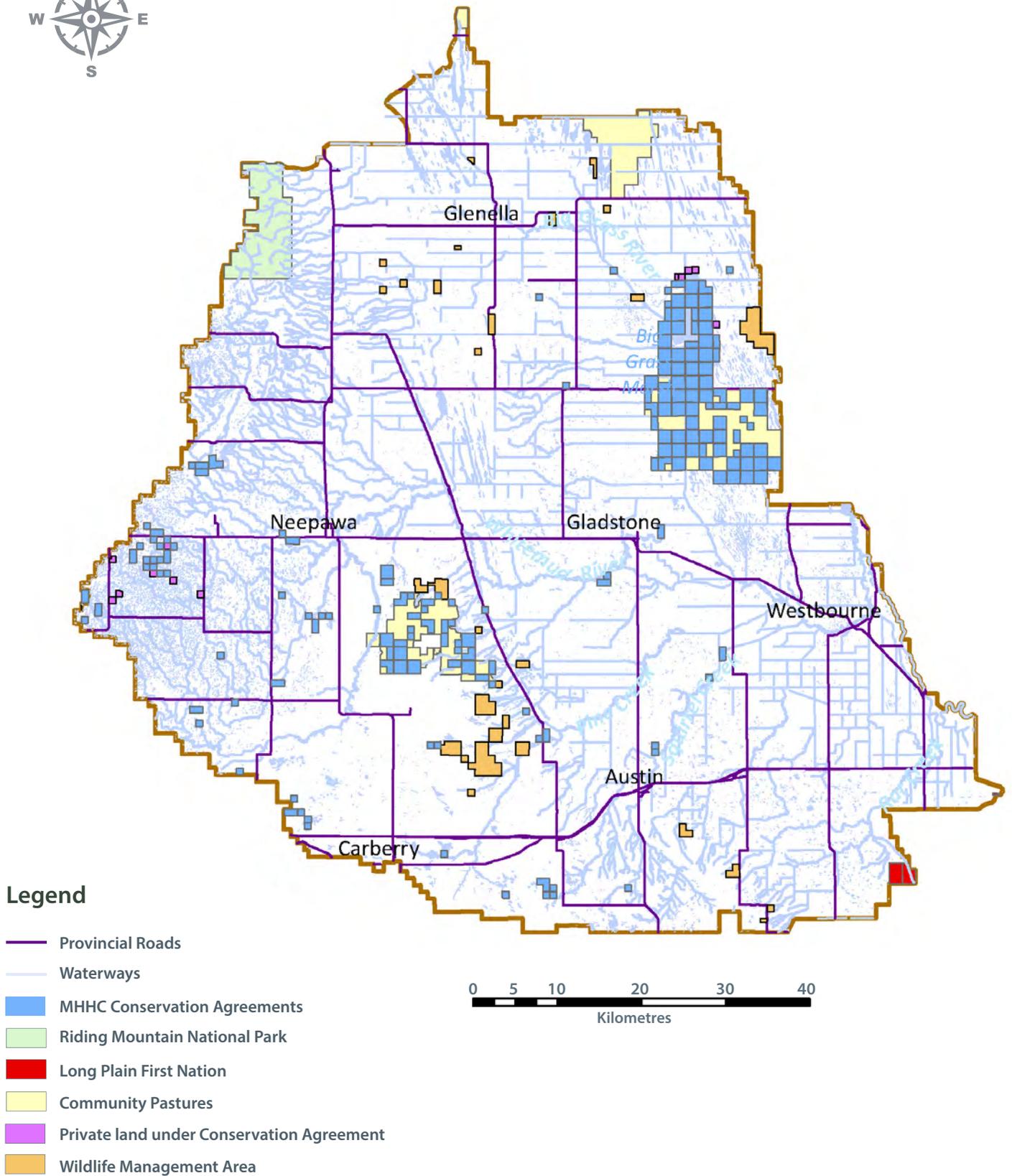


Figure 6: Parks and Conservation Lands in the Whitemud Watershed



Invasive Species

Leafy Spurge is continually expanding from the southern portion of the watershed north and along railways lines within the Whitemud River Watershed. Leafy spurge is a long lived, hardy plant introduced to North America from Europe and Asia and is declared a noxious weed in Manitoba. It will readily establish itself in a variety of environments and is quick to take advantage of disturbed sites. Leafy spurge can be found in pastures, agricultural lands, roadsides, ditches, and riparian areas. In Manitoba, it does best in sandy soils of moderate moisture. Leafy spurge has aggressive growth habits and a lack of natural predators which allow it to easily displace native vegetation. The result is reduced habitat value from reductions in species diversity. As leafy spurge expands into pastures, normal herbage production is reduced. This means less species diversity in natural vegetation and reduced grazing opportunities as livestock generally avoid consuming this plant.

Narrow-leaved cattails have spread into drains and waterways throughout the Whitemud River Watershed which has been making a thick wall in wet areas and slowing water flows. These cattails are a plant introduced to North America, and hybridize with native cattails to form dense stands that can dominate wetlands. These hybrid cattails can have male and female flowers forming from the same plant making reproduction quite prolific. The hybrid cattails will grow in wetlands, meadows, streams, drains, and lakeshores. The plant spreads by seed but once an extensive rhizome system is present it becomes the major source of reproduction. This invasive species grows in much thicker stands than native species, often closing off open water in waterways.



Siberian Elm is an invasive species that has been spreading through the Whitemud River Watershed. The Siberian Elm is a deciduous tree that can grow 10 to 20 m tall. The tree can invade and dominate disturbed prairies in just a few years. Seed germination rate for the Siberian Elm is high and seedlings will establish quickly in sparsely vegetated areas. It does particularly well in areas of poor dry soils. It is native to eastern Asia, and was introduced in North America due to its hardiness, fast growth, and ability to grow in dry conditions. It is currently being sold commercially for shelterbelts.

Common Carp has become a problematic invasive species. It originates from Asia and parts of Europe and was introduced to North America as a food and ornamental fish in 1886. They are a large fish with a high growth rate. Carp will stir up the substrate while they feed causing turbidity in the water and destroying habitat for native species. This disturbance can also release phosphorous into waterways degrading water quality and causing issues for recreation and drinking water.

Zebra Mussels have not been found to be present to date within the Whitemud River Watershed. They are a small non native, clam-like, aquatic animal that have significant environmental and economic concern to Manitoba. They can aggressively invade new areas, reproducing quickly and threatening native fish and wildlife species. Zebra mussels must be transported by boats and trailers from infested waters as they are not able to travel upstream any other way.



People of the Watershed

History

Indigenous presence has been recorded as far back as the 1600s throughout the Whitemud River. The first Europeans to explore the area were the trappers looking for furs of various animals in the 1830s. This was then followed by the agricultural expansion westward (Westbourne-Longbourne History, 1985).

The origin of the name of the Whitemud River is not known for sure, although it is thought to have been named for the color of the clay and soil along its banks. The Whitemud River was used as a transportation hub for the region. The Whitemud River has three natural low level crossings that were used for crossing the river. This first crossing was located by Westbourne; the second crossing was located by Woodside, while the third crossing was found at Gladstone. The third crossing became a popular travel destination for river crossing and became a hub for the area for travellers heading west to Saskatchewan. These crossings were necessary due to the steep clay banks of the river making crossing difficult in most locations (Golden Memories, 1980).

History of Land Use

In the Whitemud River Watershed, European settlement took place as the settlers moved west to farm new lands in the late 1800s and early 1900s. The eastern portion of the watershed was covered by vast wetlands that were drained as the land was settled and put into cultivation. The western areas drained well naturally and didn't require artificial drainage. However, over time many wetlands in this area were also lost due to the need for additional cultivated land. Over the years, farming has increased throughout the watershed. Today's landscape is mostly agricultural based with some key areas being left in their natural state. The equipment and techniques have dramatically improved the ease and efficiency of farming which has allowed for farms to become much larger. This means that small family farms are being taken over by much larger farms in the watershed. Larger farm equipment makes it cumbersome to maneuver around small pockets of wetlands which means generally square field shapes are sought.





What We Are Concerned About In Our Watershed

Early in the planning process, four public meetings were held throughout the watershed. At these meetings, watershed residents were asked to identify land and water issues and actions needed to address their concerns. Below is a summary of the top six priorities for watershed residents:

Watershed Priorities

Natural Ground Cover – As farming practices have changed over the years, the watershed has also changed. The clearing of natural cover and shelterbelts has caused overland water flows to be altered. Plants and wildlife have been impacted to the detriment of the natural environment. Management practices, policies, and incentives need to be developed to provide a greater balance.

Surface Water Storage – Holding water on the landscape to lower peak flows and reduce flooding is important to the people of the area. Erosion damage is minimized when water is held back during times of peak flows and released slowly at a later date. Storing water for drier years ensures water will be available when it is needed. Residents of the watershed would also benefit from reduced flooding impacts downstream of these storage sites.

Surface Water Quality – Clean water running through the drains, creeks, and rivers is of great value in the watershed. Although surface water isn't often used in the area for human consumption, it is still important for livestock, fish and wildlife.

Farming – Farming is the backbone of the watershed and provides a livelihood for many of its residents. Continuing to support agricultural practices on the landscape is important to the area's economy.

Surface Water Management and Tile Drainage – Drainage of a landscape is always a sensitive topic. Water should be drained in coordinated manner to support high quality farming operations while also minimizing erosion, protecting water quality and reducing flood damages.

Recreation – Recreational opportunities of all kinds are important to the people of the watershed. Keeping areas available and accessible for the public to access allows for engaged and involved communities.

Watershed Goals

Based on these watershed priorities, watershed goals were developed in three areas:

1 Groundwater Protection

2 Soils and Natural Areas

3 Surface Water Management



Goal 1: Groundwater Protection

Maintain groundwater quality and quantity throughout the Whitemud River Watershed.

Maintaining drinking water quality and supply is a top concern for residents in the Whitemud River Watershed. Clean reliable drinking water is critical for human life and essential for prosperous, sustainable communities. In the Whitemud River Watershed, groundwater is the main water source although the Portage Water Treatment Plant serves a lot of the eastern portion of the watershed and that water is sourced from the Assiniboine River.

Issues

- Wells that are not properly located, constructed, maintained or sealed can provide a conduit into the local aquifer transporting potential contaminants into the water supply.
- The porous nature of the sandy soils over many of the aquifers, like the Assiniboine Delta Aquifer, and the proximity of the water table to land surface in some areas makes these aquifers highly susceptible to contamination from sources such as sewage, petroleum products, fertilizers, manure, and pesticides.
- Accommodating increasing water demands on the Assiniboine Delta Aquifer while maintaining and protecting the ability of the aquifer to support human and environmental needs in a sustainable manner was a concern for residents.
- The quality and quantity of groundwater outside the Assiniboine Delta Aquifer is generally variable. In some areas this led municipalities to seek alternate sources, such as the Portage La Prairie Public Water System pipeline, to provide good quality drinking water. The Portage La Prairie system serves many of the communities within the watershed as water is piped as far west as Arden and Austin. Livestock water sources are generally surface water sourced because of poor quality or low quantity available from local area aquifers.

Recognizing that actions are more likely to be achieved when there is a clear understanding of the issues and solutions, measures of success for each action plan item were developed.



How We Plan To Reach Our Goal

Recommendations	Organization	Measures of Success
Locate new groundwater wells at a safe distance from potential sources of contamination and in an area away from surface water runoff.	Landowners, licensed water well drillers, Municipalities	- The percentage of private wells exceeding the maximum acceptable concentration for bacteria in drinking water under the Guidelines for Canadian Drinking Water Quality will be reduced.
Ensure abandoned wells are properly sealed to provincial regulation.	Landowners, Manitoba Sustainable Development - Groundwater Management Section, licensed water well drillers, Whitemud Watershed Conservation District, Manitoba Sustainable Development – Environmental Compliance and Enforcement	- 40 abandoned wells will be sealed by 2026.
Ensure an emergency response plan is developed for all public drinking water systems.	Manitoba Sustainable Development – Environmental Compliance and Enforcement	- Emergency response plans for all public drinking water systems will be in place by 2019.
Require fuel storage and dispensing sites to be protected from leaks and spills using containment areas.	Manitoba Sustainable Development – Environmental Compliance and Enforcement, Manitoba Agriculture	- All sites within public drinking water source buffers will have containment areas at fuelling locations by 2026.
Ensure proper manure storage plans are in place.	Manitoba Sustainable Development – Environmental Compliance and Enforcement	- Manure management plans will be completed throughout watershed by 2026.
Ensure septic systems are well managed and maintained.	Landowners, Manitoba Sustainable Development – Environmental Compliance and Enforcement	- Continue to inspect private septic systems.
Promote agricultural beneficial management practices that encourage continued healthy levels of natural habitat on private land above the Assiniboine Delta Aquifer through incentives, education, and technical assistance.	Whitemud Watershed Conservation District, Manitoba Agriculture, Manitoba Habitat Heritage Corporation, Ducks Unlimited Canada, Local Fish and Game groups	- Maintain current permanent cover over the Assiniboine Delta Aquifer.
Promote and provide workshops on household water conservation.	Whitemud Watershed Conservation District, Municipalities, Manitoba Agriculture	- Two education events are held by 2026.



