ROSEAU RIVER WATERSHED RESOURCE INVENTORY

BACKGROUND DOCUMENT FOR THE ROSEAU RIVER WATERSHED PLAN

ROSEAU RIVER INTERNATIONAL WATERSHED

RURAL MUNICIPALITY OF PINEY
RURAL MUNICIPALITY OF STUARTBURN
RURAL MUNICIPALITY OF FRANKLIN
RURAL MUNICIPALITY OF MONTCALM
ROSEAU RIVER ANISHINABE FIRST NATION GOVERNMENT

APRIL 2007

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1.0 – Roseau River International Watershed Purpose and Mission Statement

In August 1999 the forerunner of the Red River Basin Commission, The International Coalition for Land/Water Stewardship in the Red River Basin, proposed the formation of a Canada-United States water partnership. Consequently, after a series of meetings a unique transborder organization was formed on January 19, 2000 in Roseau, Minnesota. The Roseau River International Watershed (RRIW) is comprised of a board with five Canadian and five American representatives. The purpose of the group is to provide a forum for the exchange of information that is of common interest to both jurisdictions on issues such as water quality and quantity and the ability to initiate flood alleviation and conservation projects on both sides of the border. Another of the group's tasks is to examine how to set up an international conservation district.

The Canadian portion of the RRIW is comprised of representatives from the Rural Municipalities of Piney, Stuartburn, Franklin and Montcalm, as well as the Roseau River Anishinabe First Nation. Representatives from the Red River Basin Commission, the Province of Manitoba (Manitoba Water Stewardship), and the Government of Canada (Agriculture and Agri-Food Canada) participate as Canadian ex-officio members of the group. Each of the Canadian and American delegations is responsible for securing equal funding to be used for the administration and operational purposes of the RRIW. This is also the case, on a proportional basis as agreed to by both sides, for construction projects and feasibility or hydrology studies.

The mission statement of the RRIW is to promote, provide and conduct an international alliance between Manitoba and Minnesota which will work towards the proper management of the resources of the Roseau River Watershed, including flood control, economic, human and natural resources, and water quality and quantity.

2.0 – Acknowledgements

The development of the Roseau River Watershed Plan (RRWP) was the result of the motivation, initiative, hard work, and collaboration of a number of individuals and groups.

The RRWP Steering Committee provided project oversight, as well as key input from the local perspective. The Steering Committee, which consisted of representatives from each of the project partners, as well as the Province of Manitoba, met monthly during the project timeframe. Special thanks to the RM of Stuartburn who kindly provided regular use of their council chamber for these meetings. Steering Committee members and their affiliations included:

- Councillor Barb Zailo – Rural Municipality of Piney
- Reeve Wally Happychuk – Rural Municipality of Stuartburn
- Reeve Archie Hunter – Rural Municipality of Franklin
- Councillor Ghislain Dupuis – Rural Municipality of Montcalm
- Mr. Oliver Nelson / Councillor Lawrence Henry – Roseau River Anishinabe First Nation
- Mr. Henry Daniels – Manitoba Water Stewardship

RRWP Steering Committee alternates also participated in the project and were integral to retaining continuity in instances where Steering Committee members were unable to attend a meeting or provide input. Steering Committee alternates and their affiliations included:

- Councillor Alana Schoenbach – Rural Municipality of Piney
- Councillor Jim Swidersky – Rural Municipality of Stuartburn
- Councillor Duaine Riach – Rural Municipality of Franklin
- Reeve Roger Vermette – Rural Municipality of Montcalm
- Mr. Melvin Pierre – Roseau River Anishinabe First Nation
- Mr. Geoff Reimer – Manitoba Water Stewardship

A Technical Advisory Committee (TAC) was instrumental in gathering baseline data and providing the professional expertise that was essential to the foundation of the watershed plan. In some instances TAC members provided written briefs on their area of expertise and in other instances provided materials and guidance to Red River Basin Commission staff. Mr. Barry Oswald of Manitoba Water Stewardship served as the TAC Chairman and played a pivotal role coordinating this group. TAC membership and the organizations they represented included:

- Allyson Desgroseilliers – Indian and Northern Affairs Canada
- Alvin Dyck – Manitoba Transportation and Government Services
- Bill Sawka – Manitoba Intergovernmental Affairs
- Chuck Jones – Manitoba Industry, Economic Development and Mines
- Dennis Schindler / Mitch Timmerman – Manitoba Agriculture, Food and Rural Initiatives
- Duane Boutang – Agriculture and Agri-Food Canada (PRFA Manitoba Region)
- Duane Kelln / Janna Hamilton / Scott Herbert – Manitoba Water Stewardship
- Henry Buhler – Manitoba Water Stewardship
- Jason Greenall / Cary Hamel – Manitoba Conservation

- Jan Collins – Manitoba Culture, Heritage and Tourism
- Laurie Frost – Manitoba Water Stewardship
- Lindsay Donnelly – Manitoba Conservation
- Martin Erickson – Manitoba Water Stewardship
- Dale Marciski / Ron Bazin – Environment Canada
- Mike Moore – Nature Conservancy Canada
- Neil Mochnacz – Fisheries and Oceans Canada
- Rob Matthews – Manitoba Water Stewardship
- Sudhansu Majumdar – Manitoba Water Stewardship
- Tim Swanson – Manitoba Conservation
- Wendy Ralley – Manitoba Water Stewardship

In addition, a sub-committee of the TAC was formed to deal specifically with issues related to creating maps for the watershed plan. The TAC Mapping Sub-committee included:

- Lindsay Donnelly – Manitoba Conservation
- Ron Lewis – Agriculture and Agri-Food Canada (PRFA Manitoba Region)
- Jarrett Powers – Agriculture and Agri-Food Canada (PRFA Manitoba Region)
- Bill Sawka – Manitoba Intergovernmental Affairs
- Dennis Schindler – Manitoba Agriculture, Food and Rural Initiatives
- Tim Swanson – Manitoba Conservation

Harold Taylor, former Deputy Executive Director of the Red River Basin Commission, provided project management for the first 12 months of the project and was instrumental in the fundraising and initial development of the project. Mike Olczyk was the initial Watershed Planner on the project, and was supported by other staff at the Red River Basin Commission including Lance Yohe (Executive Director), Ron Hempel (mapping), April Kiers North (watershed planning), Julie Goehring (Communications Coordinator) and Leigh-Anne Bailie (Administrative Assistant).

3.0 – Introduction

3.1 – Background and Purpose

An agreement was made and entered into by and between the participating members of the Roseau River International Watershed (RRIW): the Rural Municipalities of Piney, Stuartburn, Franklin, Montcalm, the Roseau River Anishinabe First Nation Government and the Red River Basin Commission (RRBC), to develop a comprehensive, integrated watershed plan for the Canadian portion of the Roseau River Watershed. The goal of the Roseau River Watershed Plan (RRWP) is to address issues related to ensuring personal safety, reducing flood damage to infrastructure, farmland and property, providing adequate and safe water supply, and facilitating the involvement of government agencies for new economic development by utilizing the resources of the district. ***This document provides the background information on which the RRWP was based.***

The RRWP followed the completion of a hydrology study for the Roseau River by UMA Engineering Ltd. in 2002. The purpose of this hydrology study was to develop and calibrate a flood routing model capable of simulating the existing conditions on the Roseau River and using the calibrated model to evaluate various flood control options in the Canadian portion of the watershed. The study mandate specifically focused on the downstream portion of the watershed through which the Roseau River mainstem flows and did note include the upstream areas (Pine and Sprague Creek tributaries). A limited number of copies of the hydrology study remain at the Red River Basin Commission and Manitoba Water Stewardship has retained the modeling data.

The RRWP focuses on the entire Canadian portion of the Roseau River Watershed, including the lower watershed area (i.e. Roseau River mainstem) and the upper watershed area (i.e. Pine and Sprague Creeks). The watershed boundary utilized throughout this plan was obtained from staff at Manitoba Conservation (Computer Graphics) and Agriculture and Agri-Food Canada (Prairie Farm Rehabilitation Administration) and is based on watershed boundary data as of April 2005. In April 2005, RRBC staff consulted with Manitoba Water Stewardship hydrology experts to divide the watershed into 5 separate management areas for planning purposes. The 5 management areas represented an amalgamation of many smaller sub-watershed divisions based on drainage hydrology. The 5 management areas were later merged into 3 management areas based on discussions with the project Steering Committee for clarity and to aid the planning process. In the event that a Conservation District is formed in this watershed, these management areas will likely be designated as sub-districts. As denoted on Figure 1 moving from east to west:

- Management Area 1 – Pine and Sprague Creeks and all of the lands draining herein.
- Management Area 2 – Roseau River mainstem from the Canada-U.S. border to Roseau Rapids Indian Reserve No. 2A and all of the lands draining herein.
- Management Area 3 – Roseau River mainstem from Roseau Rapids Indian Reserve No. 2A to its terminus at the Red River and all of the lands draining herein.

The Roseau River was the focus of one of the earliest references to the International Joint Commission in 1928 due to chronic flooding in Canada from land development and drainage works constructed in northern Minnesota between 1904 and 1918. Further channel improvements in Minnesota were proposed that had the potential to increase flood flows downstream in Canada. These proposals also raised environmental concerns with respect to erosion, water quality, and recreational potential. While the additional channel improvements were never carried out and such projects are no longer authorized in the U.S., high springtime flows in recent years (particularly 1996 and 1997), high off-season flows in November 2001, and record summer flows in June 2002 and June/July 2005 have increased pressure on agencies to address the issue of flood mitigation and watershed management. High water on the Roseau River and overland flooding have major impacts on valuable agricultural land in the region with portions of the RMs of Montcalm, Franklin, and Stuartburn being affected regularly.

4.0 – Description of the Watershed (Resource Inventory)

4.1 – Watershed Setting

4.1.1 – Location and Size

The Roseau River Watershed is located in southeastern Manitoba and northwestern Minnesota and encompasses a drainage area of approximately 5,818 square kilometres (2,246 square miles). The Roseau River Watershed is a small component of the much larger Red River Basin which has a drainage area of approximately 116,550 km^2 (45,000 sq. mi.), excluding the drainage area covered by the Assiniboine River Basin (IJC, 2000). Flows entering into the Red River move northward, draining into Lake Winnipeg, and then eventually make their way into Hudson Bay via the Nelson River system. The total drainage area for the Canadian portion of the Roseau River Watershed is approximately 2,584 km^2 (998 sq. mi.) or 44.4% and the United States portion is 3,234 km^2 (1,249 sq. mi.) or 55.6%. The Canadian part of the watershed is bounded on the north by the Rat River and Whitemouth River Watersheds, on the east by the Bird River/Whiteshell River Watershed, on the west by the Rivière Aux Marais/Plum River Watershed and on the south by the International Border.

The upper tributary/headwater component of the Roseau River drainage area can be described as fanshaped, while the remaining drainage area following the course of the river is generally long and narrow in shape. The watershed is approximately 177 kilometres (110 miles) in total length and ranges from a minimum width of 18 to 27 km (11 to 17 mi.) in the lower reaches to 48 km (30 mi.) in the upper headwater reaches. The natural course of the Roseau River follows a meandering path in a principally northwestern direction over an approximate distance of 290 km (180 mi.) from source to mouth. The Roseau River crosses the Canada-U.S. border at roughly the midpoint of its course and terminates at the Red River approximately 15 km (9 mi.) from the International Border. There have been a number of man-made changes that have altered the natural course of the Roseau River (i.e. diversions, channelization, blockages, etc.) on both sides of the watershed. The average annual volume of water contributed by the Roseau River to the Red River is 416,210 cubic decametres (337,427 acre-feet). This contribution from the Roseau River represents 8.6% of the total average volume of flow for the Red River measured at Ste. Agathe (4,817,000 dam^3 (3,905,205 acre-feet)) and 6.1% of the total average volume of flow for the Red River measured at Lockport (6,774,000 dam^3 (5,491,771 acre-feet)). Note: the percent contribution of the Roseau River decreases at Lockport due to the fact that the overall volume of flow in the Red River is increased with the addition of flow from the Assiniboine River.

4.1.2 – Local Government (Political Units)

The Roseau River Watershed occupies significant portions of the Rural Municipalities of Piney, Stuartburn, and Franklin, as well as a small portion of the Rural Municipality of Montcalm. Each rural municipality (RM) has a reeve and council who are elected to serve four-year terms.

The number of councillors varies between municipalities, ranging from four in Piney and Stuartburn to six in Montcalm and Franklin. Each municipality also employs a Chief Administrative Officer and other staff as required. In addition, the lands of the Roseau River Anishinabe First Nation fall within the boundaries of the watershed. Local government on the First Nation consists of a Chief and four councillors who are elected and serve two-year terms.

Since the Roseau River is transboundary and drains portions of land in the state of Minnesota and the province of Manitoba, the International Joint Commission (IJC) oversees certain water-related issues between the two countries. The IJC is an independent binational organization established by the 1909 Boundary Waters Treaty. The purpose and mission of the IJC is to prevent and resolve disputes relating to the use and quality of boundary waters between the United States of America and Canada under the *1909 Boundary Waters Treaty* and to pursue the common good of both countries as an independent and objective advisor to the two governments on related questions (IJC, 2006). Duties of the IJC include: ruling on applications for the approval of projects affecting boundary or transboundary waters and potentially regulating the operation of such projects; assisting the two countries in the protection of the transboundary environment and the improvement of transboundary air quality; and alerting both governments to emerging issues along the boundary that may give rise to bilateral disputes (IJC, 2006).

Water resource planning in the watershed is currently coordinated at the local level by Canadians and Americans through the Roseau River International Watershed (RRIW) via a Memorandum of Understanding that was formulated and ratified in 2000. As noted previously, the purpose of the group is to provide a forum for the exchange of information that is of common interest to both jurisdictions on issues such as water quality and quantity and the ability to initiate flood alleviation and conservation projects on both sides of the border.

The primary local water management organization on the U.S. side of the watershed is the Roseau River Watershed District (RRWD). This formal organization is a governing body who's mission is "to manage the waters and related resources within the Watershed District in a reasonable and orderly manner to improve the general welfare and public health of the residents in the Watershed District" (RRWD, 2004). The Watershed District has been instrumental in carrying out projects throughout the watershed that have been aimed at flood damage reduction and natural resource enhancement.

The formalized local water management organization in Canada is termed a Conservation District. "A Conservation District (CD) is a group of neighboring rural municipalities working in partnership with the Province of Manitoba to develop programs to effectively manage the natural resources of their area" (Manitoba Water Stewardship, n.d.). A key to the CD Program is that a local organization is created to oversee the management of soil and water resources in the watershed. Being an established program that provides a source for funding, the CD is the vehicle for implementing some of the actions outlined in a watershed management plan. "The ultimate goal is to manage the resources for our benefit today while ensuring that generations that follow will have the same resource management options that we enjoy today" (Manitoba Water Stewardship, n.d.). At this time there is no CD formed in the Roseau River Watershed.

4.1.3 – Population Characteristics and Community Profiles

Since watershed boundaries do not follow political boundaries it is difficult to provide population figures that are representative on a watershed scale. Consequently, the population figures provided in Table 1 are based on political divisions collected in the 1996 and 2001 Census of Canada by Statistics Canada.

It is necessary to note that although data is provided for the entire RM of Montcalm only a small portion of the RM actually falls within the Roseau River Watershed area and as such, only a small number of these residents reside in the watershed area. Approximately half of the land area covered by the RM of Piney falls within the Roseau River Watershed and a significant proportion of the population resides in the watershed area. About two-thirds of the RM of Stuartburn falls within the drainage area of the Roseau River Watershed and a significant proportion of the population resides in this area. The majority of the RM of Franklin and its residents fall within the drainage area of the Roseau River Watershed. All of the land currently belonging to the Roseau River Anishinabe First Nation falls within the Roseau River Watershed and as such, all of the on-Reserve population resides in this area. *Note: more precise figures for the Roseau River Anishinabe First Nation are available from Indian and Northern Affairs Canada and are noted in the subsequent profile section for the First Nation.* Figures 2 and 2b display the political boundaries and communities in this region.

Table 1: Population Characteristics of Jurisdictions in the Roseau River Watershed

Jurisdiction	2001	1996	1996 to 2001 Population Change
RM of Piney	1,688	1,604	+5.2%
RM of Stuartburn	1,603	1,563	+2.6%
RM of Franklin	1,781	1,724	+3.3%
RM of Montcalm	1,400	1,567	-10.7%
Roseau River Reserve No. 2	569	467	+21.8%
Roseau Rapids Reserve No. 2A	92	76	+21.1%

Source: Statistics Canada (2001).

Rural Municipality of Piney

The RM of Piney is located in southeastern Manitoba roughly 175 km (109 mi.) from Winnipeg. Based on data gathered by Statistics Canada during the 2001 Census, the municipality covers a total land area of 2,434 km^2 (940 sq. mi.) and has 983 private dwellings with a total population of 1,688. When compared with the total population of 1,604 noted during the 1996 Census, the municipality experienced a total population growth of 5.2% from 1996 to 2001. English is the primary language spoken the region, but there are residents in the area who also speak French, German, Polish, and Ukrainian. The Sandilands Provincial Forest covers a large portion of the municipality and the Wampum Ecological Reserve is also found in the area. In addition, there are a number of low-lying swampland areas throughout the municipality.

Vassar and Sprague are two of the unincorporated urban centres in the municipality that fall within the boundaries of the Roseau River Watershed. Other communities within the watershed

include Menisino, Badger, Piney, Wampum, South Junction, and Middlebro. Children in the municipality primarily attend schools in the Border Land and Seine River School Divisions. The Ross L. Gray School in Sprague provides education for the K-S4 levels. Health care services in the region are provided through the South Eastman Regional Health Authority. The closest hospital and personal care homes are located in Steinbach and Vita, and there is a medical clinic in Sprague. The municipality has a memorandum of understanding with Roseau, Minnesota to provide ambulance (user pay) and hospital services to Canadian residents using U.S. resources.

There is excellent quality potable groundwater available throughout the municipality and as such, most homes and businesses are serviced by wells. There is no public water or sewer system infrastructure in the municipality. There are five separate sites for waste disposal within the municipality and a private service for residential garbage pickup. Recycling services are limited to a drop off program at municipal waste disposal locations. Police protection for the community is provided by a Royal Canadian Mounted Police (RCMP) detachment located in Sprague, where there are four officers stationed. Fire protection is provided through volunteer services stationed out of Sprague and Piney. There is a small transborder airport located at the Piney/Pine Creek Canada-U.S. border crossing.

The municipality receives limited provincial and local radio stations, television signals via satellite dishes, Winnipeg and local area newspapers, and also has dial-up Internet access (high-speed Internet has recently been introduced in limited areas). There is very limited cell phone service throughout the municipality. Community facilities include a solar-heated pool and mini-golf course in Vassar, a paved tennis court in South Junction, and an indoor curling rink in Piney. The municipality is accessible by all-weather roads via Provincial Trunk Highway #12 and the economic base consists of primarily forestry, agriculture and tourism.

Rural Municipality of Stuartburn

The RM of Stuartburn is located in southeastern Manitoba along the Canada-U.S. border approximately 120 km (75 mi.) from Winnipeg. Based on data gathered by Statistics Canada during the 2001 Census, the municipality covers a total land area of 1,162 km^2 (449 sq. mi.) and has 831 private dwellings with a total population of 1,603. When compared with the total population of 1,563 noted during the 1996 Census, the municipality experienced a total population growth of 2.6% from 1996 to 2001. The primary language spoken in the region is English and there is a strong Ukrainian heritage dating back to the homestead period of the late 1800's. Other languages spoken in the area include German, French, and Polish. The land in the municipality is flat in nature with sandy, rocky soils and a great deal of swampland in the lower areas. The Sandilands Provincial Forest reaches into the municipality in the northeastern corner and various tracks of land in the vicinity of Gardenton contain protected tall-grass prairie reserves. In an effort to preserve and protect this ecologically significant feature, the Nature Conservancy of Canada has purchased a considerable amount of land throughout the municipality. The Agassiz Interpretive Trail begins in this region and is located 1.6 km (1 mi.) from the junction of Provincial Roads #209 and #201.

Vita is the only unincorporated urban centre in the municipality that falls within the boundaries of the Roseau River Watershed. Other communities within the watershed area include

Stuartburn, Gardenton, Arbakka, Caliento, and Sundown. Children in the municipality primarily attend schools in the Border Land School Division. The Shevchenko School in Vita provides education for the K-S4 levels. Health care services in the region are provided through the South Eastman Regional Health Authority and ambulance services are available to residents. The Vita and District Health Centre is classified as a small rural hospital and has an attached personal care home located in Vita. The facility also serves as a district health centre that includes doctors' clinics and provides community health services. Some residents also use health care facilities (i.e. hospitals, medical clinics, personal care homes) located in Steinbach and St. Pierre-Jolys.

There is good quality potable groundwater available throughout the municipality and as such many homes and businesses are serviced by wells. There is no public water system in the municipality. The public sewer system for Vita consists of a sewage lagoon, but there is no other sewage infrastructure for the remainder of the municipality. There is a site for waste disposal within the municipality and residential garbage pickup is available. Municipal recycling services are limited to a drop off program at the waste disposal site. There are no police detachments located in the municipality, but police protection is provided through the RCMP detachment located in Emerson (other nearby detachments include Steinbach, St. Pierre-Jolys and, Sprague). Local fire protection is provided by a volunteer fire service based out of Vita.

The municipality receives most provincial and local radio stations, most television signals via Winnipeg, local area and Winnipeg newspapers, and also has dial-up and high-speed Internet access. There are significant areas throughout the municipality where cell phone service is not available. Community facilities include an indoor curling rink and hockey arena in Vita, as well as the Ukrainian Museum and Village in Gardenton. The municipality is accessible by all-weather roads via Provincial Trunk Highway #59 and Provincial Road #201. The economic base consists of primarily cattle farming and forage crop production.

Rural Municipality of Franklin

The RM of Franklin is located in southcentral Manitoba along the Canada-U.S. border roughly 80 km (50 mi.) from Winnipeg. Based on data gathered by Statistics Canada during the 2001 Census, the municipality covers a total land area of 953 km^2 (368 sq. mi.) and has 710 private dwellings with a total population of 1,781. When compared with the total population of 1,724 noted during the 1996 Census, the municipality experienced a total population growth of 3.3% from 1996 to 2001. English is the primary language spoken the region, but there are residents in the area who also speak French, German, Ukrainian, Scottish, and Dutch. The land in the municipality is variable, transitioning from glacially deposited sandy, rocky soils in the eastern area to flat clay-rich soils of the Red River Valley floodplain in the western area.

The largest urban centre in the municipality that falls within the boundaries of the Roseau River Watershed is Dominion City. Other communities within the watershed include Roseau River, Tolstoi, Woodmore, Green Ridge, Ridgeville, and Fredensthal. Children in the municipality primarily attend schools in the Border Land School Division. The Roseau Valley School in Dominion City provides education for the K-S4 levels. Health care services in the region are provided through the South Eastman Regional Health Authority and ambulance services are

available to residents. The nearest health care facilities (i.e. hospitals, medical clinics, personal care homes) are located in Emerson, Morris, St. Pierre-Jolys and Vita.