Recommendations	Organization	Measures of Success
Provide education on proper wellhead protection, management, well water quality testing, and water treatment systems.	Whitemud Watershed Conservation District, Manitoba Sustainable Development – Office of Drinking Water, Manitoba Sustainable Development – Groundwater	- The percentage of private wells exceeding maximum acceptable concentrations under the Guidelines for Canadian Drinking Water Quality will be shown to be reduced by encouraging routine well water sampling and installation of home water quality treatment systems where applicable.
Promote beneficial management practices that encourage groundwater quality protection on private land through incentives, education, and technical assistance. Practices should include appropriate fertilization and tillage management practices, managed grazing systems, sowing of permanent cover, remote watering systems, and exclusion fencing where the aquifer meets the surface water.	Manitoba Agriculture, Whitemud Watershed Conservation District, Landowners, Simplot, Manitoba Horticultural Productivity Enhancement Centre Inc, Canada-Manitoba Crop Diversification Centre	- 50 beneficial management practices implemented by 2026.
Protect natural areas that are vulnerable to groundwater contamination or are known groundwater recharge areas through conservation agreements with private landowners using education and financial incentives.	Whitemud Watershed Conservation District, Nature Conservancy of Canada, Manitoba Habitat Heritage Corporation, Landowners	- Increase conservation agreements by 405 ha (1,000 ac) by 2026.
Explore opportunities to expand public drinking water systems and existing rural water pipelines.	Municipalities	- The number of private homes connected to public drinking water systems and rural water pipelines increases by 2026.
Promote agricultural beneficial management practices that increase water efficiency for irrigation through incentives, education and technical assistance.	Irrigation industry, McCains Ltd., Manitoba Agriculture, Manitoba Sustainable Development – Water Use Licensing	- The ADA water use allocation will not exceed 50% of the annual discharge rate.
Maintain current practices of regulating water use from the Assiniboine Delta Aquifer based on allocation limit.	Manitoba Sustainable Development – Water Use Licensing	- The ADA water use allocation will not exceed allocation limit.
Promote the use of surface water reservoirs as opposed to using groundwater in areas outside of the Assiniboine Delta Aquifer to provide source water for livestock and irrigation.	Whitemud Watershed Conservation District, Irrigation industry, Planning District	- One education event to promote surface water projects for agricultural use is held by 2026.

Source Water Protection Plan

In Manitoba, the Office of Drinking Water defines a public water system as a potable supply of drinking water with 15 or more connections. The Whitemud River Watershed contains nine public drinking water systems (shown on page 19), all of which withdraw their water from a groundwater source. Some public drinking water systems use multiple wells to withdraw water for a single community. There are many semi-public systems (i.e. schools, hospitals, restaurants and other businesses) and a large number of private wells in this watershed. All known semi-public systems withdraw their water from a groundwater source, as do the vast majority of private systems.

During the development of this plan, a source water assessment was conducted for the nine public water systems in the watershed. To assess drinking water sources, a Source Water Assessment Team was formed. This group consisted of regional drinking water officers, a watershed planner, and conservation district representatives. A source water protection zone was developed for each of the nine systems which consist of a 1.5 km buffer around each of the wells. The team visited each of the nine systems, identified and ranked potential sources of contamination, and developed a list of recommendations to address significant threats to these systems.

Source Water Protection Recommendations

Public System: **Oberon (Neepawa)**

Site Specific Recommendations:

- Municipality of North Cypress - Langford to provide information on the proper inspection and maintenance of septic fields and septic tanks to neighbouring landowners.
- Whitemud Watershed Conservation District to complete wellhead assessments for all private wells located in the source water protection zone.

Public System: **Hummerston (Neepawa)**

Site Specific Recommendations:

- Whitemud Watershed Conservation District to complete wellhead assessments for all private wells located in the source water protection zone.
- Whitemud Watershed Conservation District to educate landowners about the effects of clearing of trees and prairie grasses for annual crops within the source water protection zone.
- Municipality of Rosedale to provide septic field or tank maintenance information to landowner within the source water protection zone.

Public System: **Eden**

Site Specific Recommendations:

- Municipality of Rosedale to provide information on the proper inspection and maintenance of septic fields and septic tanks to neighbouring landowners.
- Whitemud Watershed Conservation District to educate the community of Eden on how land use within the community can negatively affect the local drinking water supply.
- Municipality of Rosedale to educate owners of confined livestock facilities about the specific risks of being within a source water protection zone of the public drinking water system.
- Municipality of Rosedale to require fuel storage and dispensing sites to use secondary containment areas within the source water protection zone.
- The Municipality of Rosedale should continue to work with the Manitoba Water Services Board to meet the arsenic and primary disinfection standards.

Public System: **Glenella**

Site Specific Recommendations:

- The Municipality of Glenella – Lansdowne to protect the wellhead by installing steel posts with reflective tape around the wellhead.
- The Municipality of Glenella – Lansdowne to provide septic field or tank maintenance information to landowner within the source water protection zone.
- Whitemud Watershed Conservation District to complete wellhead assessments with landowner within the source water protection zone.
- The Municipality of Glenella – Lansdowne to educate owners of confined livestock facilities about the specific risks of being within a source water protection zone of the public drinking water system.
- The Municipality of Glenella – Lansdowne to require fuel storage and dispensing sites to use secondary containment areas within the source water protection zone.
- The Municipality of Glenella – Lansdowne should continue to work with the Manitoba Water Services Board to meet the arsenic standard.

Public System: **Kelwood**

Site Specific Recommendations:

- The Municipality of Rosedale to extend the casing for Well 3 to be at least 40 cm above mounded earth.
- The Municipality of Rosedale to protect the wellhead by installing steel posts with reflective tape around the wellhead.

- The Municipality of Rosedale to provide septic field or tank maintenance information to landowner within the source water protection zone.
- Whitemud Watershed Conservation District to complete wellhead assessments with landowner within the source water protection zone.
- The Municipality of Rosedale to educate the owner of the confined livestock operation about the specific risks of being within a public drinking water source protection zone.
- The Municipality of Rosedale to require fuel storage and dispensing sites to use secondary containment areas within the source water protection zone.

Public System: Lavenham
Site Specific Recommendations:

- Norfolk Treherne Municipality to educate the community of Lavenham on how land use within the community can negatively affect the local drinking water supply.

Public System: Lynch's Point
Site Specific Recommendations:

- The owner of the well should build up the area around the well to prevent flood levels reaching the wellhead. Level must be at least above 2011 levels plus three feet of freeboard.
- The owner to ensure the soil is sloped away from the wellhead.

- The owner to protect the wellhead by installing posts with reflective tape around the wellhead.
- The municipality of Westlake – Gladstone to provide septic field or tank maintenance information to landowner within the source water protection zone.

Public System: Manitoba Agricultural Museum
Site Specific Recommendations:

- The owner to protect the wellhead by installing posts with reflective tape around the wellhead.
- The Municipality of North Norfolk to provide septic field or tank maintenance information to landowner within the source water protection zone.
- Whitemud Watershed Conservation District to complete wellhead assessments with landowner within the source water protection zone.

Public System:
Shady Oaks R. V. Resort & Campground
Site Specific Recommendations:

- The owner to protect the wellhead by installing posts with reflective tape around the wellhead.
- The Municipality of North Norfolk to provide septic field or tank maintenance information to landowner within the source water protection zone.



Oberon wellhead and generating station pumping water to Neepawa.

Goal 2: Soils and Natural Areas

Conserve and restore permanent ground cover and protect soils from erosion.

Soil erosion is a naturally occurring process on the landscape. In agriculture, soil erosion refers to the wearing away of topsoil by the natural physical forces of wind and water. The risk of water erosion increases in areas with high water velocities, such as rivers or creek banks, or as water moves over steep terrain. The risk of wind erosion increases when soil is left unprotected and bare. The loss of topsoil due to erosion reduces cropland productivity and contributes to the pollution of adjacent watercourses, wetlands, and lakes.

Residents and stakeholders expressed concern over the loss of permanent cover on the landscape within the watershed. Permanent cover such as grasses, shrubs, or woodlots keep soil from eroding off the land by wind and water. Permanent cover also allows for greater water holding capacity within the soils. This ability to hold water or slow snowmelt and runoff helps to reduce peak flows during high water events and encourages increased plant use on site. The current trend in the Whitemud River Watershed is a decrease in permanent cover due to land clearing of forested areas and the breakup of grasslands to support the increased demand for annual cropland.

Protecting soils from erosion can be more difficult in areas with soils that are lighter texture, like sandy soils. This is especially true when these light soils are located on steep topography such as the Manitoba Escarpment and Riding Mountain Escarpment areas. These eroded soils enter waterways and deposit in flat regions of the drainage system or continue downstream into Lake Manitoba. While this sediment is being carried within the waterway, it is reducing the water quality for human consumption, recreation, livestock watering, and wildlife and fish.

Issues

- Clearing of natural cover has exposed soils making them vulnerable to wind and water erosion.
- The reduction of permanent cover on the landscape is increasing the risk of erosion while reducing the ability of vegetation to capture moisture - resulting in faster and increased peak runoff flows.
- Clearing of forested areas has resulted in a fragmentation of wildlife habitat.
- A lack of cover in riparian areas such as willow grasses, cattails or woodlands has resulted in stream bank and waterway erosion. Native species of cover allow for root zones to have a large holding capacity for the soil. This lack of riparian cover is often caused by the conversion of permanent cover to annual cropland.
- Livestock with direct access to waterways have impacted riparian areas by removing vegetation that holds the soil in place making it more prone to erosion. Also, the presence of livestock within these areas can lead to bacterial contamination of the adjacent surface water body, as well as increased sedimentation, turbidity, and disturbances of the streambed - all of which negatively impact water quality and aquatic habitat.
- Invasive species are spreading throughout the Whitemud River Watershed reducing the integrity of natural habitat, decreasing grazing opportunities and negatively impacting biodiversity of native plants.



How We Plan To Reach Our Goal

Recommendations	Organization	Measures of Success
Maintain current Crown lands in permanent cover by prohibiting the sale of any publicly owned lands.	Manitoba Sustainable Development, Municipalities, Whitemud Watershed Conservation District, Planning Districts	<ul style="list-style-type: none"> - There will be no Crown land sales to retain as much permanent cover on the landscape as possible. - Local Community Pastures will continue to be used for grazing and recreational use only.
Establish conservation agreements to protect permanent cover on the landscape.	Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Ducks Unlimited Canada, Nature Conservancy of Canada, Landowners	<ul style="list-style-type: none"> - Existing permanent cover will be retained including forests, riparian areas, wetlands, mixed-grass prairie and other sensitive ecosystems. - 405 ha (1,000 ac) of permanent cover will be signed into conservation agreements by 2026.
Provide incentives to keep permanent cover intact through tax incentives or an environmental goods and services program.	Landowners, Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Local Game and Fish groups, ALUS Canada	<ul style="list-style-type: none"> - Existing permanent cover will be retained including forests, riparian areas, wetlands, mixed-grass prairie and other sensitive ecosystems.
Control the spread of invasive species such as leafy spurge on pastures.	Weed Control District, Manitoba Agriculture, Municipalities	<ul style="list-style-type: none"> - No new invasive species will spread into the watershed..
Promote agricultural beneficial management practices that restrict livestock access to waterways through incentives, education, and technical assistance.	Whitemud Watershed Conservation District, Manitoba Agriculture, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada	<ul style="list-style-type: none"> - Improved riparian areas along waterways. - Complete 5 projects by 2026.
Retain permanent cover along waterways with the use of buffer zones and grassed waterways.	Landowners, Whitemud Watershed Conservation District, Manitoba Agriculture	<ul style="list-style-type: none"> - Improved riparian areas along waterways. - Complete 5 projects by 2026.
Maintain and increase the amount of conservation corridors on the landscape.	Municipalities, Landowners, Whitemud Watershed Conservation District	<ul style="list-style-type: none"> - No net loss of conservation corridors across the watershed.
Provide a tree planting program to increase permanent cover.	Whitemud Watershed Conservation District, Tree Canada	<ul style="list-style-type: none"> - 10 tree planting projects completed by 2021.
Explore the potential of regulating natural cover removal through a provincial licensing system.	Manitoba Sustainable Development – Forestry and Peatlands Management Branch	<ul style="list-style-type: none"> - Pilot program that reduces the loss of permanent cover in forested areas completed by 2026.
Promote the establishment and maintenance of shelterbelts through incentives and technical assistance.	Whitemud Watershed Conservation District	<ul style="list-style-type: none"> - No net loss of shelterbelts from 2016 to 2026.
Adopt development planning policies to protect riparian areas from new developments such as minimize vegetation removal.	Planning districts, Municipalities, Manitoba Agriculture	<ul style="list-style-type: none"> - Improved riparian areas along waterways.
Complete an assessment of the Whitemud River Watersheds drought preparedness.	Manitoba Sustainable Development – Surface Water Management	<ul style="list-style-type: none"> - A drought preparedness assessment will be completed by 2026.

Goal 3: Surface Water Management

Reduce the impacts of flooding and erosion throughout the Whitemud River Watershed with a managed drainage system.

Surface Water Management Plan

In the management of surface water it is important to consider impacts to downstream landowners and the environment. High water events have had large peak flows causing damage to infrastructure and the landscape.

Drain Licensing Partnership

The Whitemud River Watershed was the first area of Manitoba to pilot a new partnership approach to drainage licensing. The project proponent submits an application to Manitoba Sustainable Development. The local Water Resource Officer will hold a meeting with the involved landowners to go over any possible implications the project may have. The Whitemud Watershed Conservation District sub-district members attend these meetings as they manage much of the drainage network in the watershed. The Whitemud Watershed Conservation District holds a formal review by its board during a regular monthly meeting. Based on feedback from the District and others impacted by the project, the Water Resource Officer decides how and if the project can be licensed.

Water Retention Goals

Water retention sites within the Whitemud River Watershed can provide for some reduction in flood peak flows. However, the magnitude of peak flow reduction due to water retention diminishes as the size of flood events gets larger. If surface water is temporarily captured before being released, it can reduce peak flows during spring melt and summer flood events. Water retention generally sees its greatest rewards at the upstream region of the watershed.

Manitoba Sustainable Development completed an assessment of water retention goals to reduce peak flow in the Whitemud River Watershed. Some watersheds in Manitoba have established a 10% reduction as a target for flood reduction goals. However, the Whitemud River Watershed exhibits steep topography along the Riding Mountain and Manitoba Escarpments. This means the design and construction of water retention structures would need to be of considerable size to begin to approach a 10% reduction goal. Even the watersheds more modest goal of reducing peak flows by 5% for a 1 in 10 year flood event requires over 12,039 dam³ (9,760 acre-feet) of water storage. Although retention goals will be difficult to reduce flooding at the bottom of the watershed localized benefits can be seen throughout the district.



Surface Water Management Zones

In 1991, the Whitemud Watershed Conservation District developed a water management strategy for the Whitemud River Watershed to improve management of surface water management. As part of the water management strategy, 10 zones were created based on soil types, topography and land use. The Strategy was updated in 2007.

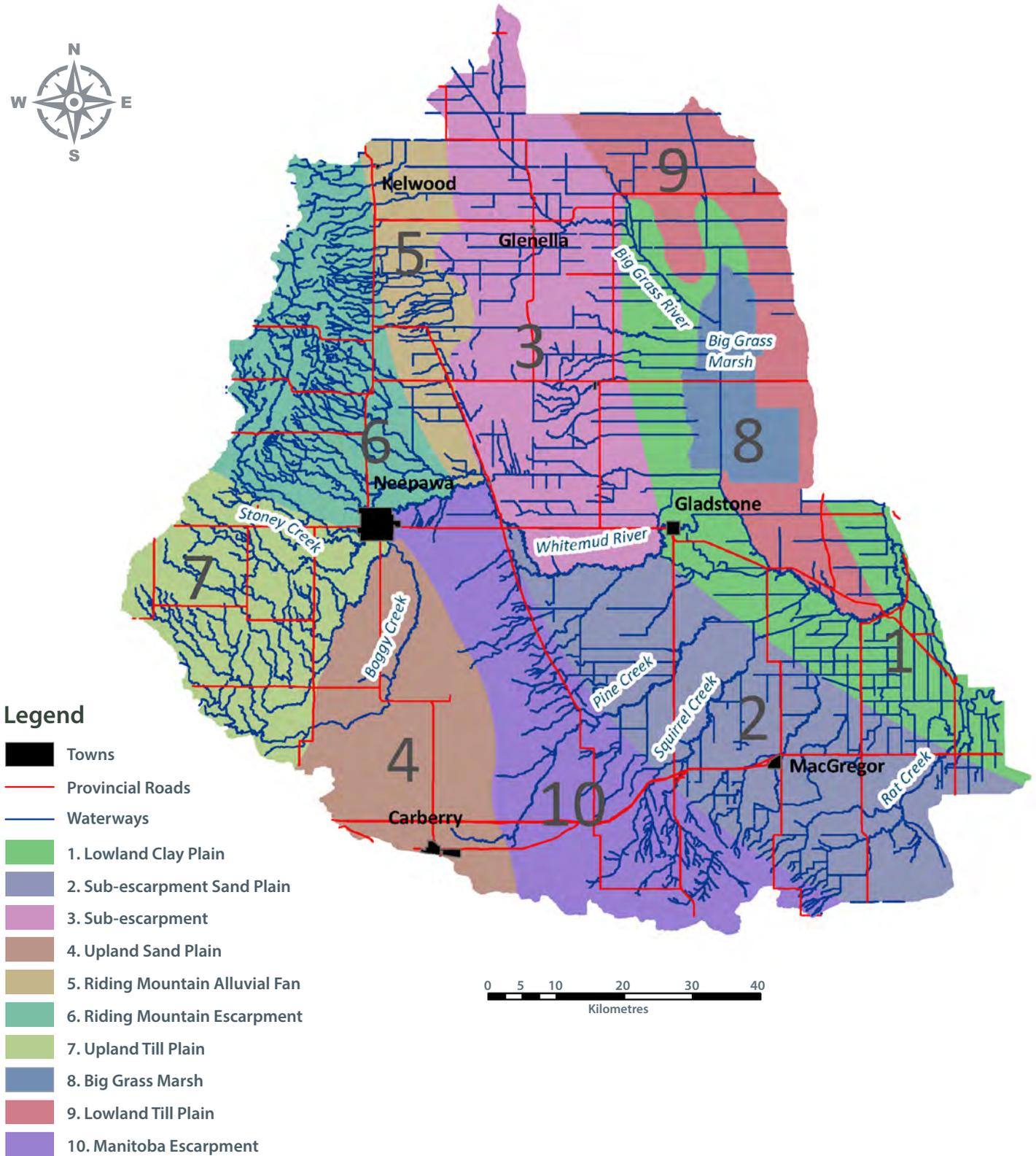


Figure 7: Whitemud River Watershed Surface Water Management Zones

ZONE 1: Lowland Clay Plain

Overview:

The Lowland Clay Plain zone is located in the east central part of the watershed. Land use in this zone is almost completely annual cropland. The zone contains productive soils and is given some priority for drain maintenance activities.

Goal:

To protect annual cropland from flooding and to improve water quality by reducing nutrient loading.

Issues:

- Flood damages along major waterway outlets caused by excessive runoff from spring and summer flooding events.
- Flooding of agricultural land along the Dead Lake Drain.
- Trash and sediment buildup causing spring flooding between Westbourne and Lake Manitoba adjacent to the Whitemud River.
- High waters in the Big Grass Marsh keep land wet along the northeastern portion of this zone.
- Jumping Deer Drain and Squirrel Creek are in need of maintenance.
- Six bridges are in need of reconstruction or maintenance

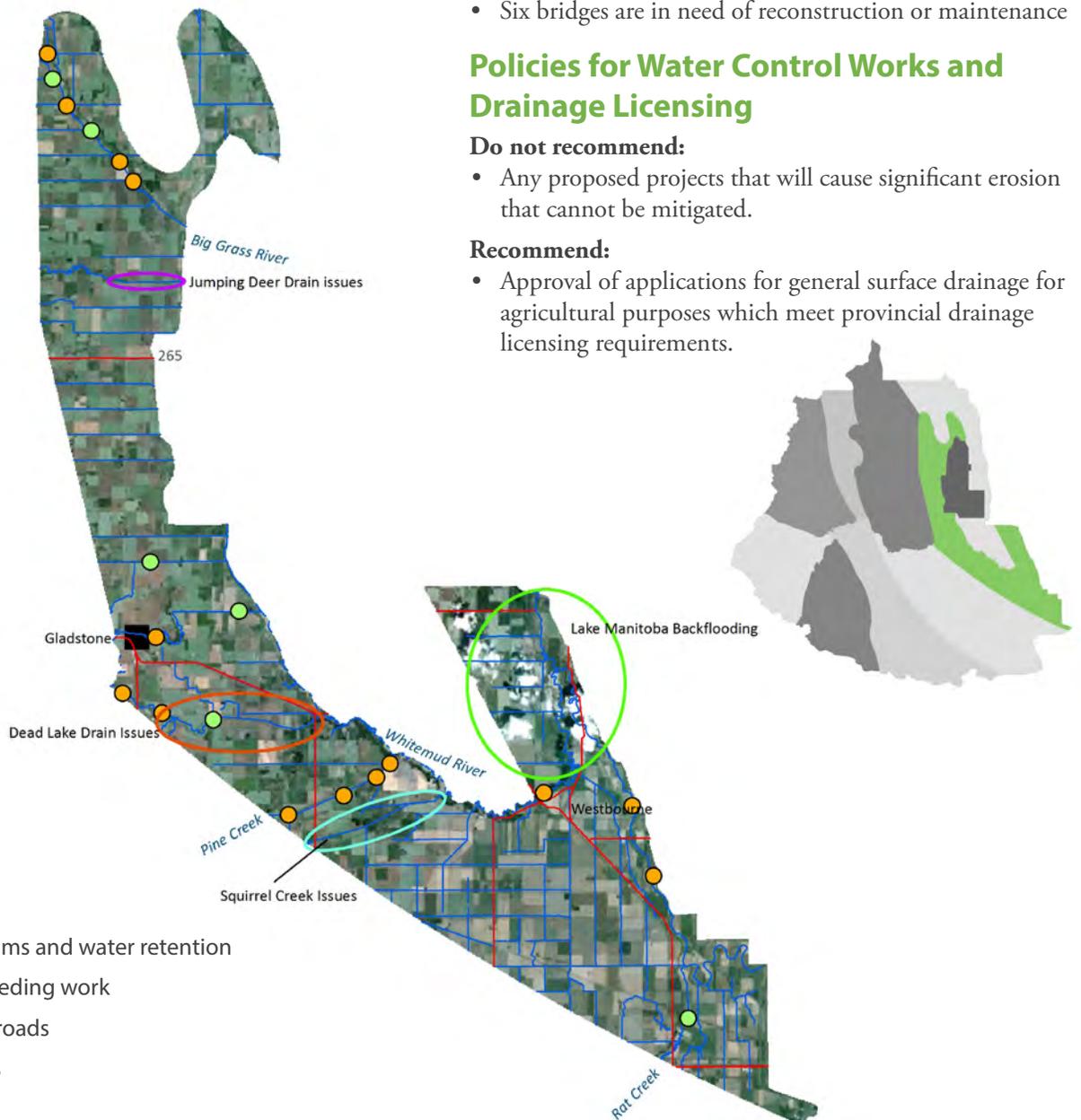
Policies for Water Control Works and Drainage Licensing

Do not recommend:

- Any proposed projects that will cause significant erosion that cannot be mitigated.