All areas in the municipality are serviced by a municipal water system. Water is supplied by the Pembina Valley Water Cooperative and also from community wells throughout the region. There is a public sewer system for Dominion City, but there is no other sewage infrastructure for the remainder of the municipality. There is a site for waste disposal within the municipality and garbage pickup is available for both residential and commercial properties. Recycling services for the municipality include a drop off program at the waste disposal site, as well as a home pick up service in certain areas. There are no police detachments located within the municipality, but police protection is provided through the RCMP detachment in Emerson (other nearby detachments include Steinbach, St. Pierre-Jolys, and Sprague). Local fire and emergency medical services are provided by a volunteer fire department based in Dominion City. The community of Dominion City is surrounded by a ring dike for flood protection.

The municipality receives most provincial and local radio stations, most television signals via Winnipeg, local area and Winnipeg newspapers, and also has dial-up and high-speed Internet access. There are some areas throughout the municipality where cell phone service is not available. Community facilities include an indoor curling rink, hockey arena, and heated pool in Dominion City and skating rinks in Roseau River and Ridgeville. The Roseau River Park is located on Provincial Trunk Highway #59 at the community of Roseau River. The Franklin Museum in Dominion City and the Swinging Cable Bridge over the Roseau River near Dominion City provide examples of the rich historical attractions in this centennial community. The municipality is accessible by all-weather roads via PTH #59 and #75, as well as by various provincial roads. The economic base consists of primarily agricultural activities including grain and mixed farming, as well as various private sector and home-based businesses.

Rural Municipality of Montcalm

The RM of Montcalm is located in southcentral Manitoba along the Canada-U.S. border roughly 60 km (37 mi.) from Winnipeg. Based on data gathered by Statistics Canada during the 2001 Census, the municipality covers a total land area of 469 km^2 (181 sq. mi.) and has 524 private dwellings with a total population of 1,400. When compared with the total population of 1,567 noted during the 1996 Census, the municipality experienced a total population decline of 10.7% from 1996 to 2001. French is the primary language spoken the region, but many residents are bilingual and also speak English. There are also residents of German, Scottish, and British descent in the region. The municipality sits in the Red River Valley floodplain where the land is flat and consists of rich black soils that are extremely fertile and valuable for crop farming.

There are three urban centres in the municipality – Saint-Joseph, Saint-Jean-Baptiste, and Letellier – all of which are outside the boundaries of the Roseau River Watershed. Children in the municipality primarily attend schools in the Border Land School Division and Division Scolaire Franco-Manitobaine. École Letellier Immersion School provides K-8 education and École Régionale Saint-Jean-Baptiste provides K-S4 education. Health care services in the region are provided through the Regional Health Authority Central Manitoba Inc. and ambulance services are available to residents. There is a community health centre located in St. Jean-

Baptiste and other nearby health care facilities (i.e. hospitals, medical clinics, personal care homes) utilized by residents are located in Emerson, Morris, and Altona.

All areas in the municipality are serviced by a municipal water system and water is supplied by the Pembina Valley Water Cooperative. There is a water treatment plant in Letellier through which water is delivered to rural areas and towns via a network of pipelines. There is a public sewer system for St. Joseph, St. Jean-Baptisite, and Letellier, but there is no other sewage infrastructure for the remainder of the municipality. There is a site for waste disposal in the municipality and garbage pickup is available for both residential and commercial properties. Recycling services for the municipality include a drop off program at the waste disposal site, as well as a home pick up service in certain areas. There are no police detachments located within the municipality, but police protection is provided through RCMP detachments located in Emerson and Morris. Local fire protection is provided by volunteer fire services based out of St. Jean Baptiste and Letellier. The communities of Saint-Jean-Baptiste and Letellier are both surrounded by individual ring dikes for flood protection.

The municipality receives provincial and local radio stations, television signals via Winnipeg, local area and Winnipeg newspapers, and also has dial-up and high-speed Internet access. Cell phone service is available throughout most of the municipality. Community facilities include an indoor curling rink and hockey arena in St. Jean Baptiste and an arena in Letellier. The Saint-Joseph Museum exemplifies the rich agricultural history of the community. The municipality is accessible by all-weather road via Provincial Trunk Highway #75, which runs directly through the municipality. The economic base is primarily agriculturally focused with crop and seed farming, but there are cattle and hog productions, as well as dairy farms, throughout the municipality. Various private sector businesses operate in the municipality, with seed and special crop exporters being prominent. Miller Environmental Corporation operates a waste treatment and recycling facility in the municipality.

Roseau River Anishinabe First Nation

The Roseau River Anishinabe First Nation (RRAFN) occupies two areas of land in southcentral Manitoba. The first area of land, located approximately 20 km (12 mi.) north of the Canada-U.S. border and 90 km (56 mi.) south of Winnipeg (just east of Letellier on Provincial Road #201), is designated as Roseau River Indian Reserve No. 2 and is the main community where the bulk of the Reserve population resides. The second area, designated as Roseau Rapids Indian Reserve No. 2A, is located approximately 30 km (19 mi.) east of the main reserve and has a much smaller population. According to population statistics provided by Indian and Northern Affairs Canada, as of 2006, the RRAFN has an on-Reserve population of 1,087 and an off-Reserve population of 975, as well as 19 other members (INAC, 2006). The total registered membership of the RRAFN is 2,081 and the native language spoken by the membership is Ojibway.

The total area covered by both reserves is 3,066 hectares (7,576 acres), with Roseau River Indian Reserve No. 2 covering 2,135 hectares (5,276 acres) and Roseau Rapids Indian Reserve No. 2A covering 931 hectares (2,300 acres). Based on provisions under the Treaty Land Entitlement, a land settlement payment was provided to the RRAFN in 1996 and the Roseau River Trust Fund was established. Part of the mandate of the trustees of this fund has been to purchase and acquire

2,372 hectares (5,861 acres) of new lands within 15 years of the 1996 settlement (RRAFN, n.d.). These newly acquired lands are held under a company titled RRFNT AKI Property Holdings Ltd. and currently all new lands are located within the RM of Franklin. Between 1998 and 2002 the RRAFN acquired 1,528 hectares (3,775 acres) of new land of which 1,046 hectares (2,585 acres) have been advanced to INAC for conversion to Reserve status (RRAFN, n.d.).

As noted in the *First Nation Community Profiles for the Manitoba Region (2004-05)* by Indian and Northern Affairs Canada, First Nation children attend the Ginew School, which is operated by the First Nation and provides K-S4 education. Some of the First Nation children also attend schools that are off-Reserve in nearby communities. Health care is provided through the Ginew Wellness Centre which offers a variety of health and wellness programs and services in cooperation with the First Nations and Inuit Health Branch of Health Canada. There is a community health representative and registered nurse on-Reserve.

The main community (Roseau River Indian Reserve No. 2) is surrounded by a ring dike for flood protection. The main community is serviced by chlorinated running water delivered through the Letellier water system. The majority of houses on the Reserve receive piped water, although a small number either: a) receive water from community wells; b) receive water from individual wells; c) have water trucked in to fill cisterns; or d) have water trucked in to fill barrels. The community has a sewage lagoon outside of the ring dike for disposal. Within the community the majority of houses have piped septic service, although some houses have individual septic fields and some have trucked septic service. The community has a landfill site located outside of the ring dike and garbage pick up and disposal services are provided to the residents. Police protection in the community is provided by the Dakota Ojibway Police Service (DOPS), which has four constables on-Reserve. The nearest RCMP detachment is located in Emerson. Fire protection in the community is provided by a volunteer fire department that is serviced by a single fire truck. The RRAFN has an agreement to purchase fire protection services from the RM of Franklin on an as needed basis.

The First Nation has its own radio station at 100.5 FM and receives most southern Manitoba radio stations, television feeds from Winnipeg, and also has dial-up and high-speed Internet access. Private telephone exchange is available on the Reserve and buried cable services have been extended to some of the newer homes. Community services and other on-Reserve facilities include an administration office, community hall, government office, an activity centre, indoor skating rink, baseball diamond and a training centre. The Reserve is accessible by all-weather roads via Provincial Trunk Highway #75 and major bus lines provide service in nearby Letellier. The economic base consists of residential development, cattle grazing and agriculture, as well as commercial and business services within the community. The Roseau River Pow Wow is held every summer and is an extremely popular and important cultural event for the community.

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4.2 – Economy

4.2.1 – Agriculture

As indicated in an earlier section of this document, the Canadian portion of the Roseau River Watershed is comprised of parts of four municipal governing bodies – the RMs of Piney, Stuartburn, Franklin, and Montcalm. Agriculture plays an integral role in the economy of these municipalities and has also played a significant role in the historical development of the region as well. The quality and productivity of the land are major factors influencing the type of agriculture conducted in different parts of the watershed.

Note that all figures utilized in this section reflect the entire land base of the municipalities and have not been adjusted to reflect the portions of the municipalities that fall within the boundaries of the Roseau River Watershed. At the time of writing data from Manitoba Agriculture, Food, and Rural Initiatives was available based on municipal divisions, not watershed divisions.

The inherent productivity of the land within the watershed generally declines moving from west to east due to increasing limitations to crop production. While only a small portion of the watershed lies within the RM of Montcalm (Management Area 3), this small portion of land is agriculturally valuable and suitable for annual crop production. Most of the land within the watershed that is suitable for annual crop production is found in the RM of Franklin (Management Area 3). Land generally becomes more suitable for tame or native forage production moving eastward into the RMs of Stuartburn and Piney (Management Areas 2 and 1). Consequently, animal-based agricultural systems dominate the landscape from the Red River Valley eastward into the Southeastern Manitoba Till Plain and the Bedford Hills (LRU, 1999a; LRU, 1999b; LRU, 1999c; LRU, 1999d).

Due to relatively higher productive capacity of the soils, land use in the Red River Valley portion of the RMs of Montcalm and Franklin is dominated by annual crop production with some special crops grown where suitable. Moving east into the Southeastern Manitoba Till Plain portion of the RM of Franklin is dominated by livestock operations and forage production (LRU, 1999b). These characteristics are illustrated by a breakdown of land use figures for the municipalities. For the RM of Montcalm land use assessments indicated that at 88% the large majority of the area is annual crop land, 0.2% forage production, 3.5% grassland, and 3% treed area (LRU, 1999a). For the RM of Franklin land use assessments indicated that 57% of the area was annual crop land, 5% forage production, 21% grassland, and 12% treed area (LRU, 1999b).

Moving further east into the Southeastern Manitoba Till Plain and the RM of Stuartburn, there are extensive areas of grassland and only small areas sustaining annual crop production. Land use assessments indicated that 7% of the municipality was annual crop land, 4% forage production, 39% supported native grassland, 39% forested areas, and 10% was covered by wetlands (LRU, 1999c). Based upon the capability of the soil resources, livestock production is the dominant agricultural enterprise in the RM of Stuartburn, with historical small cow/calf operations of greatest importance. In recent years there has been significant expansion of hog

operations in the municipality and where suitable, sites have been developed. Land use in the RM of Piney is dominated by forestry and agriculture. Land use assessments estimated that 6% of the municipality was annual crop land, 1.4% tame forage production, 7% native grassland, 50% forested areas, and 29% was identified as wetland areas (LRU, 1999d).

According to data collected by Statistics Canada for the 2001 Census of Agriculture (Statistics Canada, 2001) and as summarized in a report by Agriculture and Agri-Food Canada (AAFC-PFRA, 2005), the major crops grown in the Roseau River Watershed include: a) cereal crops such as wheat, oats, barley, mixed grains, corn for grain, buckwheat, rye, and canary seed; b) forage crops such as alfalfa and alfalfa mixtures, all other tame hay and fodder crops, forage for seed, and corn for silage; c) oilseed crops such as canola (rapeseed), flaxseed, soybeans, and sunflowers; and d) pulse crops such as dry field peas and dry beans.

Comparison of Land Use, Farm Size, and Type in the Roseau River Watershed

As indicated in Table 2, the average farm size in each of the three municipalities is slightly below the provincial average. Based on data from the 2001 Census of Agriculture, the RM of Franklin has the largest acreage in annual crops and tame forage production given its larger arable land base. The combined acres of tame and native forage production in the RM of Stuartburn exceed that of annual crop production.

Table 2: Manitoba and Municipal Land Use Comparisons (Statistics Canada, 2001)

Jurisdiction	Total Area of Farms (hectares)	Average Size (hectares)	Crops (hectares)*	Tame or Seeded Pasture (hectares)	Native Pasture (hectares)
Manitoba	7,601,779	361	4,714,830	383,474	1,580,374
Montcalm	47,707	411	45,182	146	325
Franklin	74,766	341	49,640	3,282	13,784
Stuartburn	56,724	273	16,870	2,963	27,931
Piney	27,260	270	12,294	1,486	5,918

*Excluding 2001 summer fallow.

As shown in Table 3, according to average farm size the RM of Franklin has the highest proportion of large-sized farm operations (using greater than 308 hectares (760 acres) as a threshold). This factor is related to the relative dominance of annual cropping operations in the RM of Franklin versus the prevalence of beef cow/calf operations (and therefore forage cropping) in the RMs of Stuartburn and Piney.

Table 3: Comparison of Farm Size (Statistics Canada, 2001)

Jurisdiction	Total Number of Farms	Greater than 308 Hectares
Manitoba	21,071	8,228
Montcalm	116	59
Franklin	219	73
Stuartburn	208	55
Piney	101	27

Table 4 illustrates the number of dairy farms reporting in the municipalities. While not large in number, dairy operations are an integral component of the area's agriculture economy.

Table 4: Comparison of Dairy Farm Operations (Statistics Canada, 2001)

Jurisdiction	Number	Number of Cows
Manitoba	853	42,407
Montcalm	3	104
Franklin	20	763
Stuartburn	18	692
Piney	4	162

As noted in Table 5, beef operations and more specifically cow/calf enterprises are an extremely important component of the agriculture economy in the area, especially in the RM of Stuartburn.

Table 5: Comparison of Beef Cow/Calf Farm Operations (Statistics Canada, 2001)

Jurisdiction	Number of Farms	Number of Cows
Manitoba	10,089	563,300
Montcalm	9	512
Franklin	112	5,771
Stuartburn	143	7,015
Piney	49	1,790

Over the past 5 years, a significant increase in the number of hog operations has occurred, not only throughout Manitoba as a whole, but also within three of the municipalities in the Roseau River Watershed. Since the 2001 Census of Agriculture, additional hog development has taken place in all three municipalities and as such, the values in Table 6 may have increased.

Table 6: Comparison of Hog Farm Operations (Statistics Canada, 2001)

Jurisdiction	Total Farms	Number of Pigs
Manitoba	1,668	2,540,220
Montcalm	11	14,578
Franklin	18	26,411
Stuartburn	14	12,481
Piney	8	5,890

Summary

Agriculture is an essential part of the economy for the municipalities within the Roseau River Watershed. The productivity of the land in the watershed decreases moving from west to east due in part to changing soil conditions and a resultant increase in limitations to crop production. For further, more detailed information with respect to agricultural resources in the watershed, see an excellent 2005 report by Agriculture and Agri-Food Canada titled "Summary of Resources

and Land Use Issues Related to Riparian Areas in the Roseau River Watershed Study Area." A later section of this plan provides more detail with respect to the soil resources of the watershed.

Note: Dennis Schindler and Mitch Timmerman of Manitoba Agriculture, Food and Rural Initiatives provided information/data on which this section is based.

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4.2.2 – Forestry

The Forestry Branch of Manitoba Conservation is responsible for the forest management activities on Crown Land in southeastern Manitoba. The following sections provide a summary of the current Forest Resource Inventory (FRI), access, harvest, and renewal activities that are planned for the five year period starting April 1, 2005 and ending March 31, 2010 within the Roseau River Watershed.

The topic of watershed management and forestry activity is very extensive, from the site level to the landscape level there are many considerations. This summary involves a fairly high level approach to the subject matter but is not meant to be an exhaustive work with respect to forest management and watershed protection on a block-by-block basis. The intent is to demonstrate what the impacts of planned activities may be and how management planning, implementation, and follow up will be applied to mitigate and protect the values identified as being at risk.

The Roseau River Watershed Forest

The Manitoba portion of the Roseau River Watershed falls within the boundaries of the Aspen Parkland and Pineland Forest Sections. Specifically, the watershed falls within parts of Forest Management Units (FMU) 01 and FMU 20 (see Figure 3). Since there is not enough forested Crown Land in FMU 01 to issue long-term commitments or quotas, this watershed plan will focus on FMU 20 (the eastern portion of the watershed including all of Management Area 1 and small portions of Management Area 2). There is a total land area of 258,397 hectares (638,513 acres) within the watershed boundaries. There are 94,267 hectares (232,939 acres) classified as productive forest land with the remaining 163,298 hectares (403,518 acres) classified as non-productive forest land. Productive forest land will sustain commercial tree growth and non-productive lands include marshes, swamps, open water, agricultural land clearings, as well as developed areas such as roads, utility corridors, gravel pits, and yard sites for example. A map of the forested and non-forested areas in the watershed (based on a summary of the 1983 Forest Resource Inventory) is provided (see Figure 4).

The entire forested area of FMU 20 is located within the Lake of the Woods Ecoregion (91), a subhumid transitional, low boreal Ecoclimatic region. Young forests are dominated by trembling aspen, white birch, and jack pine. More mature forests are dominated by white spruce, black spruce, and balsam fir. Dry sites support some red pine forests, as well as bur oak. Black spruce, tamarack, and black ash grow on wet sites. The eastern watershed area includes the Wampum Ecological Reserve, a portion of the Sandilands Provincial Forest, all of the Cat Hills Provincial Forest, and a small amount of the Northwest Angle Provincial Forest.

The western portion of the watershed (primarily Management Area 3 and small portions of Management Area 2) falls within two distinct Ecoregions; the Interlake Plain (155) and the Lake Manitoba Plain (162). These areas of the watershed are dominated by soils and climate suitable for agriculture. Most of the land is held under private ownership and has been developed for agriculture. The remaining Crown Land is coded to allow for agricultural expansion or wildlife habitat. Crown Land in this area that may be suitable for forestry will be identified and managed for long-term sustainability where appropriate. There are no existing Order in Council forested lands or Provincial Forests in this western part of the watershed.

Summers in the watershed are typically warm and dry, with the highest temperatures and maximum precipitation falling between June and August. Winters tend to be cold and relatively dry. Forest fire and insects are the dominant causes of natural disturbance events. The natural resiliency of a healthy forest ecosystem enables it to adapt to and recover from disturbance and stress. The flora and fauna of the area are well adapted to this disturbance based ecosystem. Large fire events have led to large areas of even-aged forests. There are no registered trap lines; however, the area is open to general use trapping. Common wildlife species include deer, black bear, wolf, lynx, snowshoe hare, hooded merganser, and piliated woodpecker.

The area is very well roaded, with forest resource access to the area that is both seasonal and year-round depending on the class of road and ground conditions (see Figure 5). There are a multitude of trails used for recreational activities such as skiing, snowmobiling, and hiking.

Forest Management and Water Quality

Prior to any planned construction all necessary reviews, procedures, advice, and permits are obtained and adhered to. Fisheries and Oceans Canada (DFO) at the federal level and Manitoba Water Stewardship at the provincial level are advised and consulted as required.

The types of forestry activities that may affect water quality include timber harvesting, road construction and use, mechanical equipment operation associated with harvesting and site preparation, and pesticide application. Forestry operations may degrade several water quality characteristics through the transport of sediments, nutrients, and forest chemicals causing changes to water temperature, streamflow, and dissolved oxygen levels. Proper planning and mitigation controls (e.g. consideration of factors such as location, type of operation, and climate), as well as the application of best practices appropriate at the site level will help ensure the protection of water quality.

Forest managers that plan operations near or adjacent to water bodies rely heavily on the *Manitoba Natural Resources Consolidated Buffer Management Guidelines*. These guidelines were published in March 1996 and are presently under review, but it is recognized that these careful management techniques, when applied consistently, will yield the protection required to support healthy water ecosystems.

Timber Harvesting Activity

Manitoba Conservation has adopted an ecosystem-based approach to managing forest resources. By applying sustained yield principles and employing best operating guideline practices on the ground, the effects of harvest are mitigated. It is generally accepted that when forestry activity emulates the natural processes, within the natural range of variability, then the ecosystem will behave in a natural way more quickly. Forestry will promote harvesting and silvicultural practices in the area that emulate some important aspects of natural disturbance. For example, fire and large wind events are emulated through clear cutting while leaving small patches of standing trees or through small patch harvest. Selection cutting tends to emulate small wind events or ground burns. There is an emphasis on techniques that encourage natural regeneration, however, planting and vegetation management may be used to ensure successful regeneration.

Timber harvest activities have occurred in the watershed area since the early 1900's. Softwood harvest will consist of primarily jack pine and black spruce. Hardwood harvest will consist of aspen and black poplar with a limited amount of white birch. While the harvest equipment and techniques have evolved over time, the level of harvest and renewal activity has been relatively stable for many years. Primary products produced from the area will include hardwood and softwood pulpwood, woodchips, and to a lesser extent a variety of softwood saw logs when suitable stand conditions exist. Markets for the forest products are found within Manitoba (small local mills and Tembec) and Ontario (Weyerhaeuser and Ainsworth), and to a lesser extent mills in the northern United States. The forest also provides non-timber forest products such as berries, medicinal plants, trapping, and recreational uses.

Forest harvesting, access, and renewal plans are reviewed for potential impacts at several levels. The regional Integrated Resource Management Team (IRMT) brings the expertise of fisheries and wildlife biologists, as well as lands and operational managers into the review and mitigation process. In addition, trappers, recreational users, and other stakeholders are consulted. Sites of historical or spiritual significance and plants and animals that are threatened, rare or endangered are mapped and given protection.

Timber harvest levels, or the Annual Allowable Cut (AAC), are determined at the FMU level and are applied based on the Timber Quota Policy established in the 1960's. *A revised version of the policy is included in the Appendix for information.* Timber cutting rights are granted for a ten-year period with a review every five years. The harvest plan currently in use covers the years 2005 to 2010. The gross sale areas within the watershed that have been identified for harvest are shown on Figure 6. The operating areas that have been selected for harvest are based primarily on the age and health of the forest. Criteria that enter into the selection process to identify stands for harvest include the level of existing infrastructure, impacts by wind and flooding, and the proposed long-term use of the land resource. For example, new right-of-way clearings or clearing for gravel pits would be among the highest priority areas and stands in older age classes would be the next priority.

Salvage harvest to deal with natural disasters through wind or fire will be conducted on an as-needed basis. While such events cannot be planned for, the Quota System allows for a quick response in order to capture the timber value that would otherwise be lost. For very large events the Province may decide to recalculate the AAC.

Timber Quota Holders are individuals or companies that acquired their harvesting rights from the Province at the inception of the Quota System or who have since purchased an existing quota. No new quotas have been offered up by the Province, however, quotas can be bought and sold between operators and interested parties. Some Quota Holders are small family run operations that provide seasonal employment and income, whereas other Quota Holders are larger businesses and companies that operate on a year-round or seasonal basis. See Table 7 for a list of the annual volume allowed for harvest by Quota Holders in the watershed.