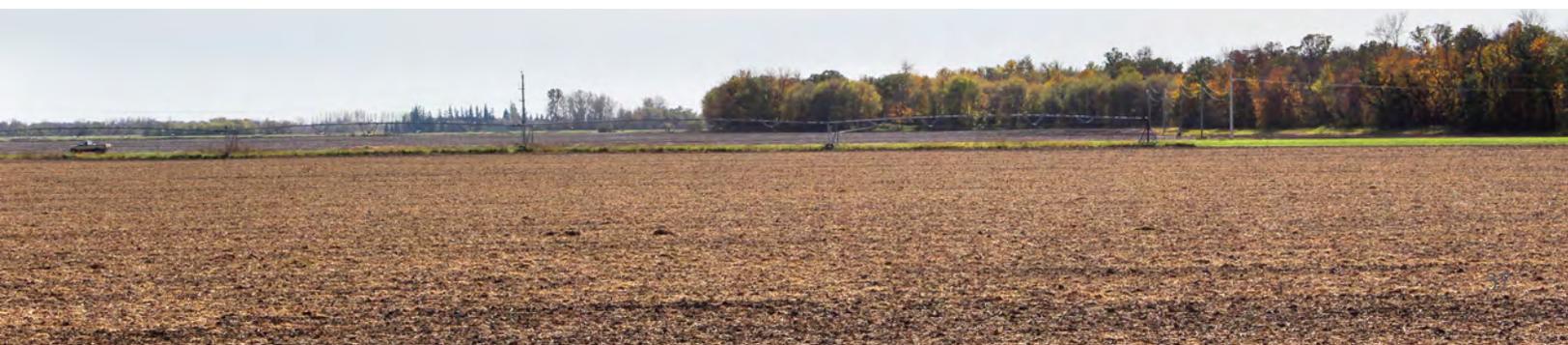
Recommend:

- Approval of applications for general surface drainage for agricultural purposes which meet provincial drainage licensing requirements.



How We Plan to Reach Our Goal:

Recommendations	Organization	Measures of Success
Maintain existing drainage infrastructure to current standard in the Whitemud River Watershed.	Landowners, Municipalities, Whitemud Watershed Conservation District	- Surface water management will not inhibit agricultural use in most cases reducing the incidences of crop damages.
Manage upstream runoff to limit peak flows using water retention structures and by protecting vegetation in riparian areas.	Landowners, Municipalities, Whitemud Watershed Conservation District, Manitoba Sustainable Development – Drainage and Water Control Works Licensing Section, Manitoba Sustainable Development – Surface Water Management	- The amount of erosion and flooding along the Whitemud River banks will be reduced. - River banks will remain intact and vegetated. - Water retention projects are investigated and completed.
Minimize flooding to neighbouring landowners through the management of Big Grass Marsh water levels.	Ducks Unlimited Canada, Landowners, Municipalities, Whitemud Watershed Conservation District	- Neighbouring property owners to the Big Grass Marsh will receive minimal impacts from flooding.
Complete maintenance works on the Jumping Deer Drain.	Whitemud Watershed Conservation District, Municipalities, Manitoba Sustainable Development – Surface Water Management	- A project is completed by 2018.
Complete maintenance works on Squirrel Creek.	Whitemud Watershed Conservation District, Municipalities	- A project is completed by 2020.
Develop a plan to resolve drainage issues in the area near Dead Lake Drain.	Whitemud Watershed Conservation District, Municipalities, Landowners	- Whitemud Watershed Conservation District will monitor the Dead Lake Drain during high water events and determine what work is required. - A project is completed by 2018.
Maintain existing permanent cover on the landscape, plant shelterbelts along annual cropland, and encourage the use of cover crops and forages.	Landowners, Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporations, Nature Conservancy of Canada, Ducks Unlimited Canada	- Field erosion will be reduced. - Reduced sediment transport in waterways improving water quality. - No net loss of permanent cover.
Investigate options to modify the control structure to drawdown the water levels in the Big Grass Marsh to allow for increased storage potential in preparation for future flood events without draining the wetland too much.	Ducks Unlimited Canada, Manitoba Sustainable Development – Drainage and Water Control Licensing Section, Municipalities, Whitemud Watershed Conservation District	- Increased water storage potential. - Downstream areas will experience reduced flooding.



ZONE 2: Sub-Escarpment Sand Plain

Overview:

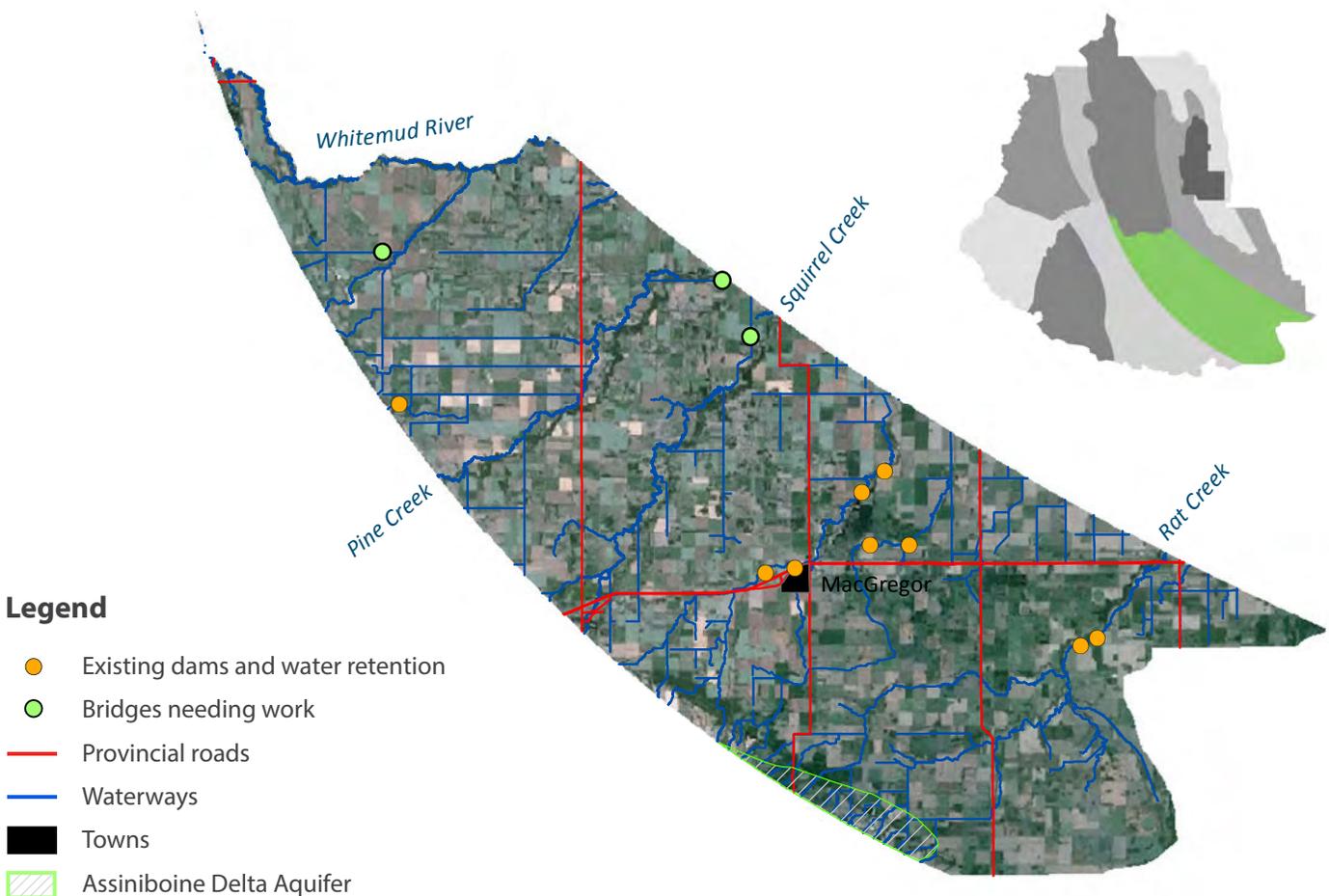
The Sub-Escarpment Sand Plain zone is in the southeastern part of the watershed. This zone contains mostly annual cropland with some forage and pasture land.

Goal:

To protect annual cropland from flooding and to reduce erosion by retaining water during high water events and holding it on the landscape to be used during drier periods.

Issues:

- Overland flooding is causing traffic disruption, crop damages and erosion of light soils.
- Excessive water flows from upstream zone during spring melt and after heavy summer rainstorms.
- Channel icing due to near surface groundwater table.
- Insufficient water quantities due to unreliable stream flow during drier times.
- Loss of permanent cover resulting in soil erosion from wind and water.
- Three bridges are in need of reconstruction or maintenance.



Legend

- Existing dams and water retention
- Bridges needing work
- Provincial roads
- Waterways
- Towns
- ▨ Assiniboine Delta Aquifer

How We Plan to Reach Our Goal:

Recommendations	Organization	Measures of Success
Maintain natural waterways in their natural state or design drainage infrastructure to be shallow and have wide grassed slopes.	Whitemud Watershed Conservation District, Municipalities, Landowners, Manitoba Sustainable Development – Drainage and Water Control Works Licensing Section	- Peak flows will be reduced, which will reduce excessive erosion and flooded adjacent cropland.
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and financial incentives.	Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada, Landowners	- No net loss of wetlands. - Reduced sediment transport in waterways improving water quality. - Increase in water storage capacity for flood protection and drought preparedness.
Identify and construct water retention sites, dry dams, and riffle structures to reduce downstream peak flows.	Whitemud Watershed Conservation District, Municipalities, Landowners, Ducks Unlimited Canada, Manitoba Sustainable Development – Surface Water Management Section	- Reduced peak flows and erosion. - Increase in water holding capacity for flood protection and drought preparedness. - 62 dam ³ (50 ac-ft) of water retained in this zone by 2026.
Provide incentives for water retention and natural cover restoration on private land.	Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	- Reduced peak flows and erosion.
Maintain existing permanent cover on the landscape, plant shelterbelts along annual cropland, and encourage the use of cover crops and forages.	Landowners, Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada, Manitoba Agriculture	- Reduced field erosion. - Reduced sediment transport in waterways, improving water quality. - No net loss of permanent cover.

Policies for Water Control Works and Drainage Licensing

Do not recommend:

- Drainage that will tap into underground water sources.
- Drainage of areas that have been cleared of permanent cover.
- Any proposed projects that will cause significant erosion that cannot be mitigated.

Recommend:

- Water storage projects.
- Grassed waterways.
- Control culverts to regulate flows leaving private lands.



ZONE 3: Sub-Escarpment

Overview:

The Sub-Escarpment zone is in the north central part of the watershed. This zone is comprised of water runoff from the northern portions of the Manitoba Escarpment. The zone includes a significant amount of annual cropland with a mix of forages and pasture land particularly in the northern areas.

Goal:

To allow for drainage of cropland while holding water for storage purposes.

Issues:

- Frequent flooding damage adjacent to conveyance channels from upstream zones.
- The conveyance channels build with sediment as this zone flattens out in topography.
- Drain maintenance is difficult and expensive.
- Loss of permanent cover causing erosion.
- Jumping Deer Drain and Colby Drain are in need of maintenance.
- Roe's Lake and Pocket Lakes reach high water levels in wet years.
- Two bridges are in need of reconstruction or maintenance.

Policies for Water Control Works and Drainage Licensing

Do not recommend:

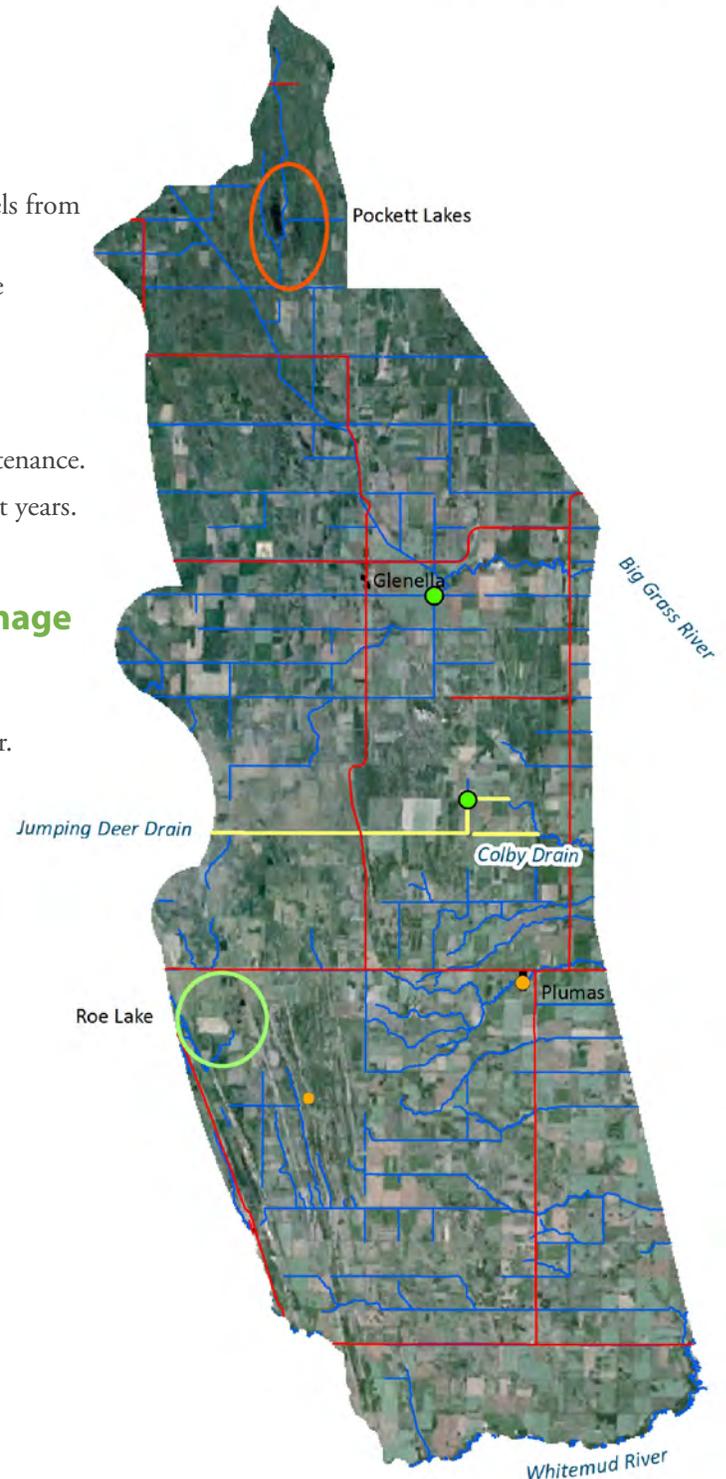
- Drainage of land that has been cleared of permanent cover.
- Any proposed projects that will cause significant erosion that cannot be mitigated.

Recommend:

- Water storage projects.
- Approval of applications for general surface drainage for agricultural purposes which meet provincial drainage licensing requirements.
- Control culverts to regulate flows leaving private lands.

Legend

- Existing dams and water retention
- Bridges needing work
- Drains needing construction
- Provincial roads
- Waterways
- Towns



How We Plan to Reach Our Goal:

Recommendations	Organization	Measures of Success
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and financial incentives.	Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - No net loss of wetlands. - Reduced sediment transport in waterways, improving water quality. - Increase in water storage capacity for flood protection and drought preparedness.
Maintain existing drainage infrastructure to current standard in the Whitemud River Watershed.	Landowners, Whitemud Watershed Conservation District, Municipalities	<ul style="list-style-type: none"> - Peak flows will be reduced, which will reduce excessive erosion and flooded adjacent cropland.
Identify and construct water retention sites, dry dams, and riffle structures to reduce downstream peak flows.	Whitemud Watershed Conservation District, Municipalities, Landowners, Ducks Unlimited Canada, Manitoba Sustainable Development – Surface Water Management Section	<ul style="list-style-type: none"> - Peak flows and erosion will be reduced. - Increase in water holding capacity for flood protection and drought preparedness. - Retain 62 dam³ (50 ac-ft) of water by 2026.
Provide incentives for water retention and natural cover restoration on private land.	Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Peak flows and erosion will be reduced.
Complete maintenance works on the Jumping Deer Drain and Colby Drain.	Whitemud Watershed Conservation District, Municipalities	<ul style="list-style-type: none"> - A project is completed by 2018.
Maintain and monitor retention structures to licensed levels on Pockett Lakes.	Ducks Unlimited Canada, Landowners, Whitemud Watershed Conservation District, Municipality, Manitoba Sustainable Development – Drainage and Water Control Works Licensing Section	<ul style="list-style-type: none"> - The water levels on Pockett Lakes will be at flood level for minimum amounts of time.
Maintain existing permanent cover on the landscape, plant shelterbelts along annual cropland, and encourage the use of cover crops and forages.	Landowners, Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada, Municipalities, Assiniboine Delta Aquifer Management Board	<ul style="list-style-type: none"> - Field erosion will be reduced. - Reduced sediment transport in waterways, improving water quality. - No net loss of permanent cover. - Shelterbelts established through programming.
Maintain and monitor retention structures to licensed levels on Roe Lake.	Landowners, Municipality, Manitoba Sustainable Development – Drainage and Water Control Works Licensing Section	<ul style="list-style-type: none"> - The water levels on Roe Lake will be at flood level for minimum amounts of time.



ZONE 4: Upland Sand Plain

Overview:

The Upland Sand Plain zone is located in the southwestern part of the watershed. Much of the water in this zone infiltrates through the ground into the Assiniboine Delta Aquifer due to sandy soil.

Goal:

To minimize drainage activities, protect groundwater and maintain riparian areas to reduce erosion and protect water quality.

Issues:

- Riparian areas have been degraded causing erosion and impacting water quality.
- Groundwater discharges into streams within this zone and causes flooding issues in downstream areas.
- Loss of permanent cover increasing the risk of erosion.

Policies for Water Control Works and Drainage Licensing

Do not recommend:

- Drainage of land that has been cleared of permanent cover.
- Any proposed projects that will cause significant erosion that cannot be mitigated.
- Drainage that will tap into underground water sources.

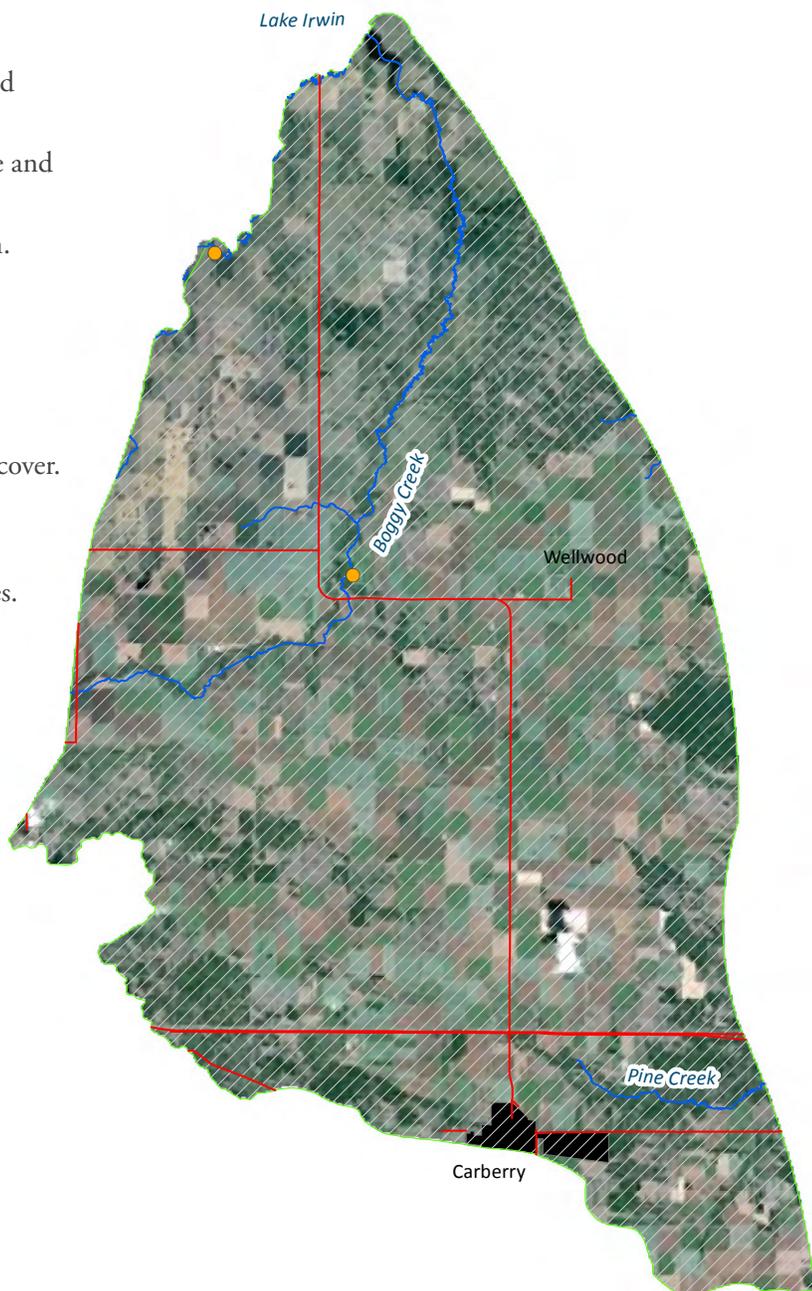
Recommend:

- Water storage projects.



Legend

- Existing dams and water retention
- Provincial roads
- Waterways
- Towns
- ▨ Assiniboine Delta Aquifer



How We Plan to Reach Our Goal:

Recommendations	Organization	Measures of Success
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and financial incentives.	Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada, Assiniboine Delta Aquifer Management Board	<ul style="list-style-type: none"> - Wetlands will no longer be drained. - Reduced sediment transport in waterways improving water quality. - Increase in water storage capacity for flood protection and drought preparedness.
Identify and construct water retention sites, dry dams, and riffle structures to reduce downstream peak flows.	Whitemud Watershed Conservation District, Municipalities, Landowners, Ducks Unlimited Canada, Assiniboine Delta Aquifer Management Board, Manitoba Sustainable Development – Surface Water Management Section	<ul style="list-style-type: none"> - Peak flows will be reduced, which will reduce excessive erosion and flooded adjacent cropland. - Increase in water holding capacity for flood protection and drought preparedness. - Retain 62 dam³ (50 ac-ft) of water by 2026.
Provide incentives for water retention and natural cover restoration on private land.	Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada, Assiniboine Delta Aquifer Management Board	<ul style="list-style-type: none"> - Peak flows will be reduced, which will reduce excessive erosion and flooded adjacent cropland.
Encourage zero till and minimum tillage practices.	Landowners, Whitemud Watershed Conservation District, Assiniboine Delta Aquifer Management Board	<ul style="list-style-type: none"> - Zero till and no fall tillage practices are increased.
Maintain existing permanent cover on the landscape, plant shelterbelts along annual cropland, and encourage the use of cover crops and forages.	Landowners, Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada, Municipalities, Assiniboine Delta Aquifer Management Board	<ul style="list-style-type: none"> - Field erosion will be reduced. - Reduced sediment transport in waterways improving water quality. - No net loss of permanent cover. - Shelterbelts established through programming.
Maintain Crown lands and municipal lands as publicly owned property.	Municipalities, Whitemud Watershed Conservation District, Province of Manitoba – Lands Branch	<ul style="list-style-type: none"> - All permanent cover on these properties will remain intact.
Maintain the conservation corridor program.	Whitemud Watershed Conservation District, Municipalities	<ul style="list-style-type: none"> - Existing amounts of permanent cover are maintained. - Cleared conservation corridors are restored.
Maximize percolation of surface water into the sandy soils over the Assiniboine Delta Aquifer.	Landowners, Municipalities, Whitemud Watershed Conservation District, Assiniboine Delta Aquifer Management Board	<ul style="list-style-type: none"> - Increased water storage. - Increase shelterbelt and tree cover. - Increase forages and permanent cover.



ZONE 5: Riding Mountain Alluvial Fan



Overview:

The Riding Mountain Alluvial Fan zone is located in the north central part of the watershed. The zone includes a mix of annual cropland, forages, and pasture.

Goal:

To retain and slow flows from the Riding Mountain Escarpment and reduce sediment transport downstream.

Issues:

- Frequent erosion issues from excessive surface runoff down steep natural waterways.
- Frequent deposition and buildup of shale from the Riding Mountain Escarpment.
- High groundwater levels and poor natural drainage capabilities result in crop damages in some areas.
- Natural alluvial fans that trapped sediment and slowed peak flows have all been drained and are no longer in functioning order.
- Loss of permanent cover increasing the risk of erosion.
- Jumping Deer Drain and Correction Line Drain are in need of maintenance.