Harvest is not tied to a specific mill and as such, these independent loggers will activate timber sale areas on an as-needed basis. When markets are strong for specific forest products then the operator will move into the allocated area that will best fill that need. This creates some uncertainty around allocated blocks as not all blocks will be active in a given season or year of the harvest plan. This plan will identify the maximum potential harvest with the understanding that the net harvest area will be at a reduced level.

Table 7: Timber Quota Holder Annual Volume in the Roseau River Watershed

Block ID	Operator	Softwood Volume (m^3)	Hardwood Volume (m^3)	Total Volume (m^3)	Estimated Area (Hectares)
3001	Boutang Enterprises	12,365	5,490	17,855	150
3002	J. Hovorka and Sons	7,992	5,329	13,321	100
3004	J. Hovorka and Sons	10,000	0	10,000	100
3008	C. Sigurdson	0	6,295	6,295	50
3035	R. Prevost	152	690	842	5
7	R. Beaudry	167	0	167	1
19	J. Chobotar	145	13	158	1
23	F. Dorvalt	100	123	223	2
24	P. Edbom	150	0	150	1
32	A. Gobiel	155	0	155	1
33	V. Gobiel	152	0	152	1
44	J. Bordun	61	0	61	1
281	R. Blixt	50	50	100	1
312	F. Eckert	85	0	85	1
330	R. Gobiel	42	0	42	1
469	L. Friesen	82	0	82	1
599	J.&P. Tkachuk	0	48	48	1
Total		31,698	18,038	49,736	518

Timber Harvesting Activity Mitigation

The effects of soil disturbance, soil compaction and rutting, and stream channel disturbance are recognized as having the greatest potential to impact water quality. By planning for winter operations to occur on fragile soils and by limiting soil exposure when moving equipment and harvested wood products during summer operations, soil disturbance can be minimized. Treed buffers reduce impacts to streams by filtering overland flow before water enters the stream and have the added benefit of moderating the effect of temperature change along the stream channel. Pre-harvest site inspections alert the planners to headwater stream locations, soil and vegetation types, and potential risks that need to be mitigated in the harvest plan.

Access Management

Access to harvest and renewal activity is required for forestry operations within the watershed. Most of the access roads required in the current harvest plan have already been constructed and even most of the winter roads already exist. Although, where possible, there will be a limited amount of all-season, low grade roads constructed to allow for spring, summer or fall harvest. For an overview of the road network see Figure 5.

Every effort is made to keep the level of access constructed to a minimum. Once renewal activities have been completed, all-season roads will be retired by removing drainage pipes and sloping crossings. Those roads which are not required for the next five-year period will have slash and debris spread on them and in some cases, the road bed will be ripper plowed and

planted. Road construction guidelines are described in Manitoba Conservation's *Forest Practice Guidelines* (available online at http://www.gov.mb.ca/conservation/forestry/).

Table 8 identifies the existing and proposed road development for the current five-year planning period by Timber Sale Block ID. All stream crossings will comply with the 1996 publication *Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat*.

Table 8: Existing and Proposed Roads in the Roseau River Watershed 2005 – 2010

Block ID	Operator	Existing Road Class*	Proposed Construction 2005 – 2010 (km)	Proposed Class*
3001-12	Boutang Enterprises	3	0	
3001-13	Boutang Enterprises	3	0	
3001-14	Boutang Enterprises	3	3	3
3001-15	Boutang Enterprises	3	0	
3001-16	Boutang Enterprises	3	4	3
3002-01	J. Hovorka and Sons	3	0	
3002-02	J. Hovorka and Sons	3	0	
3002-04	J. Hovorka and Sons	3	0	
3002 -09	J. Hovorka and Sons	4	2	4
3004-09	J. Hovorka and Sons 1999	4	0	
3004-12	J. Hovorka and Sons 1999	3	0	
3004-13	J. Hovorka and Sons 1999	3	0	
3008-01	C. Sigurdson	3	1	3
3008-02	C. Sigurdson	3	0	
3008-03	C. Sigurdson	3	0	
3035-01	R. Prevost	3	0	
3035-02	R. Prevost	4	0	
7-01	R. Beaudry	3	0	
7-02	R. Beaudry	3	0	
19-01	J. Chobotar	3	0	
23-01	F. Dorvalt	3	0	
24-01	P. Edbom	3	0	
32-01	A. Gobiel	3	0	
33-01	V. Gobiel	3	0	
44-01	J. Bordun	3	0	
281-01	R. Blixt	3	0	
312-01	F. Eckert	3	0	
330-01	R. Gobiel	3	0	
469-01	L. Friesen	3	0	
599-01	J.&P. Tkachuk	3	0	
Total			10	

*Class 1 – Highway; Class 2 – Primary Road, All Weather; Class 3 – Block Access Road, Fair Weather; Class 4 – In Block Access Road – winter; X – Denotes Access Restriction/Control.

Access Management Mitigation

Roads are considered to be a major potential source of sediment to streams and water bodies through erosion primarily from stream crossing construction and the practice of cut and fill road bed construction and associated drainage. Soil loss is understood to be greatest in the period immediately after construction, prior to stabilization and vegetation regrowth. By employing

best practices and following the *Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat*, the potential for access construction to impact water quality in the watershed is minimized. Within the Roseau River Watershed, the existing access road network minimizes this risk further since no new construction near streams and water bodies will be required during the current harvest plan period. The use of streamside buffer strips, winter roads, and frozen ground conditions will minimize the risk to water quality as well.

Silviculture Activity

A large part of a sustainable forest management initiative is to ensure the prompt and successful regeneration of harvested and disturbed sites. The silviculture plan begins with the pre-harvest survey results. Working with the knowledge of forest conditions that existed on-site prior to harvest, the plan will attempt to encourage the renewal of a similar forest type and diversity.

Within the softwood stands of jack pine, the usual method of regeneration employed in the region is to pull a patch scarifier (Bracke) with heavy equipment over the recently harvested area. This results in the exposure of a patch of mineral soil suitable for planting and the distribution of cone bearing slash and tops to encourage the establishment of natural seedlings. The area will usually be planted with jack pine seedlings within two to three years of harvest.

Black spruce and tamarack areas are most often left to seed-in on their own using a system of clumps or single seed trees left standing to provide the necessary seed source. Some of these areas may be planted as well if required. Site preparation for tree planting is usually not required on these sites.

Hardwood aspen stands are usually left to regenerate on their own. These hardwoods are seen as an early successional species that do extremely well when left alone after harvest or disturbance. No site preparation is required for this species.

Mixedwood stands require the most intervention on the part of the manager. Site preparation involves a patch scarification system to expose the mineral soil and reduce the effects of competition. Occasionally, this site preparation method is employed with a vegetation control application of the pesticide 'Vision'. This 'Bracke Herbicide' process is intended to reduce the aggressive competition found on these sites and gives the planted stock, usually white spruce, a better initial survival rate. The eventual outcome is a mixed forest stand of both hardwood and softwood. All federal and provincial regulations concerning the use of pesticides are adhered to.

Planting will be done under contract to third party planting companies. The process will involve competitive bidding with site viewing in the fall and the actual tree plant taking place in May through June the following year. For winter access sites the seedlings are stored over winter on-site in a snow cache to avoid transporting the seedlings in the spring over wet and impassable roads. *Table A1 in the Appendix* displays the proposed treated areas according to block ID.

All harvested areas will be surveyed by the Province to ensure that renewal meets provincial standards. The initial 'Regeneration Survey' occurs at year three for planted sites and year seven for areas left to naturally regenerate. Those areas found to be inadequately regenerated are

identified and retreated promptly. All areas are surveyed again at year fourteen to determine their status. If regeneration meets provincial standards at that time, the site is deemed to be 'Free to Grow' (FTG). If the provincial standards are not achieved, then some form of remedial work will be determined and action taken.

Silviculture Activity Mitigation

Mechanical site preparation and the use of herbicides may also have the potential to negatively affect water quality. The use of large tractors that drag, shear or rip to expose mineral soil to enhance natural or assisted regeneration is common practice. In order to mitigate the impact to water quality, the site preparation disturbance is restricted to the harvested areas only. Once again the use of streamside buffer strips acts to mitigate the overland runoff until the site grows back. Herbicide use is limited in application and is restricted in its use through an Environmental Licence. No chemical application is allowed near streams or water bodies. Application can only occur during times when wind speeds are low and there is little risk of drift. Riparian buffer strips also minimize the risk by creating a barrier between the watercourse and the harvest block being treated.

Special Watershed Concerns and Mitigation

Manitoba Conservation recognizes the significance of the Roseau River Watershed area to all peoples. The area provides significant natural, social, and economic security not only for the local residents, but at a provincial level as well. For these reasons, and in keeping with the sustainable ecosystem-based management approach to forest resource management, the regional IRMT thoroughly reviews all proposed forest harvest and renewal plans. For instance, the level of harvest has been and continues to be quite low. The proposed annual harvest area represents less than 1 percent of the total productive forest land base in the Manitoba portion of the Roseau River Watershed. Sites that have been identified as significant by the Historic Resources Branch of Manitoba Culture, Heritage and Tourism and the Conservation Data Centre of Manitoba Conservation are given the recommended level of protection required by the advising agency. Protection may include avoidance and buffers with seasonal adjustments depending on the concern. All lakes and rivers will have a minimum of a 100 metre (328 foot) no harvest zone around them and small streams and ponds will have a 50 m (164 ft) buffer or vegetated area that is not disturbed. The *Forest Management Guidelines for Wildlife in Manitoba* will be employed as a guiding principal in harvest and renewal design.

The timber operators working within the watershed boundaries are all well-established, conscientious professionals that rely on the heath and sustainable use of the forest. The operators employ best practice guidelines and are familiar with the aforementioned Acts and Regulations that must be complied with when working on Provincial Crown Land (e.g. *Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat,* etc.). Manitoba Conservation Natural Resource Officers in the areas where forestry work is being conducted monitor and report on all active areas on a regular basis. Any infractions or concerns that are identified will be handled promptly and consistently. When required, IRMT members, Natural Resource Officers, and timber operators will meet on-site to ensure that instructions are received, understood, and followed as prescribed.

The review of the Roseau River Watershed Plan is viewed as another level of review for forestry operations and an opportunity for input into the planning process. Comments and concerns raised will be acknowledged and where possible incorporated into the planning process by the IRMT. Feedback, comments, or concerns are welcomed. Please contact:

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Note: Tim Swanson of Manitoba Conservation provided information/data and wrote a large portion of this section.

4.2.3 – Industrial / Commercial Development

As noted previously, the major economic activity in the Roseau River Watershed is agriculture. In addition to a variety of crops, the watershed supports a full range of livestock development, with a particular emphasis on cattle. Other resource-based industries, such as forestry in the eastern part of the watershed, are very important to the regional economy. Non-agricultural based commercial activity has been declining in recent years, as evidenced by numerous vacant former businesses throughout the watershed. The Westman Wind Power Company recently announced that it will be developing eight wind farms across Manitoba and Dominion City in the RM of Franklin was chosen as one of these sites. In the event that the wind farm is constructed on private land, Westman will negotiate land use agreements with the landowner – which will help contribute to a diversified income for rural landowners (Kirbyson, 2006).

Table 9 provides a breakdown of the various types of commercial and industrial developments operating throughout the watershed. Note: the majority of businesses operating in the RM of Franklin are located in Dominion City; in Vita for the RM of Stuartburn; and in Piney, South Junction, Sprague, and Vassar for the RM of Piney.

According to the *First Nation Community Profiles (Manitoba Region 2004-05)* by Indian and Northern Affairs Canada, the primary economic base for the Roseau River Anishinabe First Nation is residential development, cattle grazing and agriculture, as well as a small number of commercial and business services operating on the Reserve. The sectors employing the majority of residents are health, education, and other types of services. The Roseau River Gaming Center (opened in 2005) is an important economic development for the First Nation. Strategic economic development is a priority of the current administration and future land purchases include negotiation for property in Winnipeg to establish an Urban Reserve (RRAFN, n.d.).

Due to the fact that only a small portion of the RM of Montcalm that falls within Roseau River Watershed area, the vast majority of industry and employment within this municipality occurs outside the Roseau River Watershed area. The part of Montcalm that falls within the Roseau River Watershed is extremely valuable agricultural land and as such, agriculture would likely qualify as the dominant economic activity in this portion of the watershed.

Table 9: Distribution of Commercial / Industrial Businesses

Type of Commercial / Industrial Development	Administrative Unit			
	RM of Franklin	RM of Stuartburn	RM of Piney	Roseau River First Nation
Accommodation (motel / hotel)	2	1	4	0
Administrative (financial, insurance, etc.)	2	2	5	0
Agricultural Services / Supplies	13	6	0	0
Automotive Services	1	6	3	1
Construction / Trucking / Trades Related	15	3	23	2
Retail Sales and Service (fuel, food, etc.)	5	4	10	1
Other Services (General)	11	8	24	9
Totals	49	30	69	13

Significant industrial developments in the watershed include water bottling facilities that utilize local groundwater resources in Middlebro (Simply Natural Spring Water Bottling Company) and Piney (Piney Fine Natural Spring Water), and a window and door manufacturing plant operated by a Hutterite colony just south of Piney (Iberville Window and Door Manufacturing Ltd.).

Based on data gathered for the 2001 Census by Statistics Canada, agriculture and other resource-based industries employ the largest number of watershed residents, followed by manufacturing and construction industries, health and education, and other services (see Table 10).

*Table 10: Distribution of Employment by Industry**

Type of Industry	Administrative Unit				
	RM of Franklin	RM of Stuartburn	RM of Piney	RM of Montcalm	Roseau River First Nation
Agriculture and other resource-based industries	300	215	225	305	0
Manufacturing and construction industries	140	140	180	75	20
Wholesale and retail trade	65	75	90	120	10
Finance and real estate	25	25	15	30	0
Health and education	145	150	70	105	55
Business services	90	70	90	35	10
Other Services	135	95	120	100	50
Total	900	765	785	770	155

*Source: Statistics Canada (2001).

Note: Bill Sawka of Manitoba Intergovernmental Affairs provided information/data on which this section is based.

References

Kirbyson, G. (2006, March 8). Blowing in the Wind. Winnipeg Free Press, p.A1,A4.

Roseau River Anishinabe First Nation (RRAFN). (n.d.). Summary of RRAFN Trust Office. Retrieved May 31, 2006, from http://www.rrafn.com/trust.html

Statistics Canada. (2001). 2001 Census of Canada. Retrieved on April 24, 2006, from http://www12.statcan.ca/english/census01/home/index.cfm

4.2.4 – Transportation and Utilities

Manitoba Infrastructure and Transportation (formerly Transportation and Government Services) is the provincial department responsible for the oversight of construction and maintenance services for the transportation system within Manitoba. Due in part to the sizeable area covered by the Roseau River Watershed there are a number of important transportation features in the region.

Highways

Provincial Trunk Highway (PTH) #12 and PTH #59 are the main highways passing through the Roseau River Watershed area, classified as *primary arterial* highways under the Department's classification system. PTH #75, classified as a four-lane "expressway" from Winnipeg to the U.S. border, is located immediately to the west of the watershed area running through the RM of Montcalm. PTH #89, Provincial Road (PR) #201 and PR #310 fall within the watershed area and are classified as *secondary arterials*. The remaining Provincial Roads within the watershed area are classified as *collectors* and include PR #200, #203, #209, #218, #302 and #308. Table 11 provides the average annual daily traffic (AADT) counts for the highways falling within the Roseau River Watershed area. A count for PTH #75, adjacent to the watershed area, has been included due to its importance to vehicular traffic within the watershed area.

*Table 11: Traffic Counts within the Roseau River Watershed***

Highway	Average Annual Daily Traffic Count (Total Vehicles)*
PTH #12	1,000
PTH #59	1,000
PTH #75	3,500
PTH #89	70
PR # 200	250-300
PR # 201	700
PR # 203	200
PR # 209	250 (in busier section south of PR #201)
PR # 218	200 (500 near junction with PTH #59)
PR # 302	800
PR # 308	800 (highest values near Sprague)
PR # 310	360

*Data provided by University of Manitoba Transport Information Group (May 2005). Traffic on Manitoba Highways 2004.
**All figures are approximate values that are variable over the length of the road

PTH #59 runs in a north-south direction through the Roseau River Watershed to the International Border. PTH #59 crosses through the communities of Roseau River and Tolstoi and there is an International Border crossing just south of Tolstoi. PTH #75 runs in a north-south direction just west of the watershed and leads to the major 24-hour International Border crossing for the province at Emerson. PR #201 runs east to west along a large portion of the Roseau River Watershed area (from PTH #75 at Letellier) through the communities of Stuartburn, Vita, Caliento, Sundown and Menisino. PR #201 then intersects PTH #12 which continues to the eastern boundary of the Roseau River Watershed area, servicing the communities of Wampum and South Junction. PTH #89 runs south from PTH #12 through the community of Piney before reaching the International Border. PR #310 runs in a southerly direction from PTH #12 at the community of South Junction leading to the International Border. Piney Customs on PTH #89 and South Junction Customs on PTH #310 are smaller border crossings that also fall within the watershed area and Sprague Customs is located just outside the watershed area to the east.

The existing Letellier bridge (PR #201 crossing the Red River) is in poor condition and is currently restricted to a maximum of 24 tonnes and one lane of vehicular traffic at a time controlled by traffic signals. A new structure has been designed for the location and is expected to be constructed in the near future. Although outside the Roseau River Watershed area, this is the primary bridge for watershed residents to cross the Red River and access PTH #75.

Railroads

Three railroads serve the area and two of the lines pass directly through the watershed area. The Canadian National Railway (CNR) Sprague Subdivision passes through the eastern portion of the Roseau River Watershed (Management Area 1). The Sprague Subdivision runs from Winnipeg, entering the watershed area immediately west of Badger following a southeasterly direction through Badger, Vassar, and South Junction where it then turns east and runs through Sprague and Middlebro before turning south and crossing the International Border at Sprague Customs just east of the watershed. The line dips into the U.S. at Warroad, Minnesota before making its way to Rainy River, Ontario.

The CNR Letellier Subdivision parallels the generally north to south nature of PTH #75 from Winnipeg to Morris to Emerson and then into the U.S. While the line does not run through the Roseau River Watershed, similar to PTH #75, it runs immediately to the west of the Red River and is an important transportation corridor for the watershed. The Canadian Pacific Railway (CPR) Emerson Subdivision also runs in a generally north to south direction from Winnipeg to Emerson and passes through the watershed at Dominion City (Management Area 3). The railway corridor from the former CNR Ridgeville Subdivision still exists in some places along its path, but the line was picked up in the 1970's. The line used to run in a west to east direction from Emerson to South Junction where it joined the CNR Sprague Subdivision going east.

Airports

There is a small transborder airport located at the Piney/Pine Creek Canada-U.S. border crossing. The airport is operated by the Piney/Pine Creek Border Airport Commission and is a registered airstrip that provides customs clearance, fuel service and storage. The airport is known as the world's only bi-national airport and is open year-round for light-twin engine planes. The airport has a single asphalt paved runway with lighting that is approximately 1,000 metres (3,300 feet) in length by approximately 23 m (75 ft) in width. Small non-registered municipal airstrips with dirt or grass runways are also located in some of the communities in the watershed.

Waterways

The Roseau River is not used for commercial navigation, but is used for recreational boating and canoeing when water levels permit.

Pipelines

There is one mainline natural gas transmission pipeline and three distribution pipelines running through the Roseau River Watershed. A branch of the mainline of the TransCanada Pipeline runs in a north to south direction just to the west of PR #218 as it transports natural gas south through the RM of Franklin into the U.S (Management Area 3). There are two facilities located within the watershed that are associated with the transport of natural gas through the TransCanada Pipeline. The Altona Sales Meter Station, located near the mainline crossing at PR #201, is where natural gas is picked up and moved west along a Centra Gas (Manitoba Hydro) natural gas distribution pipeline. This pipeline provides natural gas service to Centra Gas franchise areas in and around Dominion City and Letellier and transports natural gas west to customers in the Altona area. Another Centra Gas distribution pipeline branches off the Altona bound pipeline at Dominion City and runs south to service franchise areas in and around Emerson. The Emerson Sales Meter Station, located roughly 6 miles east of Emerson at the International Border, is where natural gas is metered on the TransCanada Pipeline before it enters the U.S. for distribution to the American market. Aside from the Centra Gas franchise areas in and around Dominion City and Emerson, there is no natural gas service in the easternmost portions of the RM of Franklin and no service throughout all of the RMs of Stuartburn and Piney (Management Areas 2 and 1). While the Centra Gas pipeline runs through the Roseau River First Nation there is no service available in the community.

There is also another natural gas distribution pipeline that runs through the eastern portion of the watershed in the RM of Piney (Management Area 1). The Spruce Siding Takeoff Line runs in a southeasterly direction through the watershed after branching off from the TransCanada Pipeline at Spruce Siding just east of Ste. Anne. This pipeline is owned by Union Gas in Ontario and is a high pressure transmission line that enters the U.S. and then re-enters Canada at International Falls and services northwestern Ontario. There are no meter stations along this distribution line that allow for the provision of gas services within the eastern Roseau River Watershed area.

Note: Alvin Dyck of Manitoba Infrastructure and Transportation provided information/data on which this section is based.

4.2.5 – Tourism and Recreation

Tourism and recreation opportunities within the Roseau River Watershed are quite varied and closely associated with the abundant natural resources of the region.

Manitoba Tall Grass Prairie Preserve

One of the most significant and high profile attractions in the watershed is the Manitoba Tall Grass Prairie Preserve, located between the communities of Gardenton and Tolstoi (Management Areas 2 and 3). The Preserve involves an aggressive campaign to acquire, preserve, and protect North America's most endangered ecosystem – the tall grass prairie. This initiative is affording significant opportunities for non-consumptive, nature-based tourism activities related to wildlife viewing and rare and endangered plants (e.g. Western Prairie Fringed Orchid). In total more than 4,000 hectares (10,000 acres) of land has been protected throughout the RM of Stuartburn and more than 150 species of plants exist on the land. One of the developments on these protected lands is the Agassiz Interpretive Trail – a self-guided hiking trail located 1.6 km (1 mi.) east of the junction between PR #209 and PR #201. This site is mentioned and promoted in Manitoba's wildlife viewing guide book titled, *Pelicans to Polar Bears: Watching Wildlife in Manitoba* by Catherine Senecal. This site also has the potential to attract clients within the international marketplace.

Trans Canada Trail

An important year-round recreational feature under development in the watershed area is the Trans Canada Trail, which is proposed to pass through the RM of Franklin in a generally north to south direction (Management Area 3). The goal of the Trans Canada Trail organization (a non-profit, registered charity) is to build a recreational trail that follows a winding path through each province and territory, linking various communities. The Manitoba Recreational Trails Association Inc. (MRTA) is responsible for the planning and promotion of the portion of the Trans Canada Trail located in Manitoba. The length of the trail that runs from Winnipeg to Emerson is called the Crow Wing Trail and the portion passing through the Roseau River Watershed is still being developed. According to the MRTA, to develop this stretch of the trail

local communities and trail builders are utilizing a map from the late 1800's to recreate an old ox-cart trail that was used for transportation between St. Paul, Minnesota and Fort Garry (located at what is now Winnipeg). On August 7, 2005 the Franklin Crow Wing Trail Committee, in partnership with the RM of Franklin and the Crow Wing Trail Association, held a grand opening for the restored Swinging Cable Bridge at Senkiw as part of the Trans Canada Trail.