Policies for Water Control Works and Drainage Licensing

Do not recommend:

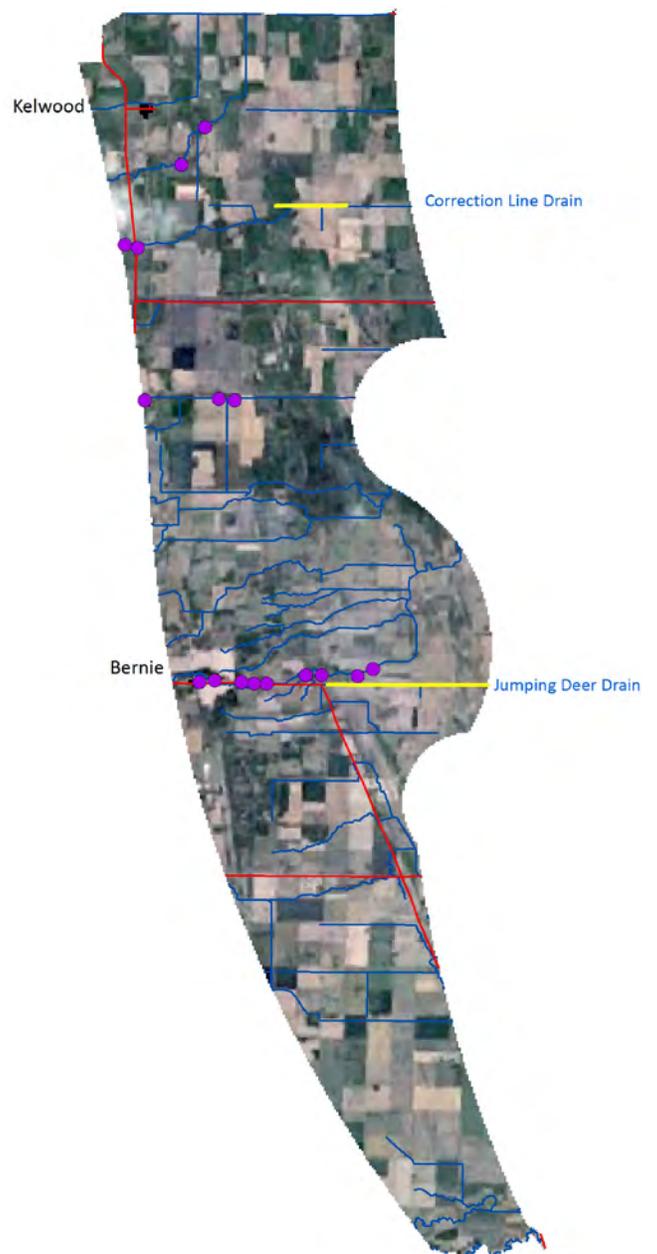
- Drainage of land that has been cleared of permanent cover.
- Any proposed projects that will cause significant erosion that cannot be mitigated.

Recommend:

- Water storage projects.
- Approval of applications for general surface drainage for agricultural purposes.
- Control culverts to regulate flows leaving private lands.

Legend

- Existing shale traps
- Drains needing construction
- Provincial roads
- Waterways
- Towns



How We Plan to Reach Our Goal:

Recommendations	Organization	Measures of Success
Maintain Crown land and municipal lands as publicly owned property.	Municipalities, Whitemud Watershed Conservation District, Province of Manitoba – Lands Branch	- Riparian area cover and water holding capacity of this zone will be maintained.
Restore one traditional alluvial fan.	Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	- Project is completed by 2026.
Provide incentives for water retention and natural cover restoration on private land.	Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	- Peak flows and erosion will be reduced.
Maintain existing erosion control structures such as shale traps to capture sediment in the waterways to reduce transfer to downstream zones.	Whitemud Watershed Conservation District, Landowners, Municipalities	- Complete maintenance on two projects per year.
Encourage zero till and minimum tillage practices.	Landowners, Whitemud Watershed Conservation District, Manitoba Agriculture	- Zero till and no fall tillage practices are increased.
Complete maintenance works on the Jumping Deer Drain and Correction Line Drain.	Whitemud Watershed Conservation District, Municipalities, Manitoba Sustainable Development – Surface Water Management	- Projects are completed by 2021.
Maintain existing riparian areas.	Landowners, Whitemud Watershed Conservation District, Municipalities	- Vegetation in riparian areas is maintained.
Maintain existing permanent cover on the landscape, plant shelterbelts along annual cropland, and encourage the use of cover crops and forages.	Landowners, Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	- Field erosion will be reduced. - Reduced sediment transport in waterways improving water quality. - No net loss of permanent cover. - 30 Shelterbelts established through programming by 2026.



ZONE 6: Riding Mountain Escarpment

Overview:

The Riding Mountain Escarpment zone is located in the north western part of the watershed. The zone includes a mix of annual cropland, forages, pasture, and part of Riding Mountain National Park.

Goal:

To reduce peak flows and store water while preventing erosion along steep topography.

Issues:

- Large volumes of snowmelt and rainstorm runoff quickly move down steep slopes causing flooding issues downstream.
- The fast flowing water causes erosion of the shale soils sending large accumulations of sediment to downstream zones.
- Loss of permanent cover increasing the risk of erosion.
- Two bridges are in need of reconstruction or maintenance.

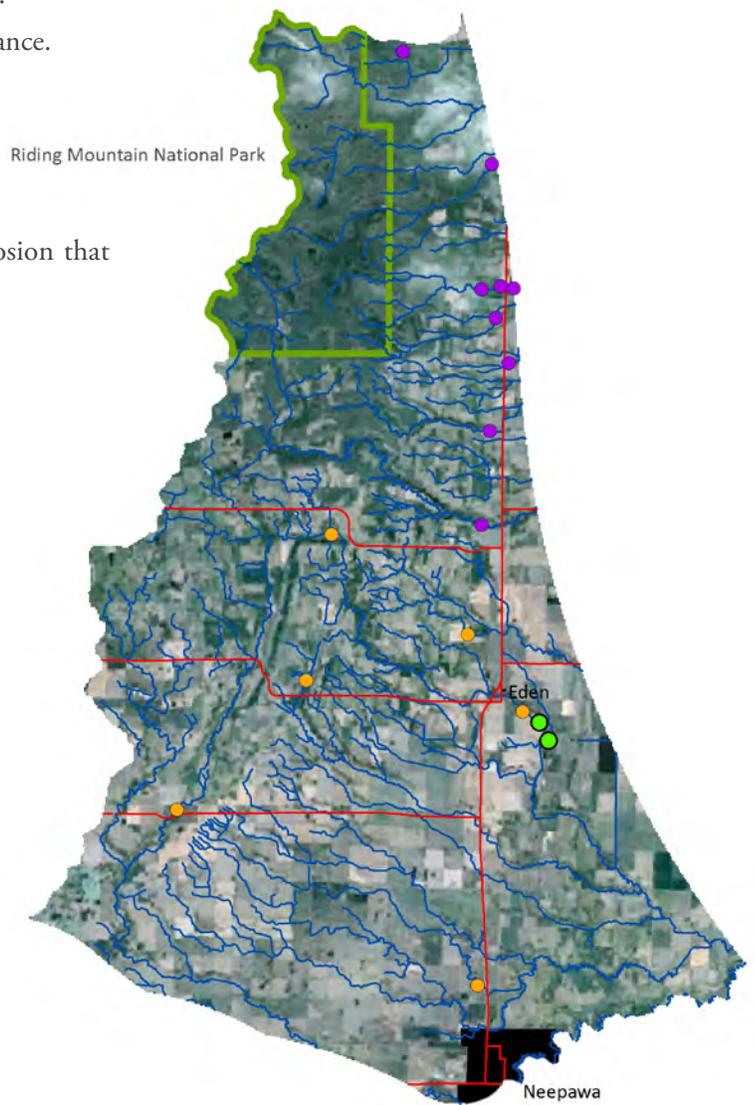
Policies for Water Control Works and Drainage Licensing

Do not recommend:

- Any proposed projects that will cause significant erosion that cannot be mitigated.
- Improved drainage to facilitate agricultural purposes.

Recommend:

- Water storage projects.

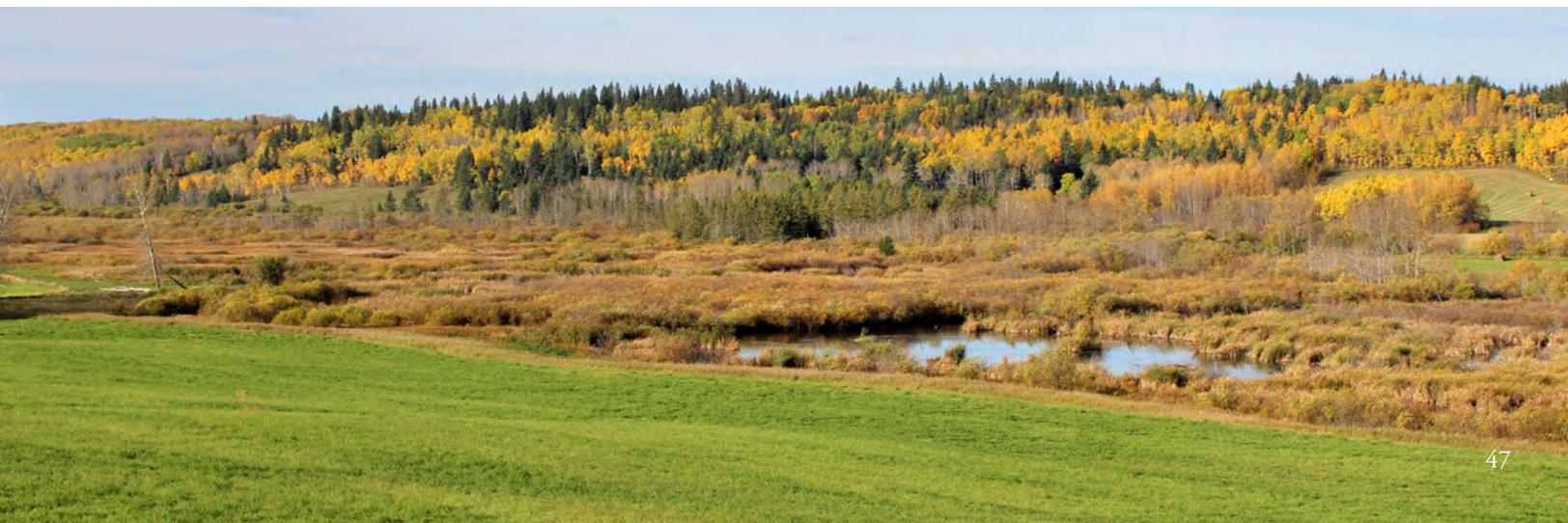


Legend

- Existing dams and water retention
- Existing shale traps
- Bridges needing work
- Provincial roads
- Waterways
- Towns
- Riding Mountain National Park

How We Plan to Reach Our Goal:

Recommendation	Organization	Measures of Success
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and financial incentives.	Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Wetlands will no longer be drained. - Reduced sediment transport in waterways, improving water quality. - Increase water storage capacity for flood protection and drought preparedness.
Maintain Crown lands and municipal lands as publicly owned property.	Municipalities, Whitemud Watershed Conservation District, Province of Manitoba – Lands Branch	<ul style="list-style-type: none"> - Riparian area cover and water holding capacity of this zone will be maintained.
Identify and construct water retention sites, dry dams, and riffle structures to reduce downstream peak flows.	Whitemud Watershed Conservation District, Municipalities, Landowners, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada, Manitoba Sustainable Development – Surface Water Management Section	<ul style="list-style-type: none"> - Peak flows and erosion will be reduced. - Increase in water holding capacity for flood protection and drought preparedness. - Retain 62 dam³ (50 ac-ft) of water in this zone by 2026.
Provide incentives for water retention and natural cover restoration on private land.	Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Peak flows will be reduced, which will reduce excessive erosion and flooded adjacent cropland.
Maintain existing erosion control structures such as shale traps to capture sediment in the waterways to reduce transfer to downstream zones.	Whitemud Watershed Conservation District, Landowners, Municipalities	<ul style="list-style-type: none"> - Complete maintenance on two projects per year.
Encourage zero till and minimum tillage practices.	Landowners, Whitemud Watershed Conservation District, Manitoba Agriculture	<ul style="list-style-type: none"> - Zero till and no fall tillage practices are increased.
Maintain existing permanent cover on the landscape, plant shelterbelts along annual cropland, and encourage the use of cover crops and forages.	Landowners, Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Field erosion will be reduced. - Reduced sediment transport in waterways improving water quality. - No net loss of permanent cover.



ZONE 7: Upland Till Plain

Overview:

The Upland Till Plain zone is located in the western part of the watershed. This zone has an abundance of annual cropland with perennial crops and pasture land. This zone is considered part of the prairie pothole region. On average, for every acre of wetland drained, four acres of surrounding lands are also drained (DUC 2012). Any efforts to store water will be a benefit for downstream landowners.



Goal:

To maintain existing potholes and increase water retention to reduce flooding in downstream zones.

Issues:

- Many of the wetlands in this area have been drained contributing to flooding issues in downstream zones.
- Erosion causing sediment loading to downstream waterways.
- Degradation of riparian areas.
- Loss of permanent cover increasing the risk of erosion.