MOM's Way and Associated Recreation Activities

Another tourism related feature of the region is 'MOM's Way' – a name for the highway system that links southeastern Manitoba, northern Minnesota, and northwestern Ontario. MOM's Way connects Winnipeg to Thunder Bay via Highway #11 in Ontario and PTH #12 in Manitoba. Along this scenic southeasterly route, PTH #12 passes through the eastern part of the Roseau River Watershed and the RM of Piney (Management Area 1). The primary feature of MOM's Way is the diverse natural beauty of the region that is of significant value from a tourism and recreational perspective. The region boasts a variety of year-round recreation activities including fishing, hunting, canoeing, water sports, sailing, snowmobiling, cross-country skiing, ice skating, snowshoeing, tobogganing, hiking, and both wildlife and nature viewing.

While the fishing in the region is exceptional, none of the lakes utilized for sport fishing lie within the Roseau River Watershed – the lakes utilized are adjacent to the watershed and are discussed later. The region is home to a variety of wildlife (e.g. white tailed deer, black bears, snowshoe hares, moose, wolves, coyotes, lynx, etc.) that provide excellent opportunities for hunting throughout the RM of Piney and as such, licensed outfitters operate in the area. Winter-related recreation activities are especially prevalent in the region with hundreds of kilometres of excellent groomed trails for snowmobiling; some of the major snowmobile trails in the southeast part of the province pass through the watershed. There are also thousands of kilometres of trails and back roads for All-Terrain Vehicle use in the spring, summer, and fall periods. The Vassar Recreation Campground is a destination in the watershed for clients utilizing these resources.

Numerous licensed outfitters also operate in the Vita and Sundown areas (Management Area 2), providing big game outfitting packages (for bear and deer) to primarily American clientele. These outfitting operations represent significant economic and employment opportunities in this rural region. This region is also used by residents of Manitoba for a variety of waterfowl and upland bird hunting opportunities as well.

Recreational River Tubing Potential

In the late 1980's, the Roseau River was the subject of a recreational study by the provincial government department responsible for tourism and recreation at the time to determine the potential for river tubing opportunities along the river. Such an initiative was envisaged to be similar to the tubing and recreation activities that exist on the Apple River in Somerset, Wisconsin. This summer tourist attraction is centered on tube rides down a stretch of the Apple River and includes a number of other related recreation activities such as camping, dining, outdoor concerts, waterslides, mini-golf, and lodging. This initiative is a significant tourist attraction and an important contributor to both local business and economy.

The study by the Province of Manitoba in the 1980's suggested the Roseau River had potential for recreational development, but unfortunately no commercial interest developed from the study. While the natural conditions and potential exists for recreational activities on the Roseau River (rapids reach in Management Area 2), there is a need to formulate a business plan to explore the actual feasibility and desire for such an undertaking. Various factors would need to be examined in such a plan, including, but not limited to: the potential for clean up of the river (i.e. removal of rocks and overhanging tree branches that could result in injuries to clients), variable levels on the river (i.e. high flows may make river recreation dangerous and low flows may create inadequate recreation conditions), and determination of which stretch of the river would be best suited to such a development.

Currently, the Roseau River Bible Camp utilizes the river for recreational tubing for its members and signage exists along PTH #59 advertising a local tubing operation.

Historical Attractions and Traditional Events

There are a number of attractions throughout the watershed that represent the historical significance of the region. The Franklin Museum in Dominion City is housed in a former Anglican Church and is designated as a Municipal Heritage Site. The museum preserves the history of one of the first municipalities formed in Manitoba and details the history of settlement in the area. The recently restored Swinging Cable Bridge over the Roseau River at Senkiw is another Municipal Heritage Site within the RM of Franklin (Management Area 3). The bridge was originally constructed in 1946 as a means for local children to cross the river to reach the Senkiw School. As noted earlier, the bridge is part of the Crow Wing Trail, which also has historical significance as a former transportation route in the 1800's between St. Paul, Minnesota and what is now Winnipeg. This resource is viewed as beneficial for heritage tourism and future work at the bridge site is proposed to include a picnic area and commemorative plaques that detail the historical significance of the bridge. A replica of the largest freshwater fish ever caught in Manitoba is located in Dominion City (see Fisheries section for details). The largest tree in Manitoba stands on the banks of the Roseau River 13 km (8 mi.) east of Dominion City; an approximately 300-year old cottonwood that is measured 9 metres (30 feet) at the base and 6 m (20 ft) in circumference (MB Community Profiles).

The first Ukrainian Orthodox church constructed in North America was built in 1897 near present-day Gardenton. St. Michael's Ukrainian Orthodox Church stills stands and is available for public viewing. The Ukrainian Museum and Village in Gardenton is an example of the early Ukrainian settlement in the municipality. Features of the museum and village include: artifact displays with clothing and small hand tools, exhibits of churches in the area (such as the St. Demetrius Ukrainian Greek Orthodox Church, which was built in 1904 and recently celebrated its centennial anniversary), a one-room school house, a thatched-roof clay house, and a picnic area. The Gardenton Ukrainian Festival is held yearly in mid-July at this site and features Ukrainian performers, ethnic foods, and arts and crafts.

Another important traditional and cultural event that occurs in the region is the Roseau River Anishinabe First Nation Pow-Wow. According to Mr. Oliver Nelson, elder and former chief, the Roseau River Anishinabe First Nation must traditionally hold two community activities – the

Sun Dance and the Pow-Wow. Unfortunately, since there are few people who still adhere to and practice the Medewin tradition, the summer religious ceremony of the Sun Dance is no longer being held. The Pow-Wow is a more commonly known traditional community dance and was revived in the early 1970's by the efforts of Mr. William Thomas (also known as Bill Tom). The Pow-Wow is held annually during the summer period and First Nation people are obligated to invite their Anishinabe brethren to come and participate in this traditional community dance.

Recreational Opportunities Adjacent to the Roseau River Watershed

There are also a number of recreational opportunities available in the areas adjacent to the Canadian portion of the Roseau River Watershed. Lake of the Woods and the Northwest Angle, located immediately east of the Roseau River Watershed, is renowned for excellent sport fishing and is an extremely popular year-round recreation destination. The Buffalo Point International Resort, located on Buffalo Bay in an area known as MOM's corner – the junction of Manitoba, Ontario and Minnesota and part of MOM's Way – offers activities and amenities such as fishing, golf, wildlife viewing, luxury cabins, campground facilities, sand beaches, beach sports, swimming, and winter activities such as ice fishing, cross-country skiing, and snowmobiling. Moose Lake Provincial Park is another recreational area nearby that offers fishing, camping, picnic sites, and a beach. Moose Lake is also the site of Silver Birch Resort and Outfitters, which offers fishing, hunting, cabin rentals, and recreation activities. Whitemouth Lake contains trophy-sized northern pike and walleye and is a popular location for water sports. While some of the Sandilands Provincial Forest falls within the watershed area, a great deal of the forest lies immediately to the north. As such, recreation activities associated with the Sandilands (e.g. hiking/snowmobile trails) occur both within and just outside the Roseau River Watershed.

There are also recreation opportunities adjacent to the western portion of the Roseau River Watershed as well. St. Malo Provincial Park is located in the RM of De Salaberry just north of the watershed area on PTH #59. The focal point of the park is the St. Malo reservoir, which was created by the construction of the Rat River dam. Main features of the park include sandy beaches, campgrounds, a large picnic area, swimming, canoeing, sailboarding, and nature trails.

The Roseau River Wildlife Management Area (RRWMA), located in northwestern Minnesota within the U.S. portion of the watershed, is a significant attraction for wildlife viewing and hunters. The RRWMA involves three pool impoundments covering 4,300 hectares (10,600 acres) that were "developed to maintain and improve habitat for resident and migrant ducks and geese and to provide public hunting. Three wildlife refuge areas provide 7,000 acres [2,800 hectares] of feeding and resting area for migratory waterfowl and other wildlife. The rest of the unit is open to public hunting" (RRWMA Management Plan, 1989, p.2).

Summary

Overall, the tourism and recreational opportunities within the Roseau River Watershed are largely resource-based activities for which the well being and sustainability of those natural resources is critical to the continuation of those activities and the associated business opportunities for future generations.

References

Note: Jan Collins of Manitoba Culture, Heritage and Tourism provided information/data on which this section is based.

Manitoba Conservation. (2004). St. Malo Provincial Park Information. Retrieved August 15, 2005, from http://www.gov.mb.ca/conservation/parks/popular_parks/st_malo/info.html

Manitoba Recreational Trails Association. (n.d.). Trans Canada – Crow Wing Trail. Retrieved August 9, 2005, from http://www.mrta.mb.ca/tc_crowwing.html

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4.3 – Land Use / Land Cover

Land use classifications for the 258,550 hectares (638,891 acres) in the Roseau River Watershed are listed in Table 12 and displayed graphically in Figure 7. The land use classification that covers the largest total area in the watershed is forested land at 29.4%. The forest category includes deciduous forest (52,508 hectares (129,750 acres) or 20.3% of the total watershed area), conifer forest (22,778 hectares (56,286 acres) or 8.8%), and mixedwood forest (717 hectares (1,772 acres) or 0.3%). Agricultural cropland is the second highest ranking land use classification occupying 27.6% of the total watershed area. This category includes agricultural cropland (60,465 hectares (149,412 acres) or 23.4%) and forage crops (10,745 hectares (26,551 acres) or 4.2%). Grasslands and rangelands are the third major land use classification in the watershed, comprising 24.8% of the land area. This category includes mixed native and prairie grasses and some of the lands are used for hay cutting and grazing. While not as significant in terms of total land area covered, wetlands still comprise a noteworthy amount of land in the watershed at 11.7%. The wetlands category includes treed and open bog areas, as well as marshes and fens. Roads and trails, trees and shrubs, and forest cutblocks comprise a small amount of watershed lands at approximately 2.3%, 2.2%, and 1.5% respectively. Land uses included in the other category, which comprise a minute 0.5% of the watershed land area, include: cultural features, water bodies, and bare rock, sand, and gravel.

*Table 12: Land Use**

Land Use	Hectares	Acres	Percent
Forest	76,003	187,808	29.4%
Agricultural Cropland	71,210	175,964	27.6%
Grassland / Rangeland	64,123	158,451	24.8%
Wetlands	30,164	74,537	11.7%
Roads / Trails	5,962	14,732	2.3%
Trees / Shrubs	5,801	14,335	2.2%
Forest Cutblocks	3,970	9,810	1.5%
Other	1,317	3,254	0.5%
Total	258,550	638,891	100%

*Source: Data obtained from Manitoba Remote Sensing Centre, Manitoba Conservation (1993-1994).

4.4 – Land Ownership

While land ownership varies throughout the Roseau River Watershed, a significant amount of the land is held under private ownership. In the western part of the watershed (Management Area 3) the majority of the land, which is predominantly utilized for agriculture, is held under private ownership. The Roseau River Anishinabe First Nation also occupies a noteworthy amount of land in the western watershed area and the RM of Franklin owns a few scattered parcels.

In the central part of the watershed (Management Area 2) there are also many private landowners, but due in part to some marginal land in this area other ownership interests also occupy notable amounts of land. For instance, the RM of Stuartburn owns roughly 5,300 hectares (13,000 acres) of land in the watershed area, primarily east of Vita, and a significant amount of wetland area exists as undeveloped Crown land. The Gardenton Community Pasture and Gardenton Floodway are other noteworthy areas of Crown land. As noted previously, the Nature Conservancy of Canada owns more than 4,000 hectares (10,000 acres) of land in the RM of Stuartburn and approximately 2,800 hectares (7,000 acres) of this land falls within the central part of the Roseau River Watershed.

The eastern part of the watershed (Management Area 1) contains less land under private ownership in comparison to the rest of the watershed and has much more land under Crown ownership. These Crown lands include many wetland areas not suitable for development, as well as areas of special interest including wildlife management areas and provincial forests. More detailed information is available on land ownership maps which can be accessed at municipal offices or by contacting Repromap Limited in Dauphin, MB.

4.5 – Physical Features

4.5.1 – Climate

The climate in the Roseau River Watershed is characterized by variability and extremes in temperature and precipitation. The most apparent characteristic of this subhumid, continental climate is the temperature range that watershed residents' experience – from winter cold snaps with very low temperatures to summer heat waves with very high temperatures. This characteristic is manifest not only in seasonal temperature variability, but also in the considerable monthly and yearly temperature variations that occur. Watershed residents have also experienced major snowfall/blizzard events, floods, droughts, and severe summer storm events that often produce thunder, hail, significant rainfall, strong winds, and in some cases tornadoes.

Climate Data Network

Environment Canada's Meteorological Service of Canada owns and operates a network of automated weather stations across Canada that measure various hourly and daily weather elements. In or near the Roseau River Watershed there are currently two such stations in operation:

1. Sprague – Latitude 49.01 North, Longitude 95.36 West, Elevation 329 metres
   (Located on the eastern side of the watershed in Management Area 1).

2. Emerson – Latitude 49.01 N, Longitude 97.10 W, Elevation 237.6 m
   (Located about 15 km south of where the Roseau River empties into the Red River adjacent to Management Area 3).

Environment Canada also collects data from a network of volunteer climate observers who are given training and official weather equipment to measure certain daily weather elements such as precipitation and temperature. In or near the Roseau River Watershed there are currently five such stations in operation:

1. Indian Bay – Latitude 49.37 N, Longitude 95.12 W, Elevation 326.7 m
   (Temperature and precipitation data from 1915 to present).

2. Piney – Latitude 49.01 N, Longitude 96.01 W, Elevation 325.5 m
   (Temperature and precipitation data from 1980 to present).

3. St. Labre – Latitude 49.21 N, Longitude 96.02 W, Elevation 352.0 m
   (Precipitation data only from 1981 to present).

4. St. Malo – Latitude 49.19 N, Longitude 96.57 W, Elevation 263.0 m
   (Precipitation data only from 1994 to present).

5. Morris 2 – Latitude 49. 25 N, Longitude 97.28 W, Elevation 237.7 m
   (Precipitation data only from 1962 to present).

While not currently operating, there have been a number of other volunteer climate stations in or near the Roseau River Watershed. Several of these stations have periods of record that cover 10 years or more:

1. Sundown – Latitude 49.01 N, Longitude 96.13 W, Elevation 320.0 m
   (Precipitation data only from 1980 to 2000).

2. Zhoda – Latitude 49.15 N, Longitude 96.31 W, Elevation 304.8 m
   (Precipitation daily only from 1980 to 1983, temperature and precipitation data from 1984 to 2000).

3. Stuartburn – Latitude 49.07 N, Longitude 96.46 W, Elevation 289.6 m
   (Precipitation data only from 1993 to 2003).

4. Green Ridge – Latitude 49.10 N, Longitude 96.58 W, Elevation 251.5 m
   (Precipitation data only from 1967 to 2004).

The data from these main stations and volunteer climate networks are collected, quality controlled, and archived in Environment Canada's National Climate Archives.

Climate Normals

Following every 10-year period, Environment Canada recalculates and publishes climate normals for those stations with a long enough period of record. The last climate normals were calculated for the years 1971-2000, although in some cases, the data may cover a shorter period. In or near the Roseau River Watershed, climate normals have been calculated for stations at Indian Bay, Sprague, Piney, Zhoda, Green Ridge, Emerson, and Morris 2.

Climate Influences

The climate of the Roseau River Watershed is part of the larger climate of Manitoba and the central part of North America. As David Philips, chief climatologist for Environment Canada, points out in his publication *The Climates of Canada*: "Manitoba's climate is purely continental. Its chief distinguishing marks are:

- Enormous temperature differences from summer to winter (the greatest in Canada).
- Long, hard winters and warm, short summers.
- Low, but notoriously variable, annual precipitation totals.
- Dry winters and summers with slightly more precipitation in summer (Phillips, 1990, p.107)."

The climate of the Roseau River Watershed follows this general description, although, its location in the southeast corner of the province makes it slightly wetter than other areas of

southern Manitoba. This additional wetness is in part due to this region being in the track of various Low Pressure Systems that generate on the lee side of the American Rockies and then move eastward or northeastward towards the Great Lakes. These systems tap into moisture from the central U.S. and Gulf of Mexico and can bring occasional heavy precipitation.

In terms of temperatures, the Roseau River Watershed is not significantly different than other areas of southern Manitoba on a mean annual basis. Air masses which originate in the Arctic can move down relatively unmodified in the winter months to bring extremely cold temperatures. On the other hand, warm air masses originating to the south or southwest can bring hot summer temperatures to the province. However, in looking at temperature records it appears that the extremes of both heat and cold have been slightly more pronounced in the Roseau River Watershed than elsewhere in southern Manitoba.

Precipitation

According to the 1971-2000 climate normals, the mean annual precipitation at Sprague is 610.1 millimetres. This is the highest mean annual precipitation for any station in Manitoba. The only other station in Manitoba that exceeds 600 mm annually is at nearby Indian Bay on Shoal Lake, with 604.9 mm. Further to the west, the numbers diminish with Emerson having a mean annual precipitation of 562.8 mm, Morris 2 with 541.4 mm, and Green Ridge with 526.4 mm. The 47.3 mm difference in mean annual precipitation between Sprague and Emerson illustrates that the eastern extreme of the watershed (Management Area 1) is wetter than the west (Management Area 3). As a comparison, Winnipeg International Airport has a mean annual precipitation of 513.7 mm, Morden CDA has 533.3 mm, and Brandon Airport is even drier at 472.0 mm.

Normally, about 80% of the annual precipitation comes in the form of rainfall and the other 20% as snowfall. About 95% of the normal annual rainfall falls in the April to October period and only 5% falls in the November to March period. With regards to snowfall, about 90% falls in the November to March period and about 10% falls in the April to October period, mostly in the months of April or October.

On the eastern side of the watershed, at Sprague (Management Area 1), the normal annual rainfall is 487.1 mm and the normal annual snowfall is 123 centimetres. The wettest month normally is June with 95.6 mm of rain, followed closely by July at 94.1 mm. The driest month is December with 24.4 mm of precipitation, comprised of 0.7 mm of rain and 23.7 cm of snow. The snowiest month is January with 26.2 cm on average.

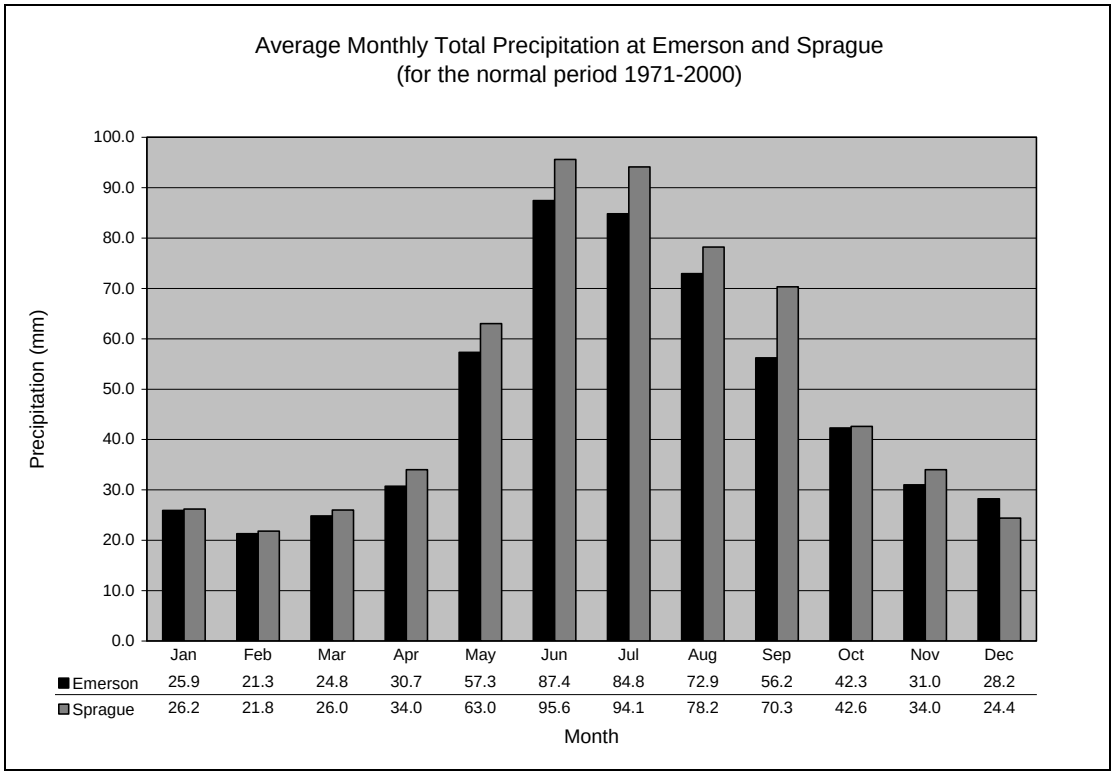
On the western and slightly drier side of the watershed, at Green Ridge (Management Area 3), the normal annual rainfall is 424.4 mm and the normal annual snowfall is 99 cm. The wettest month is also normally June with 88.5 mm of rain; however the driest month is February with 15.5 mm of precipitation, comprised of 1.8 mm of rain and 13.7 cm of snow. The snowiest month is normally January with 21.6 cm on average. At Emerson, the normal annual rainfall is 440.7 mm and the normal annual snowfall is 122.5 cm. The wettest month is also June with 87.4 mm and the driest is February with 21.3 mm, comprised of 20.8 cm of snow and 0.5 mm of rain. The snowiest month is normally January with 25.5 cm on average.

However, it must be noted that precipitation varies greatly from year to year. At Sprague the greatest annual precipitation occurred in 1991 with 883.3 mm followed by 853.8 mm in 1937. The greatest monthly precipitation occurred in June 2002 when 345.8 mm fell. This record was generated primarily by a significant and slow moving storm system that crossed the area over several days. This resulted in the greatest one-day precipitation ever at Sprague of 183.0 mm on June 10, 2002. This had been preceded by 87.0 mm the day before. The driest year on record occurred in 1952 with only 308.6 mm, followed by 345.2 mm in 1961, and 381.4 mm in 1933. The driest month recorded was February 1993 with only 0.4 mm.

At Emerson, the wettest year was also 1991 with 851.0 mm and the wettest month was July 1953 with 241.3 mm of precipitation. The greatest one day total was 104.1 mm on July 11, 1957. Similar to Sprague, the driest year recorded at Emerson was in 1952 with only 260.0 mm of precipitation. As for the driest month, there were several with only trace amounts of precipitation such as January 1951, February 1952, and others.

Table A2 in the Appendix provides a breakdown of annual, monthly, and daily precipitation extremes at stations in or near the Roseau River Watershed where such data is available. Figure 8 provides a comparison of the average monthly total precipitation (rainfall and snowfall) recorded at Emerson and Sprague for the normal period 1971-2000.

Figure 8: Comparison of Average Monthly Precipitation at Emerson and Sprague



Temperature

The continental climate that governs the Roseau River Watershed shows it influence in the large temperatures extremes that can occur on a monthly and seasonal basis, as well as from year to year. The 1971-2000 climate normals indicate that the normal annual mean temperature at Sprague is 2.4 degrees Celsius (°C) and increases moving westward, where at Zhoda it is 3.0°C and 3.4°C at Emerson. There is a 1.0°C difference in the normal mean annual temperature between Sprague and Emerson, with the western watershed area being warmer. The frost free period in the watershed varies from a range of 115 to 125 days in the western area, 105 to 115 days in the central area, and 85 to 105 days in the eastern area (MAFRI, 1999).

At Sprague, the warmest month is July with a normal daily maximum of 25.3°C, a normal daily minimum of 12.0°C, and a normal daily mean of 18.7°C. This contrasts sharply with the coldest month, January, with a normal daily maximum of -11.4°C, a normal daily minimum of -23.4°C, and a normal daily mean temperature of -17.4°C.

At Zhoda, the warmest month is also July with a normal daily maximum of 25.1°C, a normal daily minimum of 12.5°C, and a normal daily mean of 18.8°C. The coldest month is also January with a normal daily maximum of -11.0°C, a normal daily minimum of -22.1°C, and a normal daily mean temperature of -16.6°C.

July is also the warmest month at Emerson with a normal daily maximum of 26.1°C, a normal daily minimum of 13.5°C, and a normal daily mean of 19.8°C. The coldest month is also January with a normal daily maximum of -12.1°C, a normal daily minimum of -22.0°C, and a normal daily mean temperature of -17.1°C.

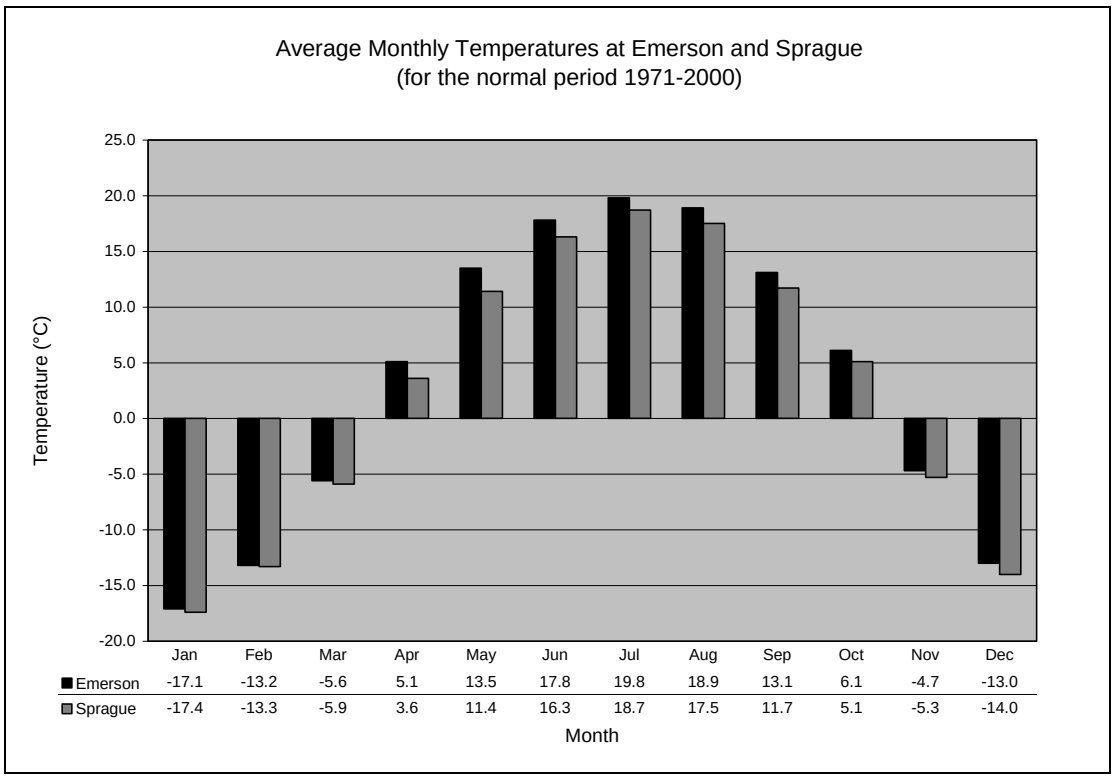
By comparison, at Winnipeg International Airport the normal mean annual temperature of 2.6°C fits closely with the values in the Roseau River Watershed. Brandon Airport is cooler however at 1.9°C and Morden CDA has the highest mean annual temperature in Manitoba at 3.8°C.

Similar to precipitation, temperatures can vary significantly from year to year. During a famous heat wave that affected parts of the Canadian Prairies and northwestern Ontario in 1936, the temperature reached 44.4°C at Emerson on July 12th. This is tied with a similar temperature the day before at St. Albans, southeast of Brandon, as the hottest temperature ever recorded in Manitoba. On that same day, Sprague recorded its hottest temperature ever at 38.9°C.

On the other hand, extremely cold winter temperatures have been recorded as well. At Indian Bay on February 7, 1933 the minimum temperature was -48.9°C and at Piney on February 2, 1996, the minimum temperature was -48.5°C. These are not the coldest temperatures ever recorded in Manitoba; that distinction goes to Norway House with a temperature of -52.8°C on January 9, 1899. However, the cold temperatures at Indian Bay and Piney do rank as some of the coldest temperatures ever recorded in the southern half of the province. The coldest temperature ever recorded at Emerson was -46.7°C on February 9, 1899. This means that the difference between the hottest and coldest temperatures at Emerson is a remarkable 91.1°C. By comparison, the coldest temperature recorded at Winnipeg was -47.8°C on December 24, 1879, at Brandon Airport -45.6 on January 7, 1966, and at Morden CDA -42.0 on January 16, 1993.

Table A3 in the Appendix provides a breakdown of annual, monthly, and daily temperature extremes at stations in or near the Roseau River Watershed where such data is available. Figure 9 provides a comparison of the average monthly temperatures recorded at Emerson and Sprague for the normal period 1971-2000.

Figure 9: Comparison of Average Monthly Temperatures at Emerson and Sprague



Severe Winter Weather

Similar to other parts of southern Manitoba, the Roseau River Watershed can receive significant severe winter weather events. Blizzards, for example, are an event that can occur any winter. As written by Phillips (1990) in *The Climates of Canada*, "[b]lizzards are characterized by intense cold, strong winds, and low visibility in snow. In Manitoba blizzards, new snow is not always present; often most of the snow that piles into huge drifts has fallen earlier and is just redistributed during the storm. Blizzards and drifting snow are a hazard in the open prairie but less so in the forests where the force of the wind is broken by the trees" (p.111).

Ice storms are much less common, but can occur in the watershed. "Freezing precipitation falls infrequently in Manitoba but when it does occur it usually results in major disruption. Heavy icing, especially when accompanied by strong winds, devastates trees and brings down wires, disrupting communications and power supplies" (Phillips, 1990, p.111).

The occurrence of freezing precipitation appears to be much more common at Emerson than at Sprague. Virtually every year there is at least one occurrence of freezing rain or drizzle at

Emerson, however, the amounts and duration vary. At Emerson, between 1977 and 1996, there were 161 days with some freezing precipitation. At Sprague, over the same period, there were only 16 days with some freezing rain or drizzle. A shallow layer of cold air trapped in the Red River Valley with overrunning moist air aloft may be the reason for this significant difference.

Severe Summer Weather

Southern Manitoba, including the Roseau River Watershed, receives thunderstorms, hail, strong winds, and tornadoes every year; however, the annual frequency varies considerably. "Manitoba has many thunderstorms, particularly in the south where Winnipeg and Portage la Prairie average between 25 and 30 days a year when thunder is heard … The prime season is mid-June to late August with a peak in the third week of July. This is the time when surface heating and vertical air movement are at their maximum. Thunderstorms accompanied by wind and hail cause local damage to crops, livestock and property … Most of the hail that falls is small. However, stones as large as golf balls are reported often in Southern Manitoba during each summer, and stones as large as baseballs have occurred" (Phillips, 1990, p.111).

Tornadoes are reported every year in Manitoba and over the last 30 years the annual average number of tornadoes reported for the entire province is 9.2. However, it is likely that many tornadoes do not get reported, especially if they are weak, short-lived or occur in less populated areas where little or no damage is caused to property and witnesses are absent. Due to "the low density of population, loss of life is quite rare and damage is confined to farm buildings and telephone, power and transmission lines. Tornadoes in Manitoba favour July and August and the late afternoon and evening. The frequency is highest in the Red River Valley and adjacent areas" (Phillips, 1990, p.111).

There have been several significant tornadoes reported in or near the Roseau River Watershed. On the afternoon of Sunday, June 19, 1955, Vita was hit by a tornado that injured 30 people and destroyed the hospital, the church, a school, many homes, and various other buildings. The tornado struck at 4:30 p.m. – shortly after rain and hail had driven residents inside – and nearly destroyed the community in about two minutes (Penziwol, 2004). "Fire in the aftermath of the storm aided in the complete destruction at Vita" (Penziwol, 2004, p. 53).

On Monday, July 18, 1977, a tornado near Rosa killed three people and caused extensive damage estimated at over one million dollars. The tornado struck between 7:30 and 8:00 p.m. and followed a path from St. Malo to Rosa approximately 14 km (9 mi.) long and up to 1.6 km (1 mi.) wide (Penziwol, 2004). This tornado was rated an F4 on the Fujita scale, one of only a very few of this intensity to ever occur in Canada. Such tornadoes are described as "devastating" with wind speeds of 331 to 417 kilometres per hour (206 to 259 miles per hour). The Fujita scale ranges from F1 (weakest) to F5 (most severe) and Dr. Fujita actually visited the Rosa area to survey the damage and classify the intensity of this tornado (Penziwol, 2004). Tornadoes have also been reported in or near Gardenton (1958, 1994), Zhoda (1959), Stuartburn (1960), Emerson (1968, 1982), St. Malo (1984), Piney (1985, 1991, 1994, 1999), Tolstoi (1989), Caliento (2005), and Dominion City (2005), however, these events resulted in less damage and no loss of life.

Severe thunderstorms can also create downbursts resulting in very strong straight-line winds (also known as plough winds). These winds are not caused by tornadoes, but can result in extensive damage and can affect large areas. Straight-line winds can reach speeds of 100 to 160 km/h (60 to 100 mph) or higher and can be more severe because they are longer in duration, often persisting for an hour to several hours (Penziwol, 2004).

The severe weather season was very active in 2005 and had considerable impacts in the Roseau River Watershed. One of the more significant events took place on Sunday, June 19th when very strong thunderstorms developed in northeastern North Dakota and then moved into the Gretna-Altona region. These storms continued tracking eastward into the Letellier area, through the Roseau River First Nation, and then moved towards South Junction and Sprague. Along with local heavy rains and large hail, these storms had very strong winds which uprooted trees, damaged power lines, and caused extensive power outages. Several grain cars were blown off the tracks at Letellier. Storm investigations indicated that these were straight-line winds caused by downbursts from the thunderstorms and were not tornadoes.

Just four days later on June 23rd, a severe thunderstorm produced heavy rain and hail in the Sundown and Woodridge areas. A few days later on June 27th, a severe thunderstorm in the St. Malo and Tolstoi region created wind gusts which were reported to be over 100 km/h (60 mph). Less than a week later, during the early evening of July 2nd, a severe thunderstorm with golf-ball sized hail was reported near Letellier, Tolstoi, and Stuartburn. Later in the evening and overnight into the early morning of July 3rd, a severe thunderstorm with strong winds uprooted trees and damaged some buildings in the Menisino, Piney, Badger, and Whitemouth Lake areas. Severe thunderstorms re-developed in the afternoon of Sunday, July 3rd and several tornadoes were reported, including one which touched down south of Ste. Elizabeth and then moved to the area east of Dominion City causing some localized damage to buildings. Large hail covering the ground was also reported in the Rosa, Badger, Piney, and Sprague areas.

Summary

Historical weather data for the area in and near the Roseau River Watershed indicates a true continental climate with large differences in temperature from season to season and year to year. Some of the hottest and coldest temperatures in Manitoba have been observed in this region. This is also the area of Manitoba with the highest normal annual precipitation, but with significant seasonal and annual variations from the norm. Severe winter and summer weather events occur relatively frequently with resulting impacts on lives and property.

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Note: Dale Marciski of Environment Canada provided information/data and wrote a large portion of this section.

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4.5.2 – Topography and Geology

The topography that exists throughout the Roseau River Watershed was developed as a result of glacial processes associated with melting ice sheets. Thousands of years ago during the Pleistocene Epoch Ice Age, the retreat of ice sheets left behind a landscape dominated by glacial till and outwash deposits. Glacial till consists primarily of unsorted sand, silt, clay and boulders deposited directly by melting ice. Glacial outwash consists of well-sorted sand and gravel material deposited by meltwater flowing from ice sheets. The Sandilands Upland area is a notable outwash deposit that stretches into the northeastern part of the Canadian portion of the watershed. The Beltrami Island area is another outwash deposit in the southeastern part of the American portion of the watershed. Former glacial Lake Agassiz was created by meltwater and covered the watershed area for an extended period of time, depositing glacial-lacustrine sediments (silt and clay) which are prominent in the western portion of the watershed.

As a result of these geologic processes, the Roseau River is characterized by a poorly defined river channel that has little vertical erosion and predominantly cuts laterally, establishing new channels and abandoning old ones. Generally speaking, the Roseau River Valley is a flat plain that passes through sandy upland areas, cuts through beach ridges creating a reach where stream velocity and bank height are increased, and terminates in the heavy clay soils of the Red River Valley. The elevation of the watershed varies from approximately 381 metres (1,250 feet above sea level) in the headwater reaches to approximately 238 m (780 ft a.s.l.) at the mouth where the Roseau meets the Red River. The total elevation change of the Roseau River Watershed from source to mouth is approximately 143 m (470 ft a.s.l) (IRREB, 1975).

Since a thick sequence of silts and rather impermeable clays underlie much of the region, the water table is normally quite high and as a result, peat bogs are a common occurrence in localized depressions (IRREB, 1975). Historically, regional land cover was dominated by wetlands, significant amounts of forest and brush, and prairie grassland. In order to increase agricultural productivity throughout the watershed, there is an extensive drainage network that has contributed to an altered landscape with a corresponding decrease in wetlands, forest, brush, and prairie grassland cover. While much of the wetland areas throughout the watershed have been drained, the Caliento and Sundown Bogs remain as major wetland features. As noted previously, the Manitoba Tall Grass Prairie Preserve in the central watershed area (Management

Areas 2 and 3) exists as an attempt to preserve some of the historical natural prairie grassland landscape. A significant amount of forested land remains in the eastern watershed (Management Area 1) in the Sandilands, Cat Hills, and Wampum Provincial Forests (IRREB, 1975).

Bedrock Geology

While the Canadian portion of the Roseau River Watershed is underlain by rocks of the Precambrian Shield, there are no visible bedrock exposures or outcroppings. The underlying Precambrian Shield is predominantly composed of granite and metavolcanic rocks of the Wabigoon Domain, which is part of the Superior Structural Province.

The Ordovician Winnipeg Formation, Ordovician Red River Formation, and Jurassic Amaranth Formation subcrop along the western portion of the watershed (i.e. these geologic formations are buried underground and not exposed at the surface). The Winnipeg Formation subcrop belt strikes north-south along Ranges 9 E.P.M. and 10 E.P.M. This belt is approximately 2 km (1.25 mi.) wide and is composed predominantly of quartzose, sandstone and shale. The overlying Red River Formation subcrops to the west of the Winnipeg Formation and consists of mottled dolomitic limestone. The Jurassic Amaranth Formation subcrops in Townships 2 and 3, Ranges 10-12E. This sedimentary sequence comprises an east-west trending outlier of Jurassic rocks known as the Dominion City Channel into Ordovician rocks of the Winnipeg and Red River Formations. The Amaranth Formation is comprised of red argillaceous siltstones and sandstone overlain by evaporites (gypsum).

Geological History – Late Wisconsinan Glaciation

During the Late Wisconsinan glaciation, the last and most recent glacial period, two major glacial ice lobes had a notable influence on the surficial geology of southeastern Manitoba – the Rainy Lobe of the Laurentide Ice Sheet and the Red River Lobe of the Keewatin Ice Sheet. These ice lobes deposited unsorted debris generally at the base of the ice (till) and sorted debris along meltwater channels within the ice or near the ice margin (glaciofluvial sand and gravel). The glaciofluvial sand and gravel deposits are the most important source of aggregate in southeastern Manitoba.

The Rainy Lobe advanced from the northeast into southern Manitoba and deposited the Senkiw till. The till is exposed and boulders are visible in the river bed along the Roseau River Rapids near Senkiw. During its retreat, the Rainy Lobe stabilized in the vicinity of what is now the Sandilands area where it was met by an advancing northwest ice sheet – the Red River Lobe. Between these two ice sheets an interlobate moraine (Sandilands Moraine) was built by glacial meltwater that flowed southward into a predecessor of glacial Lake Agassiz (Teller and Fenton, 1980). The high sand ridges in the Sandilands area are known as the Bedford Hills and Cypress Mountains and are noted as the second highest points of elevation in Manitoba (IGA, 2000). Multiple advances of the Red River Lobe have been recorded in the Roseau River sections.

Approximately 13,000 years ago, during the retreat of these two ice lobes, numerous ice-marginal lakes merged to form glacial Lake Agassiz. In the deep water of the lake, silt and clay were deposited, while along the shore of the lake, beach ridges of sand and gravel were built and

now serve as an important source of local aggregate. The deepest areas of glacial Lake Agassiz occurred in western part of the watershed (flat plain area) and the former beach ridges are visible moving eastward into the central portion of the watershed where the elevation increases.

The history of Lake Agassiz is complex due to ice advances into the lake and numerous inlets and outlets that controlled the lake levels. Each lake level is recorded by a developed shoreline, commonly defined by beach ridges. Drumlinoid ridges – straight glacial ridges commonly composed of sand and gravel – attest to the late glacial advances of the Red River Lobe into Lake Agassiz. Drainage of Lake Agassiz from southeastern Manitoba occurred around 8,500 years ago. Surficial deposits of lacustrine clay and silt associated with glacial Lake Agassiz are common in the western portion of the watershed in Manitoba (Management Area 3).

Mineral Resources

There is potential for base metals, gold and diamonds in the subsurface (Precambrian rocks) of the watershed area. While there has been exploration for these mineral commodities both historically and recently, no producing mines have been developed within the watershed area.

Economically valuable sand and gravel deposits are located in the glaciofluvial deposits and beach ridges. These deposits contain medium to high quality aggregate and are important commodities that are needed for local and provincial construction and infrastructure requirements. Consequently, important resource management issues are centered on: a) the need to protect high quality non-renewable aggregate resources for future infrastructure requirements; b) the reclamation of depleted deposits; and c) the need to ensure that aggregate extraction is conducted in an environmentally sustainable manner.

Mineral Tenure

Manitoba owns many parcels of mineral under-rights throughout the Roseau River Watershed. There are several valid mineral dispositions that are currently in good standing under The Mines and Minerals Act for aggregate and other mineral commodities. Mineral dispositions are granted to companies for exploration and possible development purposes. Figure 10 displays the location of mineral resource activities in the watershed area.

References

Note: Chuck Jones of Manitoba Industry, Economic Development and Mines provided information/data on which this section is based.

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4.5.3 – Soils

Whenever soil survey information is used, it is very important to note the level of detail to which it was collected and its appropriate uses. Detailed soil survey data (scales of 1:20,000 to 1:50,000) should be used where they exist for a given area because the mapping is based on more field data and therefore provides a better indication of soil types and variability present in an area. Detailed data are appropriate for site-specific, field-scale assessments. Reconnaissance soil survey data (smaller than 1:50,000 scale, e.g. 1:126,720) are based on less field data and therefore, are less reliable in indicating soil types and variability. Reconnaissance data are appropriately used for general planning and description purposes. Since only a portion of the watershed has been surveyed to a detailed scale, this distinction between different types of soil survey data should be kept in mind when assessing the land resources and environmental risks within the watershed. As indicated previously, the inherent productivity of the land within the Roseau River Watershed generally declines moving from west to east due to increasing limitations to crop production. Figure 11 displays the soils of the watershed.

Note that all figures utilized in this section reflect the entire land base of the municipalities and have not been adjusted to reflect the portions of the municipalities that fall within the boundaries of the Roseau River Watershed. At the time of writing data from Manitoba Agriculture, Food, and Rural Initiatives was available based on municipal divisions, not watershed divisions.

Rural Municipality of Montcalm (Management Area 3)

General Properties – The small area of the RM of Montcalm lying within the boundaries of the watershed is characterized by nearly level topography and fine-textured soils developed from clayey lacustrine (i.e. glacial lake sediments) parent material. In formal soil classification terms, Black Chernozems and Gleysols are the predominant types. Excess moisture is the primary limiting factor for crop productivity with the occurrence of heavy precipitation. "Clayey soils with slow to very slow permeability are subject to surface ponding and slow runoff unless adequate drainage is provided" (LRU, 1999a, p.6). Consequently, almost all of this area is classified as being either imperfectly drained (72%) or poorly drained (18%).

Agriculture Capability – Despite the inherent properties of the soils in this area, with improved drainage the ratings for agriculture capability are predominantly Class 2 to 3 (77% and 18% respectively), with a small amount of Class 1 land (3%); classifications are based on the Canada Land Inventory (CLI) system. The majority of land in the municipality (76%) has a negligible to low risk of degradation from water erosion (due to the flat topography and clayey soil textures) and the remaining soils with silty and loamy textures (22%) have a moderate risk from water erosion. The loamy soils of the region are vulnerable to the risk of wind erosion and as such, require protection to reduce degradation (LRU, 1999a).

Rural Municipality of Franklin (Management Area 3 and part of Management Area 2)

General Properties – On the western side of the RM of Franklin, soils developed predominantly from clayey lacustrine parent material (Black Chernozems and Gleysols), with a small pocket based on loamy lacustrine. On the eastern side of the municipality, soils developed mostly from sandy or sandy loam lacustrine materials (Gleysols). Similar to the RM of Montcalm, this part of the watershed is characterized by nearly level topography and fine-textured soils, a combination that leads to excess moisture limiting crop productivity with heavy precipitation. The majority of the municipality (61%) is classified as being imperfectly drained, with most of the remaining portion of the municipality classified as poorly drained (30%). "Clayey soils with slow to very slow permeability are subject to surface ponding and slow runoff unless adequate drainage is provided … In contrast, the sandy soils are much more permeable near the surface but because of a loamy till subsoil, they typically have seasonal high water tables and may experience occasional surface ponding in spring or following heavy rains" (LRU, 1999b, p.6).

Agriculture Capability – Approximately 43% of the municipality is classified as having Class 2 soils and 42% of the municipality is classified as having Class 3 soils. As such, these soils have the capability to support annual crop production, with the Class 2 soils capable of supporting some special crop production dependent upon the development and extent of surface drainage. The majority of land in the municipality (62%) has a negligible risk of degradation from water erosion and the remainder (37%) has a low to moderate risk, due mainly to the flatness of the land. The loamy and sandy soils of the region are vulnerable to the risk of wind erosion and as such, require protection to reduce degradation (LRU, 1999b).