Legend

- Existing dams and water retention
- Provincial roads
- Waterways
- Towns
- ▨ Assiniboine Delta Aquifer



How We Plan to Reach Our Goal:

Recommendations	Organization	Measures of Success
Restore previously drained wetlands using wetland plugs.	Ducks Unlimited Canada, Landowners, Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada	<ul style="list-style-type: none"> - Reduced flows in natural watercourses. - No net loss of wetlands. - Plug five drained wetlands by 2026
Maintain existing riparian areas.	Landowners, Whitemud Watershed Conservation District, Municipalities	<ul style="list-style-type: none"> - Vegetation in riparian areas is maintained, reducing the risk of erosion.
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and financial incentives.	Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Wetlands will no longer be drained. - Reduced sediment transport in waterways improving water quality. - Increase in water storage capacity for flood protection and drought preparedness.
Identify and construct water retention sites, dry dams, and riffle structures to reduce downstream peak flows.	Whitemud Watershed Conservation District, Municipalities, Landowners, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada, Manitoba Sustainable Development – Surface Water Management Section	<ul style="list-style-type: none"> - Peak flows will be reduced, which will reduce excessive erosion and flooded adjacent cropland. - Increase in water holding capacity for flood protection and drought preparedness. - Retain 62 dam³ (50 ac-ft) of water in this zone by 2026.
Provide incentives for water retention and natural cover restoration on private land.	Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Peak flows will be reduced, which will reduce excessive erosion and flooded adjacent cropland.
Encourage zero till and minimum tillage practices.	Landowners, Whitemud Watershed Conservation District, Manitoba Agriculture	<ul style="list-style-type: none"> - Zero till and no fall tillage practices are increased.
Maintain and promote grassed waterways	Whitemud Watershed Conservation District, Manitoba Agriculture, Landowners	<ul style="list-style-type: none"> - Field erosion will be reduced. - Reduced sediment transport in waterways will improve water quality. - Complete 5 grassed waterway projects by 2026.
Maintain existing permanent cover on the landscape, plant shelterbelts along annual cropland, and encourage the use of cover crops and forages.	Landowners, Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Field erosion will be reduced. - Reduced sediment transport in waterways improving water quality. - No net loss of permanent cover.

Policies for Water Control Works and Drainage Licensing

Do not recommend:

- Any proposed projects that will cause significant erosion that cannot be mitigated.
- Excessive drainage to facilitate agricultural purposes.
- Straightening of waterway channels.

Recommend:

- No net loss of wetlands.
- Water storage and wetland restoration projects.
- Grassed waterways.

ZONE 8: Big Grass Marsh

Overview:

The Big Grass Marsh zone is located on the east side of the watershed. The region is a low lying flat area that consists of a large marsh surrounded by community pastures and agricultural land. The marsh provides exceptional habitat biodiversity for many species. This zone retains flows from the northern half of the watershed.

This region was drained for agricultural purposes in 1909. In 1938, Ducks Unlimited Canada started their first wetland project at this location. The area is known for its bird habitat and is considered an Important Bird Area by Nature Manitoba. During the spring and fall, many migratory birds use the Big Grass Marsh during their seasonal travels.

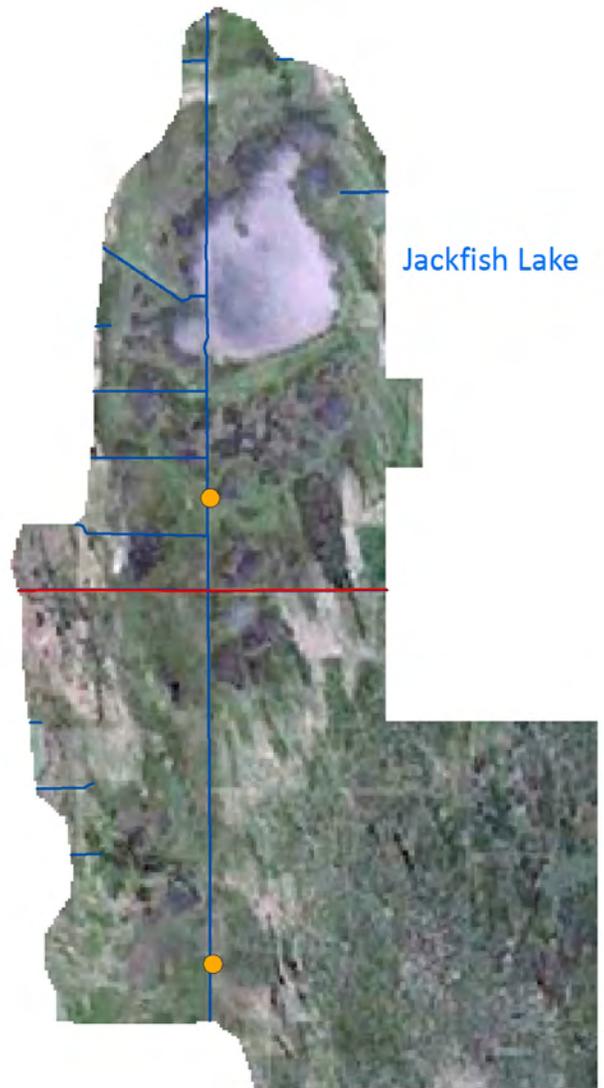
A large area of this zone has been protected through a Conservation Agreement with the help of Manitoba Habitat Heritage Corporation, the local municipalities, and the Whitemud Watershed Conservation District. The conservation agreement protects the land in perpetuity, preserving over 18,210 hectares (45,000 acres) of wetland, tall grass prairie, and wooded habitat in its current state as wetland and pasture land. The ability of the marsh to hold water during flood events is a major benefit to the watershed. It allows for the water to be slowed down before flowing to problematic downstream areas.

Goal:

To retain water within the Big Grass Marsh to significantly reduce downstream flooding while limiting impacts to adjacent landowners.

Issues:

- Issues can arise during high water events when water levels in the marsh rise and flood neighbouring agricultural land.
- Difficult to balance managing water levels for flood mitigation, wildlife habitat, and agricultural use all at the same time.
- Water storage potential in the Big Grass Marsh can be limited when it reaches full capacity during a previous high water event.
- There is a need to revisit the design of the water retention structure at Big Grass Marsh.



Legend

- Existing dams and water retention
- Provincial roads
- Waterways

How We Plan to Reach Our Goal:

Recommendations	Organization	Measures of Success
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and financial incentives.	Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Wetlands will no longer be drained. - Increase in water storage capacity for flood protection and drought preparedness. - Healthy functioning marsh reducing peak flows and filtering nutrients.
Protect land surrounding the Big Grass Marsh through conservation agreements or land acquisition for properties affected by high water levels.	Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Healthy functioning marsh. - Reduction in crop insurance claims for damages.
Investigate options to modify the control structure to drawdown the water levels in the Big Grass Marsh to allow for increased storage potential in preparation for future flood events without draining the wetland too much.	Ducks Unlimited Canada, Manitoba Sustainable Development – Drainage and Water Control Licensing Section, Municipalities, Manitoba Sustainable Development – Wildlife and Fisheries Branch	<ul style="list-style-type: none"> - Increased water storage potential. - Downstream areas will experience reduced flooding.
Minimize flooding to neighbouring landowners through the management of marsh water levels.	Ducks Unlimited Canada, Whitemud Watershed Conservation District, Municipalities, Landowners	<ul style="list-style-type: none"> - Neighbouring property owners to the marsh will receive minimal impacts from flooding.

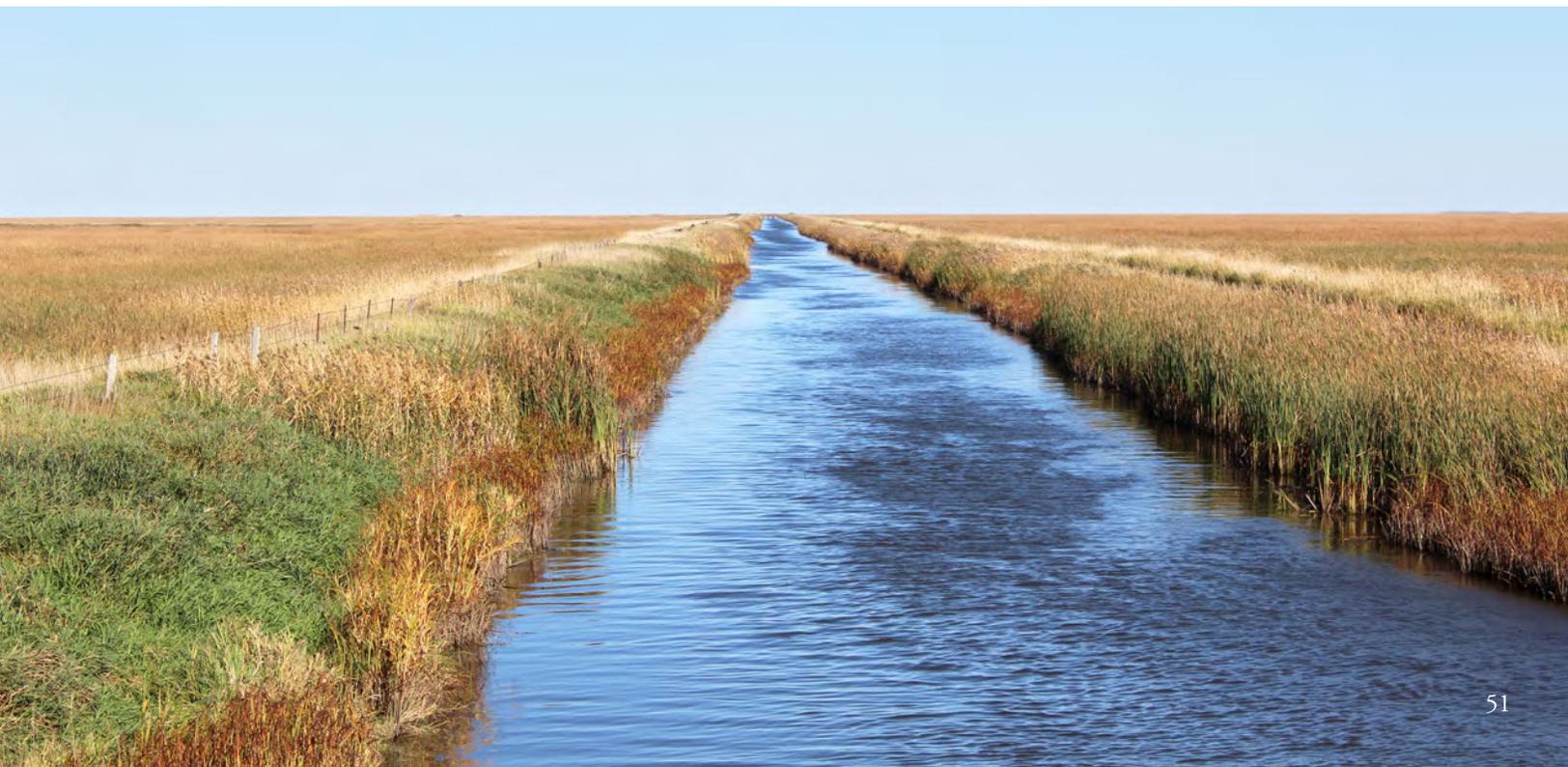
Policies for Water Control Works and Drainage Licensing

Do not recommend:

- Retaining high water levels in the marsh at all times.
- Draining the marsh to the detriment of its health.

Recommend:

- Maintenance of existing infrastructure.
- Management of water levels for multiple purposes such as flood mitigation, wildlife habitat, and agricultural activities.



ZONE 9: Lowland Till Plain

Overview:

The Lowland Till Plain zone is located at the northeastern region of the watershed. The area includes a mix of annual crops, forage, and pasture land. This relatively flat zone is comprised of ridge-and-swale formations that were created from receding glaciers and run in a northwest to southeast direction. This zone is impacted by the management of water levels in the Big Grass Marsh.

Goal:

To protect existing wetlands and permanent cover, while supporting minimal drainage activities.

Issues:

- Flooding adjacent to and downstream of the Big Grass Marsh.
- Spring flooding causes sediment to buildup between Westbourne and Lake Manitoba adjacent to the Whitemud River.
- Loss of permanent cover increasing the risk of erosion.

Policies for Water Control Works and Drainage Licensing

Do not recommend:

- Drainage of land that has been cleared of permanent cover.
- Any proposed projects that will cause significant erosion that cannot be mitigated.