Rural Municipality of Stuartburn (Management Area 2 and parts of Management Areas 3 and 1)

General Properties – Inherent soil conditions in the RM of Stuartburn are generally characterized by thin sandy to coarse loamy textured lacustrine sediments underlain by stony, extremely calcareous loam textured glacial till. There are areas in the municipality where waterworked very calcareous, stony loam till is found and other areas where gravelly sand outwash and beach deposits are present. Taxonomically, the dominant soil classifications are Gleysols and Chernozems, with occurrences of Brunisols and Regosols as well. Accordingly, 43% of the municipality is classified by imperfect drainage, due mainly to the flat topography and high water table. An additional 25% of the municipality is classified as poorly drained and 27% is classified as very poorly drained (LRU, 1999c). "The sandy soils are permeable near the surface but because of a loamy till subsoil, they typically have seasonal high water tables and may experience occasional surface ponding in spring or following heavy rains" (LRU, 1999, p.6).

Factors impacting the agriculture resource in the RM of Stuartburn include coarse textured soils, stoniness and wetness. Large areas of the municipality (particularly in the eastern portion of the municipality are characterized by organic soils (as identified in the Soil Survey of the Roseau River Watershed). These areas have limited capability for agricultural production, except for the periphery where adequate surface drainage has been established (LRU, 1999c).

Agriculture Capability – Ratings for mineral soils in this municipality are predominantly classified as Class 4 (21%) and Class 5 (31%). The most productive soils (Class 2 and Class 3)

account for 7% and 15% (respectively) of the land base in the municipality. Poorly productive soils (Class 6 and organic soils) cover a considerable area (16% and 9%, respectively) and offer limited capability for crop production. The vast majority of land in the municipality (95%) has a negligible risk of degradation from water erosion, due mainly to the flatness of the land, and the remainder (5%) has a low, moderate or high risk due to more slope in some areas. The loamy and sandy textured soils of the region are vulnerable to the risk of wind erosion and as such, require protection to reduce degradation (LRU, 1999c).

Rural Municipality of Piney (Management Area 1 and part of Management Area 2)

General Properties – The central portion of the RM of Piney is dominated by the Bedford Hills, where the soils are characterized by sandy and gravelly outwash and beach deposits. Throughout the remainder of the municipality there are local areas of stony calcareous loam textured glacial till, which is overlain in some places by sandy to coarse-loamy textured lacustrine deposits, and also significant areas of shallow to deep organic deposits. Clayey lacustrine materials can be found in some areas of the Whitemouth Lake Lowland. The dominant soil classification is Gleysolic, with occurrence of Luvisolic (forest), Chernozemic, and Organic soils as well. Just over 50% of the municipality is impacted by very poor to poor drainage; especially in the Whitemouth Lake Lowland and Southeastern Plain areas where the topography is flat and the water table high. A further 30% of the municipality is classified as having well to rapidly drained soils (predominately found in the Bedford Hills area) and 19% of the municipality is classified as being imperfectly drained (LRU, 1999d).

Agriculture Capability – An evaluation of agriculture capability indicates that only 7% of the soils in the municipality are classified as Class 3, which will sustain annual crop production, and 15% are Class 4. Approximately 25% of the soils in the municipality are Class 5, which are generally suitable for native forage production, with an additional 41% of the soils in the municipality classified as organic. In a natural undrained condition, organic soils have no capability to be utilized for agriculture. The large majority of land in the municipality (80%) has a negligible risk of degradation from water erosion due mainly to low relief and sandy soil textures, and the remainder (19%) has a low, moderate or high risk due to higher local relief and steeper slopes in some locations. The sandy soils of the region are very vulnerable to the risk of wind erosion and as such, require protection to reduce degradation (LRU, 1999d).

Summary

The majority of soils data for the Roseau River Watershed exists at the reconnaissance level (e.g. 1:126,720) and for management purposes, it would be beneficial to conduct detailed soil surveys (e.g. scales of 1:20,000 to 1:50,000) to produce more precise data. The data source for this section was a series of publications by Agriculture and Agri-Food Canada (AAFC) titled *Soils and Terrain: An Introduction to the Land Resource.* These publications are an excellent resource for additional, more detailed data with respect to soil resources for municipalities in the watershed, including data on soil classification, soil drainage, soil texture, agriculture capability, irrigation suitability, potential environmental impacts related to irrigation, and water erosion risks. In addition, for further soil resource information see the 2005 report by AAFC (see references) titled “Summary of Resources and Land Use Issues Related to Riparian Areas in the

Roseau River Watershed Study Area" and a report by Mills et al. (1977) in which the authors mapped the organic soils of the watershed at a semi-detailed scale.

References

Note: Dennis Schindler and Mitch Timmerman of Manitoba Agriculture, Food and Rural Initiatives provided information/data on which this section is based.

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4.6 – Natural Resources

4.6.1 – Wildlife and Biodiversity

The remarkable biodiversity of the Roseau River Watershed mirrors the diversity of its landscapes. The watershed represents an ecological gradation from the continuous boreal forests and large peatlands in the east to grasslands, aspen woodlands and wetlands, and finally into the rich open croplands upon what was once the open tall grass prairie of the Red River Valley.

Eastern Watershed (Management Area 1 and part of Management Area 2)

The eastern portion of the watershed lies within the boreal forest. Vast fens, often dominated by black spruce and tamarack, occur here. Jack pine often dominates the sand ridges, with aspen and mixed aspen-white spruce forests occurring on moister sites. The extensive black spruce stands in this area are a favourite haunt of the Great Gray Owl, Manitoba's Provincial Bird. Moose, black bear, wolves, and white-tailed deer are commonly observed in the eastern portion of the watershed.

Central Watershed (Management Area 2 and part of Management Area 3)

The central portion of the watershed is characterized by a mosaic of trembling aspen groves, tall grass prairie, sedge-dominated wet meadows, marshes, peatlands, riparian areas, and the Roseau River itself. The area bound by Vita, Stuartburn, Tolstoi, the Canada-U.S. border, and Gardenton supports the most significant concentration of provincially and nationally rare plants in Manitoba, and as noted previously, is the home of the Manitoba Tall Grass Prairie Preserve. Big bluestem-dominated grassland occurs on many drier upland areas, often with an important and diverse mixture of shrub species. Sedge meadows often occupy low areas adjacent to big bluestem prairies and are usually characterized by dense shrub cover (typically willow and bog birch); the species in these meadows are adapted to the localized flooding that generally occurs for 2 to 6 weeks in the springtime, and in some instances after heavy rains. Small gravelly outcrops occur throughout the central and western portion of the watershed – these areas often support oak savannah and dry tall grass prairie, which is usually dominated by little bluestem. Wooded riparian areas are characterized by a dense deciduous canopy of green ash, Manitoba maple (box elder), bur oak, and aspen.

White-tailed deer are often observed in the central portion of the watershed. Wolves and black bears are also observed and one of the most interesting mammals in the area is elk. A small elk herd regularly winters in the Arbakka area and utilizes the prairie/aspen/parkland/wetland complex between Vita, MB and the Caribou Wildlife Management Area in Kittson County, MN. This elk herd appears to have fluctuated between 30-60 animals since its establishment in the 1960's and there are very few places left in North America where it is possible to view a bull elk standing majestically over a native tall grass prairie field (C. Hamel, personal communication, October 12, 2005). Numerous smaller mammals, such as the plains pocket gopher, plains pocket

mouse, and prairie vole are commonly observed as well. More than 50 species of mammals are likely found in the watershed area (C. Hamel, personal communication, October 12, 2005).

The central part of the watershed has been identified as an important site for birds and numerous avian species are present. The interspersion of closed forest and shrubby meadows makes this an important sharp-tailed grouse breeding area. The central part of the watershed is also an important breeding and migratory stop-off area for sandhill cranes. The shallowly-flooded sedge meadows and prairies of the area represent ideal breeding habitat for this bird. In addition, large populations of yellow rails, marbled godwits, and over 100 other grassland, wetland, and forest birds breed in the area's diverse habitat (C. Hamel, personal communication, October 12, 2005).

Approximately 20 different species of herpetofauna (i.e. reptiles and amphibians) have been identified as likely present in the central portion of the watershed. Included in this group are various species of frogs, toads, salamanders, turtles, and snakes which have been identified.

Western Watershed (Management Area 3 and part of Management Area 2)

Much of the western portion of the watershed, especially the westernmost area in the Red River Valley, is cropland. However, important areas of remnant prairie and woodland remain, providing cover for deer and small mammals. The primary tree species in this part of the watershed include aspen, bur oak, cottonwood, elm, and willow.

At this point in time very little work has been done to identify and classify aquatic invertebrate species in the Roseau River Watershed. Dr. Eva Pip of the University of Winnipeg conducted some research on the Canadian portion of the Roseau River mainstem channel and observed 11 species of aquatic invertebrates (C. Hamel, personal communication, October 12, 2005).

Note: Jason Greenall of Manitoba Conservation provided information/data on which this section is based.

4.6.1.1 – Rare and Endangered Species

An integral element of conserving natural resources and biological diversity is the identification and protection of rare and endangered species. Consequently, the *Species at Risk Act (SARA)* at the federal level and *The Endangered Species Act* at the provincial level, have been put in place to help protect species at risk. Due to the considerable biodiversity in the Roseau River Watershed, both pieces of legislation are of importance to activities occurring in the watershed. Manitoba Conservation's Wildlife and Ecosystem Protection Branch and Environment Canada's Canadian Wildlife Service are two primary sources for data related to rare and endangered species in the watershed. Another important piece of legislation in this regard is the federal *Fisheries Act* and the role of Fisheries and Oceans Canada (DFO) – see fisheries section.

A number of endangered, threatened, and/or species of special concern have been identified in the habitat of the Roseau River Watershed. Current threats to these species vary, but are often related to habitat degradation or destruction. Habitat destruction, prevention of naturally

occurring disturbance events (e.g. wildfire, regular flooding), and invasive species such as leafy spurge all threaten the continued existence of these species in the watershed.

Rare Species in the Eastern Watershed (Management Area 1 and part of Management Area 2)

The eastern white pine, an evergreen tree which is rare in Manitoba, occurs near Sprague, as does Hop-hornbeam (also known as ironwood), a member of the birch family and another tree which is rare in Manitoba. Visitors to rich woodlands in the eastern watershed in early spring may encounter the rare Bloodroot, an herbaceous perennial of the poppy family which blooms on undisturbed slopes before shade-casting tree leaves unfurl.

Rare Species in the Central Watershed (Management Area 2 and part of Management Area 3)

The concentration of rare species in the central portion of the watershed is a reflection of the rarity of habitat types that occur here. Less than 1% of North America's tall grass prairies remain intact today, as their rich black soils have become some of the best available farmland. Much of the tall grass prairie that remains intact in the watershed escaped cultivation due to the stoniness of local soils and the wetness of the area. As a result of this loss of habitat, a number of the species that were once common across the Great Plains are now only found in isolated prairie remnants. The Powesheik Skipperling, Yellow Rail, Western Silvery Aster, Culver's-root, Riddell's Goldenrod, Great Plains ladies'-tresses, Small White Lady's-slipper, and Western Prairie Fringed Orchid are all species listed under Canada's *Species at Risk Act (SARA)* and/or Manitoba's *Endangered Species Act* that are found in the central portion of the watershed. The western prairie fringed orchid population that occurs within the watershed is the only one in Canada and represents the largest known population of this globally imperilled species.

It is worth noting that biodiversity data for the central portion of the watershed is more available due in part to the fact that the Roseau River Watershed forms the core of the Tallgrass Aspen Parklands landscape. This landscape "was identified as a 'high priority site' for conservation action through an ecoregional planning process that concluded in 1998" (TAP, 2003, p.1). Consequently, a partnership was established to develop "an holistic, science and experience-based blueprint for conservation action in the area" (TAP, 2003, p.1). The Tallgrass Aspen Parklands Conservation Planning Area effort brings together various partners, including the Nature Conservancy of Canada, Manitoba Region (NCC) and The Nature Conservancy, Minnesota Chapter (TNC). The NCC and TNC have been working to conserve Tallgrass Aspen Parklands landscape in Manitoba and Minnesota for more than 10 years. The primary work area for this initiative falls primarily within the RM of Stuartburn and in the central part of the Roseau River Watershed (see the prior Tourism and Recreation section for a description of the Manitoba Tall Grass Prairie Preserve – part of the NCC's efforts in Manitoba).

Rare Species in the Western Watershed (Management Area 3 and part of Management Area 2)

Provincially uncommon plains pocket gophers are especially abundant in the western part of the watershed and remnant populations of Great Plains ladies'-tresses and Culver's-root (listed under Manitoba's *Endangered Species Act*) can be found in ditches and undeveloped road allowances.

Other Rare Species Associated with the Roseau River Watershed

In addition to the species positively identified within the boundaries of the Roseau River Watershed, there are various other species whose territory may cross through or run adjacent to the watershed. While factual data have not confirmed the presence of these species within the watershed, the potential exists that some of the species may be influenced by activities in the watershed or at some point may utilize or become part of the habitat in the watershed.

The Least Bittern is a threatened species that has not yet been found in the Roseau River Watershed, but its main habitat in Manitoba is the Rat River Swamp. Since the Rat River Swamp is located directly north of the Roseau River Watershed boundary, the possibility exists that the Least Bittern might nest within the watershed and as such, any positive watershed activities would likely benefit the Least Bittern and its nesting habitat. The Least Bittern is also protected by the federal *Migratory Birds Convention Act*, and as such, this legislation will be of importance if this species of bird is ever found within the Roseau River Watershed. The Sprague's Pipit is another threatened species whose range borders the Roseau River Watershed at the westernmost edge in the Red River Valley. If the Sprague's Pipit were ever found in the watershed, there would likely be few occurrences because this area falls along the very eastern edge of this bird's range (R. Bazin, personal communication, November 2, 2005).

The Grey Fox is a threatened species whose territory covers southeastern Manitoba and consequently, the Roseau River Watershed. But, there are very few historical records of this species in the watershed area and the last known specimen identified in Manitoba was a road kill near Sprague in about 2001 (R. Bazin, personal communication, November 2, 2005).

The Carmine Shiner is a threatened fish species, though not in the Roseau River Watershed itself, this species is found in the Whitemouth River and Whitemouth Lake, immediately north of the watershed boundary (R. Bazin, personal communication, November 2, 2005).

4.6.1.2 – Areas of Special Interest

There are a number of biologically diverse areas in the Roseau River Watershed that have been set aside and protected as part of Manitoba's Protected Areas Initiative. These include Wildlife Management Areas and Ecological Reserves. Lands owned by the Nature Conservancy of Canada and the Manitoba Tall Grass Prairie Preserve and fall under this initiative (detail on the Preserve is discussed under the Tourism and Recreation section of this plan). In addition, three Provincial Forests exist fully or partially within the eastern part of the watershed (Management Area 1) and provide further examples of biological diversity, but are not protected areas.

Wildlife Management Areas

The Spur Woods Wildlife Management Area (WMA) is located along Provincial Road #201, approximately 1.6 kilometres (1 mile) east of Menisino and roughly 6 km (4 mi.) west of Piney (Management Area 1). The Spur Woods WMA encompasses 731 hectares (1,806 acres) and was designated in 1995 to protect stands of old growth red pine and eastern white cedar that exist in

the area. The Province of Manitoba's *"Land for Wildlife and People"* information sheet states that the Spur Woods WMA is located within the major breeding and migration corridor for northern forest owls, including the great gray owl, northern saw-whet, and boreal owls, and also provides habitat for deer and grouse. The information sheet also notes that there are a number of access trails within the WMA available for year-round use and one of the trails follows the old railway spur line that passed through the region (i.e. former CNR Ridgeville Subdivision).

The Stuartburn WMA is located along Provincial Road #209 approximately 1.6 km (1 mi.) north of Gardenton and 1.6 km (1 mi.) south of junction between Provincial Roads #201 and #209 (Management Area 2). The Stuartburn WMA encompasses 329 hectares (813 acres) of land that was donated to the Province by the RM of Stuartburn and comprises part of the Manitoba Tall Grass Prairie Preserve. The Province of Manitoba's *"Land for Wildlife and People"* information sheet states that the impetus for the donation was to preserve critical wildlife habitat and to provide opportunities for public hunting. The information sheet also notes that the WMA is: characterized by vegetation that includes a combination of tall-grass prairie, aspen parkland, and small sedge meadow; utilized as a travel and breeding habitat by neo-tropical migrant birds; and a habitat for commonly found species such as white-tailed deer, monarch butterflies, and various reptiles and amphibians.

Ecological Reserves

The Wampum Ecological Reserve is a 62 hectare (153 acre) site located between Wampum and South Junction in the RM of Piney (Management Area 1). The Wampum site was set aside as an ecological reserve in 1978 because it was one of only two remaining locations in Manitoba where mature Red Pine stands grow and reforest naturally. Established under *The Ecological Reserves Act*, these lands are set aside throughout the province to preserve and protect ecologically sensitive areas that contain unique and rare examples of plants, animals, and geologic features – ecological reserves were not created to facilitate recreation, but rather are an attempt to conserve ecosystems and maintain biodiversity in concert with Manitoba's Protected Areas Initiative (Manitoba Conservation, n.d.). There are a total of 16 ecological reserves in the province, including Wampum, and two exist just north of the eastern watershed area – the Whitemouth Island Ecological Reserve and the Whitemouth River Ecological Reserve.

Provincial Forests

The Cat Hills Provincial Forest covers roughly 100 hectares (247 acres) and is located directly northwest of Sprague. This parcel of land is known for an abundant supply of wild blueberries. A noteworthy portion of the Sandilands Provincial Forest passes through the watershed area and similar to the Cat Hills Provincial Forest, the Sandilands Provincial Forest is known for its abundant source of blueberries, as well as Saskatoon berries. As noted previously, the Sandilands area contains the second highest point of elevation in Manitoba (Bedford Hills and Cypress Mountains) and majestic pine trees and mixed hardwoods (RM of Piney, n.d.). A small portion of the Northwest Angle Provincial Forest enters the easternmost part of the watershed.

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4.6.2 – Fisheries

Most of the published data available on the fisheries resources of the Roseau River Watershed are from the early to mid-1970's and the early to mid-1990's. In addition, a limited amount of more recent data collected between 2002 and 2004 by Fisheries and Oceans Canada (DFO) was also used to provide an overview of the fisheries resources in the watershed. Nonetheless, a comprehensive fish inventory may be necessary to gain an understanding of the current status of the fisheries resources throughout the watershed.

Recreational fishing occurs primarily near the communities of Stuartburn, Dominion City, and Roseau River. Natural Resources Officers indicate the primary catch is walleye, pike, sauger and goldeye, and that angling success is considered "moderate" on the Roseau River.

Fish Species Inhabiting the Roseau River

There are a variety of fish species present in the Roseau River. Gaboury et al. (1995) stated that historically the Roseau River was extensively fished for species such as northern pike, walleye, goldeye, and various types of suckers. An historical narrative on Dominion City for the 19th and 20th centuries supported the historical significance of the Roseau River and noted that it was renowned for its excellent fishing (Waddell, 1970). Waddell (1970) described an ancient stone fish dam located on a shallow rapids site near Senkiw and the Roseau Rapids Indian Reserve No. 2A that was over a thousand years old and had been used by many different tribes, including the Saulteaux up to the 1940's (Gaboury, 1995). Waddell (1970) proclaimed that prior to 1903 and the construction of the St. Andrews Lock and Dam at Lockport which prevented upstream fish migration, this site near Senkiw was the greatest place in Canada to catch lake sturgeon. In fact, First Nations elders maintained that historically lake sturgeon were so plentiful that one could nearly walk across the river on their backs during the June spawning run (Waddell, 1970). In addition, the largest fish ever caught in Manitoba waters was pulled from the Roseau River in 1903; a sturgeon weighing approximately 400 pounds, measuring 15 feet in length, and estimated to be 150 years of age (Waddell, 1970). To commemorate this event, a replica of this massive fish was erected in Dominion City on Waddell Avenue.

The IRREB (1975) and Stepaniuk (1994) noted that fishery inventories conducted in the early 1970's found 21 different species of fish inhabiting the Roseau River. The most common species found during this period included walleye, bullheads, suckers, burbot, freshwater drum, and smaller forage fishes. More recent fishery inventories conducted in the 1990's indicated the presence of 35 species of fish within the Roseau River with species such as rock bass, northern pike, walleye, freshwater drum, channel catfish, and goldeye most commonly caught. Data from the more recent fishery inventories were collected by Manitoba Water Stewardship's Fisheries Branch and are noted on Fisheries Inventory and Habitat Classification System (FIHCS) information sheets, which provide a current overview of biology in the Roseau River mainstem, as well as for Pine and Sprague Creeks based on 1990's data. Since the 1990's, 5 additional species have been recorded and accordingly, the FIHCS biology sheets indicate that 40 species of fish inhabit the Canadian portion of the Roseau River mainstem (see Table 13), 4 species inhabit Sprague Creek (brook trout, fathead minnow, northern pike, and walleye), and 1 species inhabits Pine Creek (brook trout). All 21 species identified in the IRREB (1975) report from the 1970's were also found on the FIHCS biology sheets and are denoted by ***bold italics*** in Table 13.

The inventory data from the FIHCS sheets indicate the presence of 2 fish species which are listed under Canada's *Species at Risk Act (SARA)* – the chestnut lamprey and the silver chub both have a COSEWIC designation of special concern. These species have been collected in Management Area 3, but their abundance has not been determined.

Table 13: Common Names of Fish Species Inhabiting the Roseau River

Species	Presence	Species	Presence
1. Black Bullhead	***Unknown***	21. Mooneye	Unknown
2. Black Crappie	Common	***22. Northern Pike***	***Common***
3. Blacknose Dace	Common	***23. Northern Redbelly Dace***	***Unknown***
4. Blacksided Darter	***Common***	24. Quillback	Unknown
5. Brook Stickleback	***Unknown***	25. Rainbow Trout	Unknown
6. Brown Trout	Unknown	***26. River Darter***	***Unknown***
7. Burbot	***Rare***	***27. River Shiner***	***Abundant***
8. Carp	Common	***28. Rock Bass***	***Abundant***
9. Central Mudminnow	***Common***	29. Sand Shiner	Common
10. Channel Catfish	Common	***30. Sauger***	***Unknown***
11. Chestnut Lamprey	Rare	***31. Shorthead Redhorse***	***Common***
12. Common Shiner	Abundant	32. Silver Chub	Common
13. Creek Chub	***Unknown***	33. Silver Lamprey	Unknown
14. Emerald Shiner	Unknown	34. Spotfin Shiner	Common
15. Fathead Minnow	***Common***	35. Stonecat	Rare
16. Flathead Chub	Unknown	***36. Tadpole Madtom***	***Unknown***
17. Freshwater Drum	***Abundant***	***37. Trout Perch***	***Unknown***
18. Goldeye	Unknown	***38. Walleye***	***Common***
19. Johnny Darter	***Common***	39. White Bass	Unknown
20. Longnose Dace	***Rare***	***40. White Sucker***	***Abundant***

Research by Fisheries and Oceans Canada (DFO) in 2002, 2003, and 2004 made note of 20 different species inhabiting the Roseau River mainstem and tributaries (i.e. Pine and Sprague Creeks, as well as various drains including Main Drain and Vita Drain). These 20 species are noted in Table 14. The majority of species found during this recent sampling (see 13 species denoted by ***bold italics*** in Table 14) were also identified in the 1990's and 1970's inventories referenced previously and another 2 species were identified only in the 1990's inventory (blacknose dace and common shiner). This indicates that some fish populations have been relatively stable over the past 30 years.

In addition, there were some species identified that had not been found previously in the 1990's or 1970's inventories, including the brassy minnow (in Pine and Sprague Creeks), brown bullhead (in Jordan Drain), finescale dace (in Main Drain, Pine and Sprague Creeks), iowa darter (in Pine Creek Diversion), and pearl dace (Pine and Sprague Creeks). According to DFO, the collection of brassy minnows in the upper reaches of the Roseau River Watershed represents the first collection of this species east of the Red River in Manitoba. The research made note that large-bodied fish including walleye and white sucker were present in Pine and Sprague Creeks and large-bodied fish including northern pike, walleye, and white sucker were present in some of the drains in the watershed including the Vita Drain. It is worth noting that many of the species identified by DFO were not only found in the Roseau River mainstem, but also in Pine and Sprague Creeks (e.g. northern redbelly dace, central mudminnow, johnny darter, blackside darter, among others) – this indicates that more species inhabit these tributaries than had been identified in previous inventories.

Note that the federal *Fisheries Act* aims to conserve and protect fish habitat and fisheries resources and as such, any undertakings that occur in or near water may be affected by this legislation.

Table 14: Common Names of Fish Species Inhabiting the Roseau River*

1. Black Bullhead	11. Finescale Dace
2. Blackside Darter	12. Iowa Darter
3. Brassy Minnow	***13. Johnny Darter***
4. Brook Stickleback	***14. Longnose Dace***
5. Brown Bullhead	***15. Northern Pike***
6. Burbot	***16. Northern Redbelly Dace***
7. Central Mudminnow	17. Pearl Dace
8. Common Shiner	***18. Walleye***
9. Creek Chub	19. Western Blacknose Dace
10. Fathead Minnow	***20. White Sucker***

*Includes Roseau River mainstem and tributaries. Data collected from 2002 to 2004.

The RPC Ltd. (1974) report, the IRREB (1975) report, and Stepaniuk (1994) noted that the fishery in the Roseau River is primarily supported by fish stocks that originate in the Red River rather than from fish stocks that originate in the Roseau River. The IRREB (1975) also noted that a limited scale of trout stocking took place in Pine and Sprague Creeks between 1973 and 1975. The FIHCS biology sheets for Pine Creek support the notation of trout stocking and also indicate that walleye were introduced to Sprague Creek as fry in 1997. Overall, based on

findings in the various studies available, in some places the Roseau River appears to provide reasonably adequate habitat for supporting fisheries resources. Gaboury et al. (1995) noted that many pools and rapids exist in the steeper reach of the river downstream from the community of Roseau River and this provides excellent spawning opportunities for species such as walleye, white sucker, and channel catfish. Hayden (1972) indicated that the some of the best fish habitat on the river occurs in the stretch from the Arbakka Dam to the International Border because the water flow here is slower than in any other part of the river.

Potential Limitations to Fisheries Resources

The IRREB (1975), Stepaniuk (1994), and Gaboury et al. (1995), as well as the FIHCS biology sheets, indicated that there are a number of potential limitations to the fisheries resources in the Roseau River Watershed. The construction of the Dominion City Dam in 1957 was a major limitation to the fisheries resources in the watershed until the problem was addressed in 1992. The primary difficulty created by the dam was that it impeded fish migration upstream, especially during the spring spawning period. During normal spring high flow conditions the dam would be overtopped and fish were able to migrate upstream past the dam, but during regular or low flow conditions fish were unable to get past the dam and reach the upstream areas of the Roseau River – thus affecting fish population and angling opportunities in the river system between 1957 and 1992. As noted previously, in September 1992 three riffles were constructed downstream of the dam to raise downstream water levels and allow for fish passage over the dam. This fish ladder project was a solution (an alternative would have been to remove the dam) to the above noted problems and allows for fish passage to the upstream areas of the Roseau River during low spring flows and during summer and fall periods when flows are lower. Stepaniuk (1994) questioned the effectiveness of the pool and riffle system to allow upstream fish migration at this site. The current status and effectiveness of the fish ladder is unknown. Stepaniuk (1994) also made reference to an artificial in-channel weir at a Hutterite Colony upstream of Dominion City that presented a further limitation to fish in the Roseau River.

Further potential limiting factors for the fisheries resources in the Roseau River include erosion, sediment loading, and turbidity. Increased drainage with resultant fluctuating flows and a lack of streambank vegetation in some areas has contributed to increased streambank erosion and increased sediment loads in the river channel which can in turn have a negative effect on fish habitat. "Shorelines absent of vegetation contribute to increased: soil erosion, water temperature, opportunities for introduction of coliforms and macronutrients, turbidity, allocthonous pollutants and increased peak flows" (Stepaniuk, 1994, p.41). Log jams can also be a significant problem in the Roseau River, especially in the lower watershed area around Dominion City. Although Stepaniuk (1994) considers log jams to be a potential limiting factor for fish populations, Manitoba Fisheries Branch does not consider log jams to be a barrier for fish movement. In fact, log jams may provide benefits to fish populations such as cover and increased pool depth.

Man-made channelization of the river in the Gardenton Floodway area has negatively affected fisheries resources by effectively removing fish habitat in this portion of the river. Unlike the original slow-moving, meandering river channel the modified straight, fast-flowing channel is not conducive for fish habitat. In addition, the increased rate of flow that resulted from the channelization of the river also contributes to increased turbidity in the river which has a

negative effect on the fisheries resources downstream (IRREB, 1975). Stepaniuk (1994) found turbidity to be a problem in various stretches of the river and stated that "excessive turbidity negatively interferes with the productive capability of water for fish and various aquatic organisms" (p.41).

During the recent wet period low flows in the Roseau River have not been a major concern, but historically this has been a major issue for the river system as in times of low flow fish migration can be restricted. For instance, when there are low flows in the rapids reach of the river boulders impede the upstream movement of fish (IRREB, 1975). Low levels of dissolved oxygen resulting from a combination of low water levels, extensive ice cover, and decomposition of vegetation have caused fish kills in the Roseau River in the past and were also noted as a limitation (IRREB, 1975). The FIHCS biology sheets for Pine Creek identified population control of beavers and the removal of the majority of beaver dams as necessary issues to help improve fish habitat in this tributary; however, Manitoba Fisheries Branch does not consider beaver dams an impediment to fish populations.

Potential Solutions for the Fisheries Resources

The IRREB (1975) also discussed potential solutions to some of the above noted limitations. Recommended action included the removal of the Dominion City Dam or the construction of a fish ladder. As mentioned previously, a fish ladder was constructed at the dam to eliminate the restrictions posed by the in-channel blockage. Other potential solutions put forth included installing channel complexing structures in the Gardenton Floodway to reduce turbidity downstream in the Roseau River and to decrease the seasonal fluctuations in Roseau River discharge through the use of storage structures and flow regulation. The channel complexing solution was rejected since it would not appreciably increase fish capacity and there were not enough adequate storage sites available to create sufficient flow increases during certain periods.

The FIHCS sheets suggested further development of best management practices to reduce nutrient and sediment loading into the river as a means of protecting water quality and fish habitat (i.e. riparian zone enhancement and protection). Stepaniuk (1994) suggested that "low in-channel weirs may further increase low water depths, improve aquatic habitat and facilitate continued migration of Roseau fish stock" (p.42). Stepaniuk (1994) also put forth that bank armouring (rip-rap) to reduce erosion, installation of channel complexing structures in the Gardenton Floodway and some sections of the lower watershed area, log jam and debris removal, and improved land use practices along the streambanks to help prevent erosion through the maintenance of good vegetative cover would help the fisheries resources. "Diverse fish populations are excellent indicators of watershed stability. Wide shoreline buffer zone vegetation bands reduce water temperature, increase oxygen content, filter sediments which cover spawning habitat and suffocate fish eggs, decrease runoff carrying fertilizers and pesticides, contribute insect populations to water for food, and slow releases of water which contribute to flood peaks and erosion which damage fish habitat limiting potential for sport fish like walleye" (Stepaniuk, 1994, p.32).

Fisheries Resources in the U.S. Portion of the Roseau River Watershed

A fishery inventory conducted for the U.S. portion of the watershed in 2000 produced similar findings to a number of surveys that dated back to 1978 and it appears that fish populations in the U.S. portion of the watershed have been rather stable for the past 25 years (RRWD, 2004). Dominant game fish identified in the Roseau River included walleye, sauger, catfish, and northern pike and common small and forage fish species included blackside darter, central mud minnow, creek chub, and white sucker. In addition, the Minnesota Department of Natural Resources annually stocks brook trout in the headwaters of Hay Creek (RRWD, 2004).

Summary

Studies conducted in the 1970's and 1990's, supplemented by more recent research from 2002 to 2004, have provided an overview of the fisheries resources of the Roseau River Watershed. Various types of species inhabit the river and some species have remained constant over a 30-year period. Overall, certain stretches of the Roseau River provide adequate fish habitat, but there are some potential limitations due to fish migration blockages, erosion, sedimentation, log jams, turbidity, channelization, drainage, and low flows. Solutions such as vegetative buffer strips have been suggested, but "before any reconstructive measures of any magnitude are attempted … more detailed biological monitoring is necessary to provide information towards the relative health of the present Roseau River fish stock" (Stepaniuk, 1994, p.47). It may be beneficial to first gain an understanding regarding fish distribution, relative abundance, and present exploitation (yield and stock response) throughout the watershed (RPC Ltd., 1974).

Given that the Roseau River is an international river it is important to link activities related to the fisheries resources in Canada with those being undertaken in the U.S. Some of the management practices proposed in the U.S. may or may not conform to Canadian regulations and could differ from Canadian goals and objectives for fisheries resources. Additionally, some management practices in Canada may or may not conform to U.S. regulations and could differ from U.S. goals and objectives for fisheries resources. Some level of joint management may be required to sustain and enhance the overall health of the fisheries resources in this international watershed.

References

Note: Martin Erickson of Manitoba Water Stewardship and Neil Mochnacz of Fisheries and Oceans Canada provided information/data on which this section is based.

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4.7.1 – Streams

As noted previously, the Roseau River Watershed encompasses a drainage area of approximately 5,818 square kilometres (2,246 square miles) and has 55.6% of its area in Minnesota and 44.4% in Manitoba. There are four primary headwater tributaries that contribute to the mainstem flow of the Roseau River. The Sprague and Mud Creeks have a drainage area of approximately 484 km^2 (187 sq. mi.) and Pine Creek has a drainage area of roughly 360 km^2 (139 sq. mi.). While the drainage area for both of these tributaries is primarily within Canada, they enter the mainstem of the Roseau River on the U.S. side of the watershed. The South Fork tributary has a drainage area of approximately 686 km^2 (265 sq. mi.) and Hay Creek has a drainage area of roughly 2,282 km^2 (881 sq. mi.). The drainage area for both of these tributaries is entirely within the U.S. and they enter the mainstem of the Roseau River on the U.S. side of the watershed.

It is important to note that during periods of high flood stages there can be flow transfers between the Roseau River Watershed and adjacent watersheds. On the Canadian side, when there are high water levels and "Lake Roseau" has formed, there can be an overflow from the Roseau River Watershed into the Rat River Watershed via the Marsh River. Conversely, when there are high flows on the Rat River, there can be overflow into the Roseau River Watershed through the Caliento Bog. On the U.S. side, excess floodwaters from the Roseau River can flow across the watershed divide into the Two Rivers Watershed system via the Big Swamp.

Pine Creek

Pine Creek originates in the Sandilands Upland area in Canada at an elevation of roughly 46 metres (151 feet) above the surrounding lowlands and flows southwards until it meets the Roseau River just east of Ross, Minnesota (IRREB, 1975). In 1953, the Pine Creek Diversion was constructed to provide water for three impoundment pools in the Roseau River Wildlife Management Area (RRWMA) in Minnesota. Much of the flow from Pine Creek is channeled through this diversion and drains into the pools. Through a series of discreet channels, the water retained by the pools is routed to drain into the Roseau River on the U.S. side of the watershed.

Sprague Creek

Sprague Creek also has its headwaters in the Sandilands Upland area and drains the far northeastern part of the watershed. It flows through the Sprague Creek lowlands until it intersects with Mud Creek immediately south of Sprague. Sprague Creek then flows southwest and drains into the Roseau River just a few miles upstream of the confluence of Pine Creek and the Roseau River on the U.S. side of the watershed.

Roseau River

After all of the tributaries have joined the Roseau River mainstem channel on the U.S. side of the watershed, the river meanders west and northwest from Minnesota crossing into Manitoba at Caribou, Minnesota. The original river channel has been blocked at the Arbakka Dam and the river has been diverted through the Gardenton Floodway. After the Gardenton Floodway reenters the Roseau River channel, the river continues to meander northwest passing through Gardenton and Stuartburn. At the intermunicipal boundary with the RM of Franklin, the river channel begins to turn in a straight westerly direction through the beach ridge area where there is a significant drop in elevation. After passing through the beach ridge area the river channel turns south towards Dominion City in the flat plains area and then north as it approaches its endpoint at the Red River. A unique feature of the river is that after this northern directional change the river once again turns and flows south, joining the Red River at the Roseau River Anishinabe First Nation community opposite of Letellier (in essence flowing parallel to the Red River channel, but in the opposite direction). In the Canadian portion of the Roseau River Watershed, the river follows a path of approximately 83 km (52 mi.) along the river valley and 145 km (90 mi.) along the low flow channel. From its more southerly headwaters to its mouth, the land slopes from 381 m (1,250 ft) in the eastern part of the watershed to 238 m (781 ft) at the Roseau River's confluence with the Red River.

Streamflow and Runoff Data

Hydrometric stations are placed on rivers to gauge and collect data relating to streamflow and water levels. A number of stations have been placed throughout the Roseau River Watershed to monitor water levels and flow. These stations are noted in Table 15, which outlines the activity status and a breakdown of the years in which data from the stations was published. Six stations were chosen from this group to represent the river data for the watershed in this plan. Within this selection, three stations are still actively collecting data and the other three have been deactivated. Three of the stations are located on the Roseau River mainstem: one near Dominion City, one at Gardenton, and one international station near Caribou, Minnesota. The other three stations are on tributaries: one on the Main Drain near Dominion City, one on the Pine Creek Diversion, and a second international station on Sprague Creek near Sprague.

Table 15: Hydrometric Stations in the Roseau River Watershed

Station Number	Station Name	Status	Published Period	Years Not Published
05OD001	Roseau River near Dominion City	Active	1913-2004	1915
05OD002	Roseau River at Dominion City	Discontinued	1912-1912	
05OD003	Roseau River below Railway Bridge, Dominion City	Discontinued	1914-1915	
05OD004	Roseau River at Gardenton	Active	1915-2004	1923-1961 1997-2000
05OD014	Roseau River at Stuartburn	Discontinued	1914-1969	1931-1933 1937-1961
05OD027	Pine Creek Diversion near Piney	Discontinued	1953-1996	1956-1957
05OD028	Main Drain near Dominion City	Active	1960-2004	1997-1999
05OD029	Main Drain near Fredensthal	Discontinued	1960-1982	

05OD030	Roseau River near Caribou	Discontinued	1917-1997	1918-1919
05OD031	Sprague Creek near Sprague	Discontinued	1928-1981	
05OD032	Pine Creek near Pine Creek	Discontinued	1928-1953	
05OD033	Main Drain near Ridgeville	Discontinued	1983-1987	

The Gross Drainage Area (GDA) of these six stations is outlined in Table 16. GDA is the area enclosed by a drainage divide. Figure 12 displays the location of these stations within the Roseau River Watershed. It is also worthy to note that another 17 stations existed in the watershed at various times and collected data primarily in the 1929-1930 period. Data collection at these stations was discontinued and while unconfirmed, it is likely that these were manual gauges that collected water levels around the time the Gardenton Floodway was constructed. The data were never published but exist in the archive holdings of the Water Survey of Canada.

Table 16: Gross Drainage Area for Selected Hydrometric Stations

Station	Hydrometric Station Name	Gross Drainage Area (km^2)
05OD001	Roseau River near Dominion City	5,260
05OD004	Roseau River at Gardenton	4,382
05OD030	Roseau River near Caribou	4,083
05OD027	Pine Creek Diversion near Piney	158
05OD031	Sprague Creek near Sprague	455
05OD028	Main Drain 4A near Dominion City	236

Peak Flows

Values of peak flow based on frequency curve analyses are shown for the three mainstem and three tributary stations of the Roseau River in Table 17. Frequency analyses determine how often a certain peak flow is expected to occur in a 100-year period. For example, in Dominion City (as noted in data table A within Table 17) a peak flow of 205.0 cubic metres per second (m^3/s) (7,240 cubic feet per second (cfs)) is expected to occur 1% of the time, or once every 100 years, while a peak flow of 55.0 m^3/s (1,940 cfs) is expected to occur 50% of the time, or once every two years.

The Roseau River Watershed has experienced a number of major flood events over the years. The conditions producing some of the most recent events along with the estimated frequency of occurrence are described briefly as follows:

Spring 1966 – 6% frequency occurrence at Dominion City. The 1966 spring flood resulted from high autumn soil moisture and a very heavy winter snowcover. A major blizzard in early March greatly increased the snowpack and created a high flood potential. While spring flooding did occur, it could have been much worse but for a very gradual melt and very little spring rain.

Spring 1996 – 4.5% frequency occurrence at Dominion City. In 1995, soil moisture was above average going into the winter and cumulative snowfall was approximately 140 percent above

normal during the winter of 1995/96. A 100 mm rainstorm in the U.S. portion of the watershed in May 1996 was a prime reason for the spring flooding that occurred later that month.

Table 17: Frequency Curve Data Analyses for Stations in the Roseau River Watershed

A. Roseau River near Dominion City 05OD001 (Frequency curve based on 92 years of recorded and estimated data)

Frequency		Peak Flow (m^3/s)	Peak Flow (cfs)
Percent	Years		
1%	100	205.0	7,240
2%	50	176.0	6,220
3%	33	159.0	5,620
5%	20	139.0	4,910
10%	10	113.0	3,990
20%	5	88.0	3,110
30%	3	74.0	2,610
50%	2	55.0	1,940

B. Roseau River at Gardenton 05OD004 (Frequency curve based on 47 years of recorded and estimated data)

Frequency		Peak Flow (m^3/s)	Peak Flow (cfs)
Percent	Years		
1%	100	141.0	4,980
2%	50	126.0	4,450
3%	33	118.0	4,170
5%	20	107.0	3,780
10%	10	91.3	3,220
20%	5	74.6	2,630
30%	3	64.0	2,260
50%	2	49.0	1,730

C. Roseau River near Caribou 05OD030 (Frequency curve based on 79 years of recorded and estimated data)

Frequency		Peak Flow (m^3/s)	Peak Flow (cfs)
Percent	Years		
1%	100	109.0	3,850
2%	50	100.0	3,530
3%	33	94.5	3,340
5%	20	87.3	3,080
10%	10	76.8	2,710
20%	5	65.2	2,300
30%	3	57.6	2,030
50%	2	46.4	1,640

D. Main Drain 4A near Dominion City 05OD028 (Frequency curve based on 42 years of recorded and estimated data)

Frequency		Peak Flow (m^3/s)	Peak Flow (cfs)
Percent	Years		
1%	100	59.5	2,100
2%	50	50.0	1,770
3%	33	44.6	1,580
5%	20	38.1	1,350
10%	10	29.6	1,050
20%	5	21.6	760
30%	3	17.0	600
50%	2	11.2	400

E. Pine Creek Diversion near Piney 05OD027 (Frequency curve based on 42 years of recorded and estimated data)

Frequency		Peak Flow (m^3/s)	Peak Flow (cfs)
Percent	Years		
1%	100	19.7	700
2%	50	17.7	630
3%	33	16.5	580
5%	20	15.0	530
10%	10	12.8	450
20%	5	10.5	370
30%	3	9.0	320
50%	2	6.9	240

F. Sprague Creek near Sprague 05OD031 (Frequency curve based on 59 years of recorded and estimated data)

Frequency		Peak Flow (m^3/s)	Peak Flow (cfs)
Percent	Years		
1%	100	69.5	2,450
2%	50	58.8	2,080
3%	33	52.9	1,870
5%	20	45.8	1,620
10%	10	36.8	1,300
20%	5	28.4	1,000
30%	3	23.5	830
50%	2	17.4	610

Autumn 2000 – Unknown frequency occurrence at Dominion City. Twice the normal October rainfall in the U.S. portion of the Roseau River Watershed was followed by a record 75 mm rainfall over the Manitoba portion of the watershed during the first week of November 2000. Flooding occurred during November due to the resultant record high flows and from backwater flows that were a result of both stationary and frazil ice.

Summer 2002 – 2% frequency occurrence at Dominion City. A record rainstorm of 200-300 mm on June 8-9, 2002 produced the highest flows on record at the U. S. boundary near Caribou, MN. The Gardenton Floodway sustained a record high flow and needed to be reinforced by emergency diking to prevent serious outbreaks and flooding. Serious flooding did occur in areas downstream of Gardenton, much of it on tributaries and in the form of overland flow. Record flooding also occurred in the Manitoba headwater area, on Sprague Creek and Pine Creek. The peak flow on Sprague Creek was 4 times as great as the previously highest flood since 1929. The village of Sprague was seriously flooded June 10-11, 2002.

Summer 2005 – The spring runoff was somewhat above average but did not produce flooding. A series of rainstorms during late June and early July raised the Roseau River at Dominion City to the second highest summer flow on record, second only to that of 2002. The summer peak at Gardenton was the 5th highest on record. Minor flooding occurred along the Roseau River from Gardenton to the Red River. High Red River levels created record high summer levels in the portion downstream of Dominion City in early July (i.e. Lake Roseau). A 100-125 mm downpour near the U.S. boundary south of Dominion City on July 2 caused extensive flash flooding in the R.M. of Franklin. (A. Warkentin, personal communication, November 1, 2005).

Mean Monthly Discharge

Data collected from the hydrometric stations is presented in the form of 'Mean Monthly Discharge' and can be noted in *Tables A4 through A9 in the Appendix*. Note the highlighted data in *Table A4 (Mean Monthly Discharge at Roseau River near Dominion City):* since this station has not collected raw data during the winter months in recent years, average monthly discharge values were entered in these highlighted sections. Since river flow is generally very low in the winter months and doesn't change a great deal from year to year, it was assumed that using the calculated mean monthly value (found in the second-to-last row of the table) would still provide sufficiently accurate results when calculating annual discharge volume.