Recommend:

- Water storage projects.



Legend

- Provincial roads
- Waterways



How We Plan to Reach Our Goal:

Recommendations	Organization	Measures of Success
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and financial incentives.	Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	- Increase in water storage capacity for flood protection and drought preparedness.
Maintain existing drainage infrastructure to current standard in the Whitemud River Watershed.	Landowners, Whitemud Watershed Conservation District, Municipalities	<ul style="list-style-type: none"> - Peak flows will not cause excessive erosion and flooded adjacent cropland. - Neighbouring property owners to the marsh will receive limited flooding.
Identify and construct water retention sites, dry dams, and riffle structures to reduce downstream peak flows.	Whitemud Watershed Conservation District, Municipalities, Landowners, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada, Manitoba Sustainable Development – Surface Water Management Section	<ul style="list-style-type: none"> - Peak flows and erosion will be reduced. - Increase in water holding capacity for flood protection and drought preparedness. - Retain 62 dam³ (50 ac-ft) of water in this zone by 2026.
Provide incentives for water retention and natural cover restoration on private land.	Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	- Peak flows and erosion will be reduced.
Maintain existing permanent cover on the landscape, plant shelterbelts along annual cropland, and encourage the use of cover crops and forages.	Landowners, Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	- No net loss of permanent cover.
Modify the control structure to drawdown the water levels in the Big Grass Marsh to allow for increased storage potential in preparation for future flood events without draining the wetland too much.	Ducks Unlimited Canada, Manitoba Sustainable Development – Drainage and Water Control Licensing Section, Municipalities	<ul style="list-style-type: none"> - Increased water storage potential - Downstream areas will experience reduced flooding.
Minimize flooding to neighbouring landowners through the management of Big Grass Marsh water levels.	Ducks Unlimited Canada, Whitemud Watershed Conservation District, Municipalities, Landowners	- Neighbouring property owners to the Big Grass Marsh will receive minimal impacts from flooding.



ZONE 10: Manitoba Escarpment

Overview:

The Manitoba Escarpment zone is located in the south central part of the watershed. This zone includes a large amount of pasture land and annual crop land with some forage.



Goal:

To reduce erosion and retain water to reduce flooding downstream.

Issues:

- Steep slopes that cause fast water runoff causing flooding in downstream areas.
- Permanent cover loss increasing the risk of erosion.
- Degradation of riparian areas.
- Dependence of stream flow on surface water runoff, results in flooding in spring and low flow in summer.

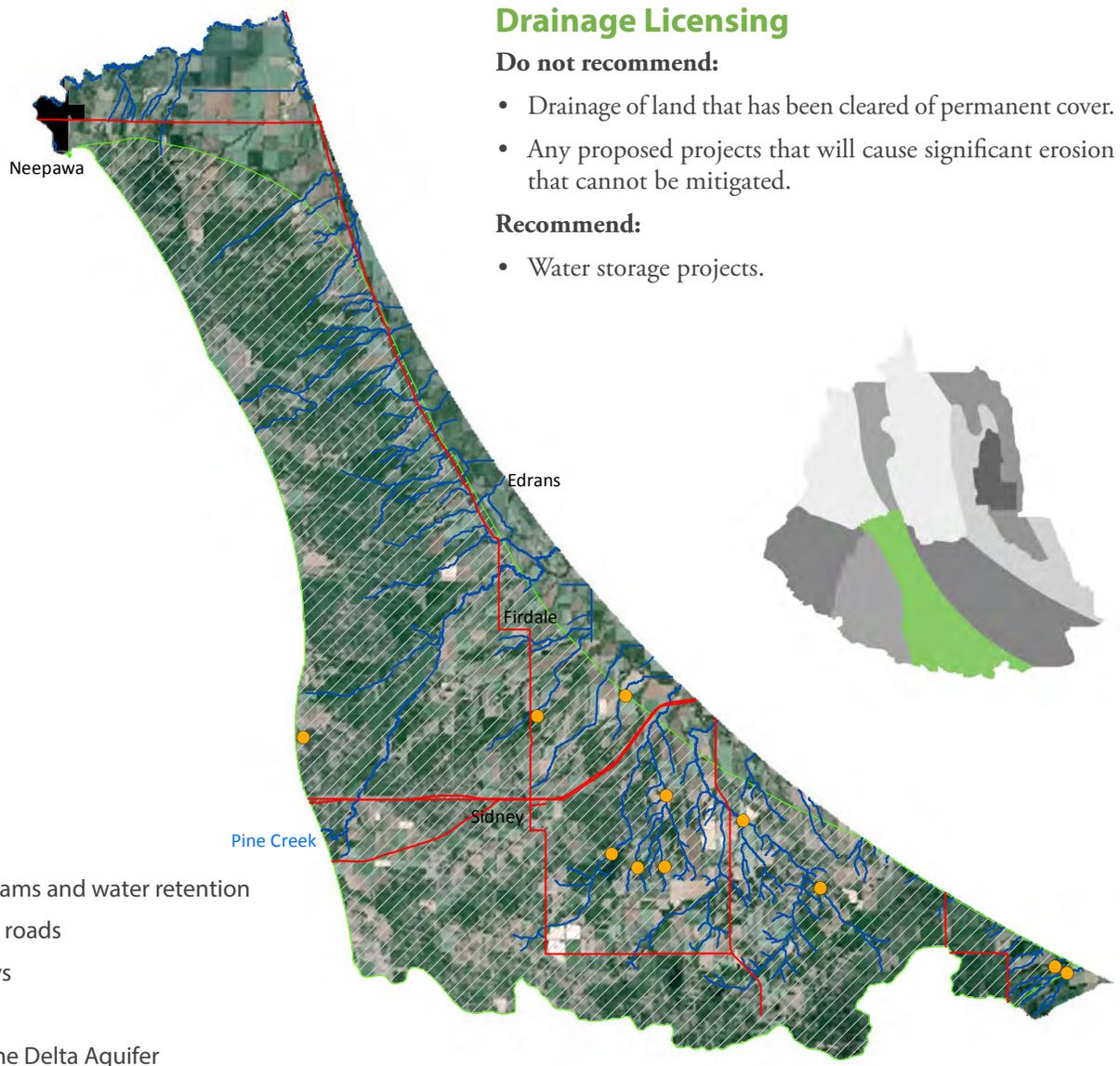
Policies for Water Control Works and Drainage Licensing

Do not recommend:

- Drainage of land that has been cleared of permanent cover.
- Any proposed projects that will cause significant erosion that cannot be mitigated.

Recommend:

- Water storage projects.



How We Plan to Reach Our Goal:

Recommendations	Organization	Measures of Success
Continue the conservation corridor program.	Whitemud Watershed Conservation District, Municipalities	<ul style="list-style-type: none"> - No loss in permanent cover. - Water retention will increase.
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and financial incentives.	Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Increase in water storage capacity for flood protection and drought preparedness.
Identify and construct water retention sites, dry dams, and riffle structures to reduce downstream peak flows.	Whitemud Watershed Conservation District, Municipalities, Landowners, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada, Manitoba Sustainable Development – Surface Water Management Section	<ul style="list-style-type: none"> - Peak flows will be reduced, which will reduce excessive erosion and flooded adjacent cropland. - Increase in water holding capacity for flood protection and drought preparedness. - Retain 62 dam³ (50 ac-ft) of water in this zone by 2026.
Provide incentives for water retention and natural cover restoration on private land.	Whitemud Watershed Conservation District, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Peak flows will be reduced, which will reduce excessive erosion and flooded adjacent cropland.
Encourage zero till and minimum tillage practices.	Landowners, Whitemud Watershed Conservation District, Manitoba Agriculture	<ul style="list-style-type: none"> - Zero till and no fall tillage practices are increased.
Maintain Crown lands and municipal lands as publicly owned property.	Municipalities, Whitemud Watershed Conservation District, Province of Manitoba – Lands Branch	<ul style="list-style-type: none"> - Riparian area cover and water holding capacity of this zone will be maintained.
Maintain existing permanent cover on the landscape, plant shelterbelts along annual cropland, and encourage the use of cover crops and forages.	Landowners, Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Field erosion will be reduced. - Reduced sediment transport in waterways, improving water quality. - No net loss of permanent cover.
Maintain existing riparian areas.	Landowners, Whitemud Watershed Conservation District, Municipalities, Manitoba Habitat Heritage Corporation, Nature Conservancy of Canada, Ducks Unlimited Canada	<ul style="list-style-type: none"> - Vegetation in riparian areas is maintained reducing the risk of erosion.
Maximize percolation of surface water into the sandy soils over the Assiniboine Delta Aquifer by retaining surface flows.	Landowners, Municipalities, Whitemud Watershed Conservation District	<ul style="list-style-type: none"> - Peak flows are reduced. - Wetlands and water storage areas will increase.





Linking to Development Planning

The following recommendations are proposed for adoption in the development plans for Neepawa and Area Planning District, Cypress Planning District, Nor-Mac Planning District, and the Big Grass Planning District.

Proposed for adoption in the development plans for land within the Whitemud River Watershed:

- Intensive and high pollution risk developments (developments, activities, land uses and structures that have a high risk of causing pollution and include, but are not limited to chemical and fertilizer storage facilities, septic fields and tanks, fuel tanks, waste disposal grounds and sewage treatment facilities) should be restricted in source water protection areas (within 1.5 km) for all public drinking water sources. Where restrictions are not possible, development must be limited and may be subject to:
 - demonstration by the proponent that no significant negative effect on water is likely to occur;
 - the implementation of mitigation measures and alternative approaches that protect, improve or restore these areas; or
 - the preparation of a strategy for mitigation in the event that negative impacts do occur.
- Ensure an emergency response plan is developed for each public drinking water system to address spills, accidents, and other emergencies that may affect public drinking water sources.
- All new developments above the Assiniboine Delta Aquifer should include mitigation plans for any potential groundwater contamination issues before being approved.
- All new developments should be required to identify and seal all known abandoned wells, as well as, identify proposed new wells.
- To prevent significant surface water quality and drinking water quality deterioration, developments in or near surface water and riparian areas will be restricted or limited, if they:
 - lead to the contribution of nutrients, pathogenic organisms, deleterious chemicals or materials to these waters;
 - accelerate erosion and bank instability;
 - cause the removal of natural vegetation cover; or
 - may have impact on in-stream flows needed to maintain healthy aquatic ecosystems.
- Adopt policies for a minimum setback distance of 30 m (100 ft) above normal high water mark for new residential and business development or buildings along waterways of order 1 or 2.
- Adopt policies for a minimum setback distance of 50 m (165 ft) above normal high water mark for new residential and business development or buildings along waterways order 3 or higher.
- Elevation should be taken into consideration to increase setback distances above flood levels.
- Ensure wetlands are considered in land use and management decisions. If a wetland is to be compromised, another wetland should be restored somewhere in the same sub-watershed to ensure no net loss of wetlands.
- Adopt policies for a minimum set back distance for annual cropping of 3 m (10 ft) along order 1 and 2 waterways. A minimum setback of 6 m (20 ft) along order 3 or waterways. A minimum setback of 10 m (33 ft) for order 4 waterways. A minimum setback of 20 meters (66 ft) for order 5 waterways. As well as a minimum setback of 30 m for order 6 waterways for the purpose of maintaining and improving water quality and reducing the risk of erosion and the impacts of stream flooding on agricultural lands.



Continued...

- Opportunities to expand public drinking water systems and rural water pipelines should be considered.
- Conservation agreements or the establishment of public reserves adjacent to waterways and sensitive habitat is recommended when it is reasonable and desirable to do so in conjunction with planning approvals.
- Planning districts are encouraged to develop agreements between municipalities and prospective developers that address relevant conservation concerns.

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5. Westbourne-Longbourne History, 1985. When the West was Born: A History of Westbourne and District 1985.
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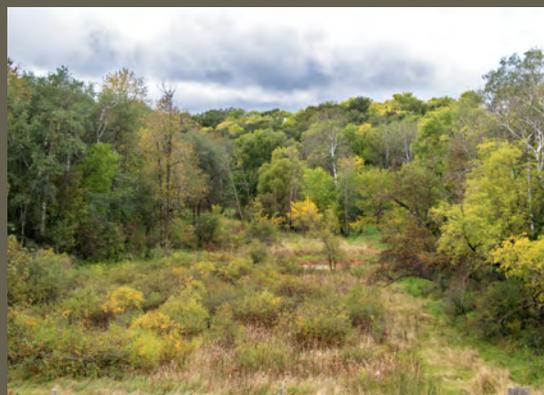
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