A difference that should be emphasized in the data of the Roseau River tributaries is that the Main Drain discharge data, noted in *Table A7 in the Appendix*, indicates "zero flow" during many months, while the Pine Creek Diversion and Sprague Creek data, noted in *Tables A8 and A9 in the Appendix*, does not indicate any "zero flow" months. This distinction is a result of the organic wetlands in the eastern portion of the watershed around the Pine Creek Diversion and Sprague Creek, which store water throughout the year and provide groundwater recharge and stream base flow even during dry seasons. The clay soils around the Main Drain do not store moisture, but rather facilitate immediate runoff of precipitation, and thus there are months when discharge drops to zero in the Main Drain. Tables 18 and 19 provide a summary of the mean monthly discharge and average annual mean monthly discharge values calculated for the three mainstem and three tributary stations of the Roseau River.

Table 18: Mean Monthly Discharge at Roseau River Mainstem Stations

	Roseau River near Dominion City 05OD001 Mean Monthly Discharge (m^3/s)*	Roseau River at Gardenton 05OD004 Mean Monthly Discharge (m^3/s)*	Roseau River near Caribou 05OD030 Mean Monthly Discharge (m^3/s)*
January	0.70	Insufficient Data	0.56
February	0.48	Insufficient Data	0.43
March	4.60	4.19	3.33
April	28.95	24.62	22.42
May	31.06	27.99	26.40
June	17.73	16.24	15.35
July	12.11	11.41	10.71
August	5.75	5.51	5.36
September	6.84	6.41	6.37
October	5.69	5.31	5.05
November	5.05	Insufficient Data	4.36
December	1.95	Insufficient Data	1.61
Average Annual Mean Monthly Discharge (m^3/s)	10.08	Insufficient Data	8.50
Average Annual Discharge Volume (dam^3)	319,000	Insufficient Data	269,000

* Values calculated from the period 1973 to 1996.

Table 19: Mean Monthly Discharge for Roseau River Tributaries

	Main Drain 4A near Dominion City 05OD028 Mean Monthly Discharge (m^3/s)*	Pine Creek Diversion near Piney 05OD027 Mean Monthly Discharge (m^3/s)*	Sprague Creek near Sprague 05OD031 Mean Monthly Discharge (m^3/s)*
January	-	0.16	0.05
February	-	0.15	0.04
March	0.27	0.38	0.26
April	2.93	2.28	6.23
May	0.58	1.61	4.97
June	0.42	1.12	2.99
July	0.16	0.49	1.09
August	0.06	0.32	0.75
September	0.23	0.47	0.74
October	0.07	0.52	1.03
November	-	0.39	0.56
December	-	0.22	0.15
Average Annual Mean Monthly Discharge (m^3/s)	0.39**	0.68	1.57
Average Annual Discharge Volume (dam^3)	12,321**	21,300	49,598

*Values calculated from the period 1960 to 1981. **Note: Average Annual Discharge Volume and Average Annual Mean Monthly Discharge have been calculated assuming winter flow from November to February in the Main Drain is zero.

Annual Discharge Volume

The Annual Discharge Volume data for four of the stations is presented in Figures 13 through 16. The average annual discharge volumes (in cubic decametres or dam^3) calculated for the three mainstem and three tributary stations of the Roseau River are summarized and denoted in Tables 18 and 19. These figures reveal the great variability of streamflow in the Roseau River, Main Drain, Sprague Creek, and Pine Creek Diversion from year to year. On the Roseau River near Dominion City, there was a minimum discharge of 40,000 dam^3 (*note: 1 cubic dam = 1,000 cubic metres*) in 1988 and a maximum discharge of 952,000 dam^3 in 2004. Note that in years where data were not collected or estimated for all twelve months, an annual volume value could not be calculated and is not portrayed on the graphs (noted as insufficient data). As mentioned previously, the Main Drain is an exception, where the annual discharge volume was calculated using only March to October data and winter flow was assumed to be zero.

At the Roseau River near Dominion City, the annual discharge volume is only a small percentage of the total precipitation received in the watershed every year. The average runoff coefficient for the basin is 0.104 (or 10.4% runoff). This is the average annual percentage of precipitation that becomes streamflow in the Roseau River Watershed. Runoff coefficients have great variability, and range from a maximum of 0.231 to a minimum of 0.015.

Comparison of Average Monthly Flows

In Figure 17, the average flows for the three gauging stations on the Roseau River are compared. From this graph, it can be observed that the Roseau River picks up flow as it travels towards the Red River. At Gardenton, downstream of Caribou, the Roseau River has a greater flow than it does at Caribou, MN and an even higher flow is measured at Dominion City, which is downstream of both of these stations. Data used for this comparison were taken from the years 1973 to 1996; during this period fairly consistent records of flow were kept for all three stations. Since Gardenton had very little raw data for the winter months during this time period, the graph only presents data from Caribou and Dominion City for November through February.

In Figure 18, the average monthly flows for the Pine Creek Diversion and Sprague Creek are compared. There is a large difference between the drainage area of the two tributaries and thus, there is a corresponding large difference between their flow values as well; but, it is interesting to note the flow pattern that both waterways exhibit. For both tributaries the maximum flow occurs in April, with gradually decreasing flow each month until August. After August a slight increase in flow is seen monthly until October, and then flow decreases again during the winter. Figure 19, a graph of average flows in the Main Drain, also shows this same general pattern for the period between 1960 and 1981, having a peak in April and another slight peak in September.

Since this streamflow pattern has been exhibited in other streams, it has been surmised that the pattern may be attributable to greater evapo-transpiration and evaporation in the summer than later on in the fall. During the summer months, the great amount of green foliage and the warm temperatures facilitate the process of evapo-transpiration, in particular from areas directly adjacent to water bodies. Much of the water that would otherwise add to the river flow is taken up by root systems of living plants and evapo-transpired from the leaves. Thus, over the summer

there is a pattern of decreased river flow. In September, as trees and plants start to lose their leaves and other vegetation dies, the process of evapo-transpiration is significantly reduced (in comparison to rates that occurred during the summer). At this time of year, precipitation water, which would normally evapo-transpire in the summer, is allowed to contribute to the base flow of the river and an increase in flow is seen. Not until after October, when precipitation falls as snow and runoff decreases for the winter, does the flow pattern show another decrease.

Percentage of Annual Flow Discharged per Month

One main difference to note between the Pine Creek Diversion, found on the eastern side of the watershed, and the Main Drain, found on the western side of the watershed, is the percentage of annual flow discharged each month. These percentages are compared in Figure 20. The Pine Creek Diversion, rather than Sprague Creek, was chosen to represent the eastern portion of the watershed because while both tributaries exhibit similar percentage flows, the Pine Creek Diversion has a more comparable drainage area to the Main Drain. Referring once again to Figure 20, although both water courses discharge the greatest percentage of flow during April, the Main Drain discharges over 60% of its annual flow in that single month, while Pine Creek Diversion discharges the same 60% of its annual flow over three months – April, May, and June. During the spring freshet, from March to May, the Main Drain discharges 80% of its annual flow and Pine Creek Diversion discharges only 53% of its annual flow.

The difference between the percentage flows of the Main Drain and the Pine Creek Diversion can be explained by examining the soils and land use of both regions (see Figures 11 and 7). There is a great deal of organic soil, mainly peat and sand, in the eastern portion of the watershed surrounding the Pine Creek Diversion. These soils store a significant amount of water and cause gradual runoff because of their moderate permeability; thus explaining the gradual three-month flow pattern observed in the graph (Figure 20). In the western portion of the watershed, there is a great deal of clay soil that is typical of the Red River Valley. Since clay significantly inhibits water infiltration, unlike the peat and sand in the eastern area, immediate runoff is seen in the drainage area surrounding the Main Drain. Looking at land use patterns (Figure 7), there are many grassland, woodland, and marshland areas around the Pine Creek Diversion – all of which have good water retention characteristics, causing more gradual runoff. The land around the Main Drain is used almost solely as cropland. After bare fields have become initially saturated, they have very little water-retention ability; thus, spring runoff is very quick and concentrated, resulting in the 60% of annual flow discharge in the month of April.

Note: Duane Kelln, Janna Hamilton and Scott Herbert of Manitoba Water Stewardship provided information/data and wrote a large portion of this section.

Figure 13: Annual Discharge Volume of Roseau River near Dominion City

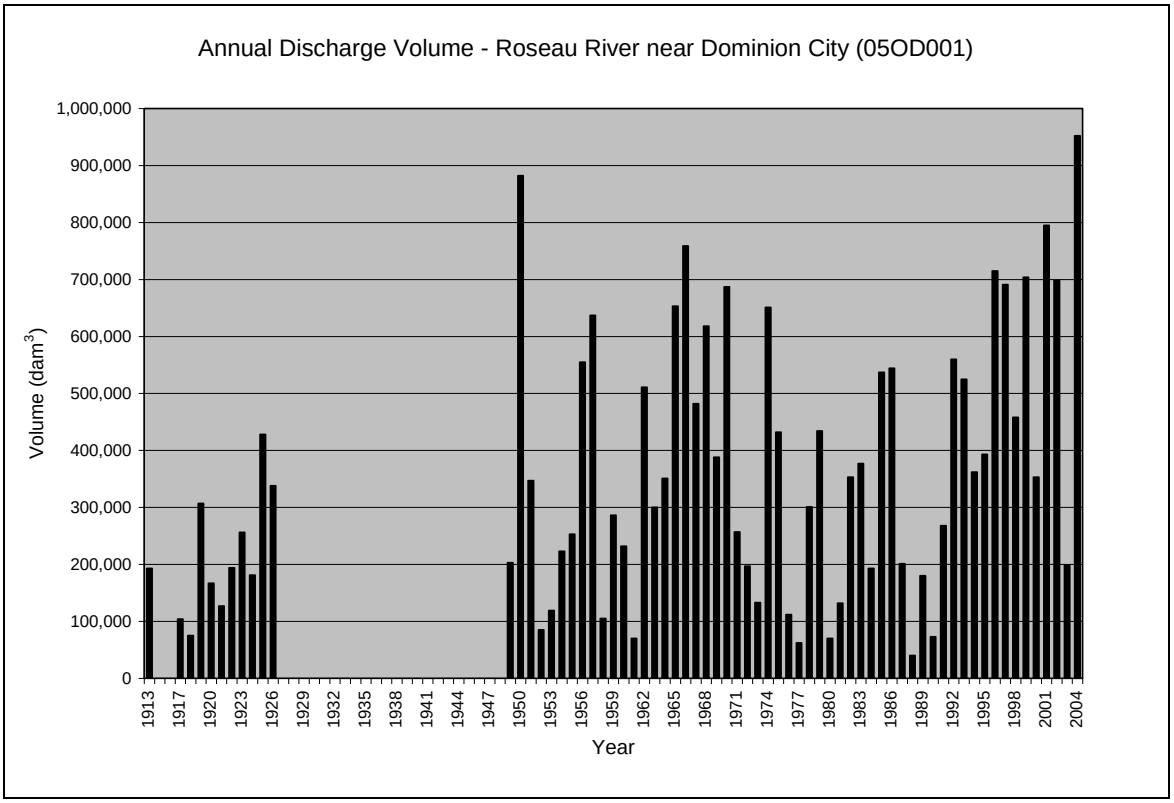


Figure 14: Annual Discharge Volume of Main Drain 4A near Dominion City

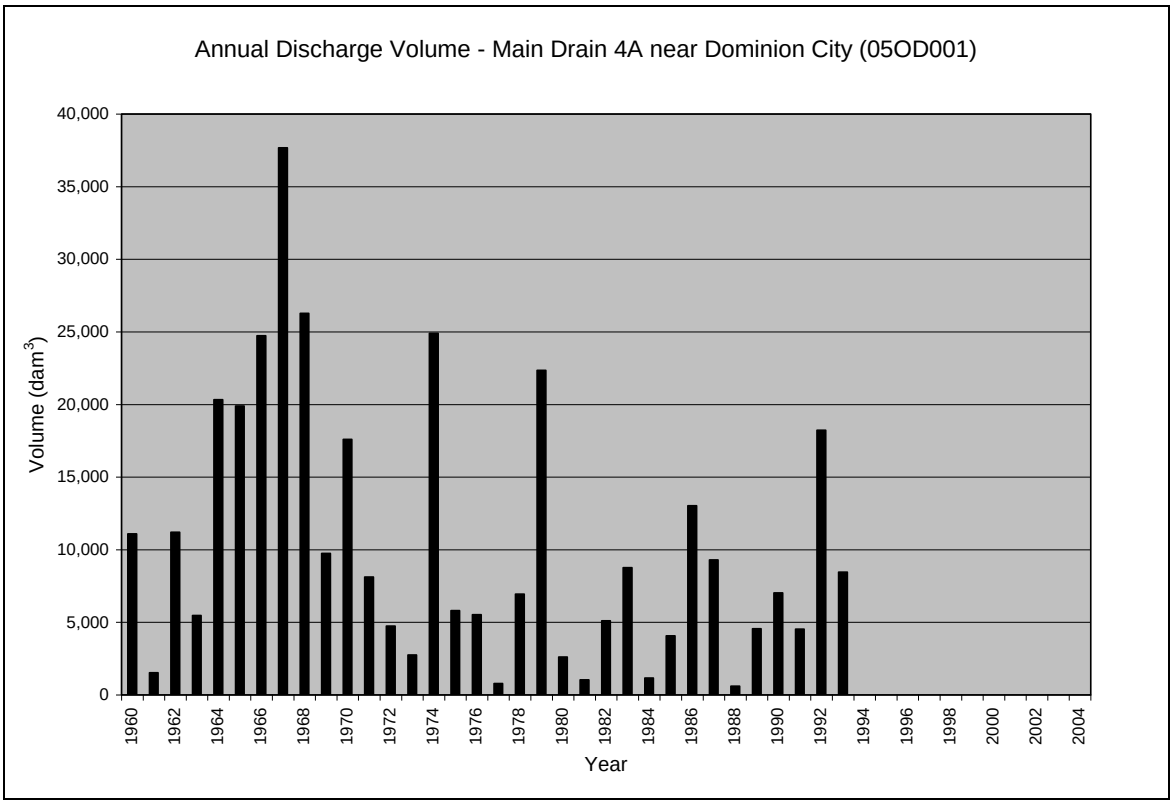


Figure 15: Annual Discharge Volume of Pine Creek Diversion near Piney

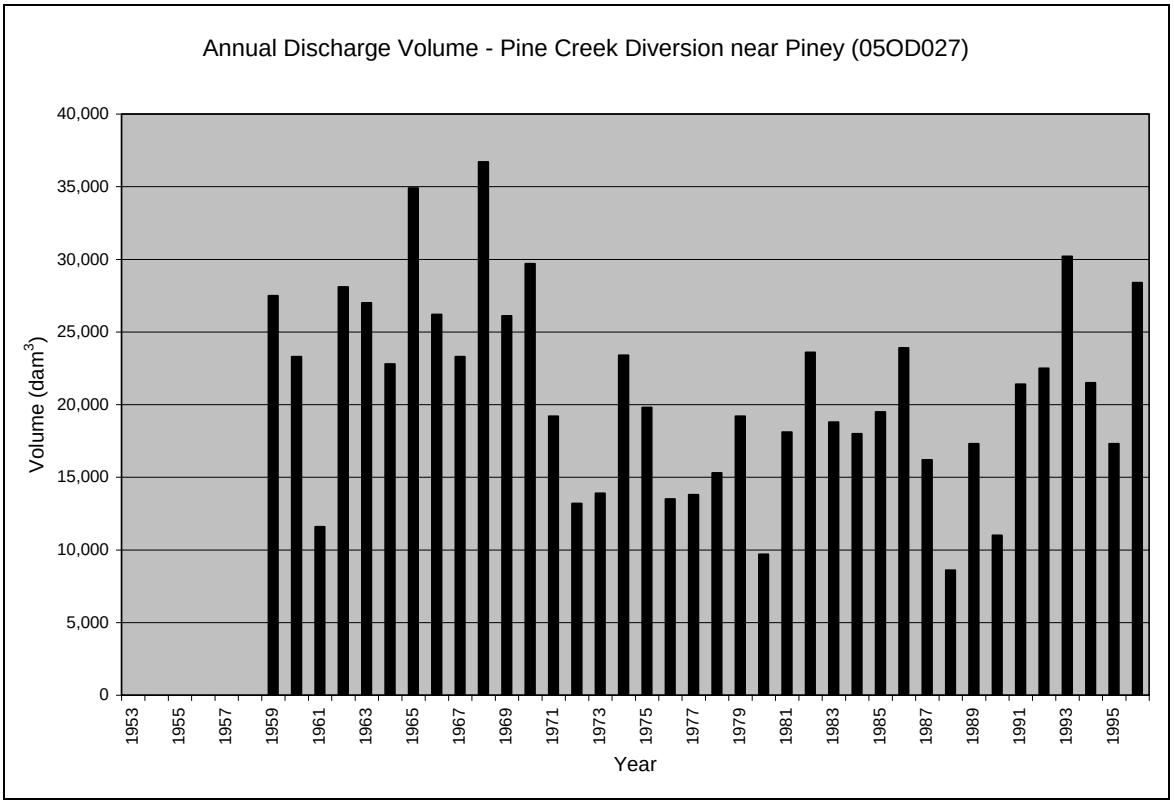


Figure 16: Annual Discharge Volume of Sprague Creek near Sprague

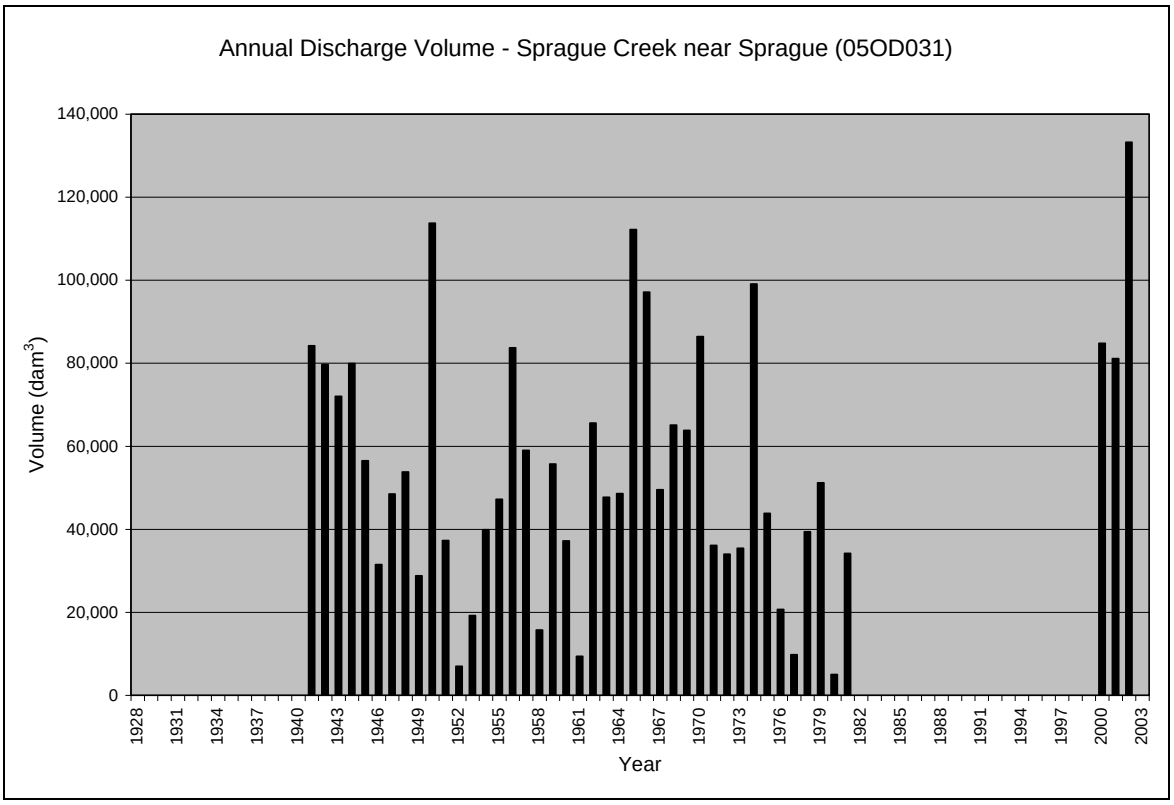


Figure 17: Average Monthly Flows at Roseau River Mainstem Gauging Stations

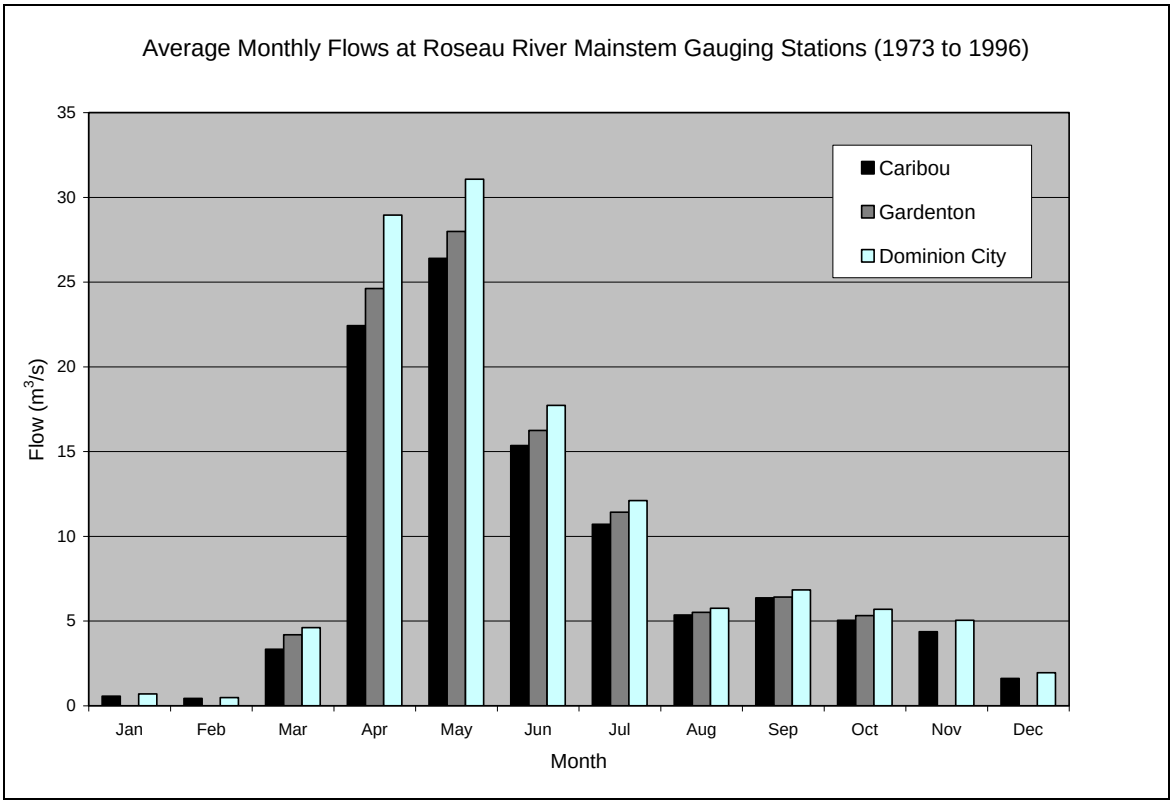


Figure 18: Average Monthly Flows at Roseau River Eastern Tributary Gauging Stations

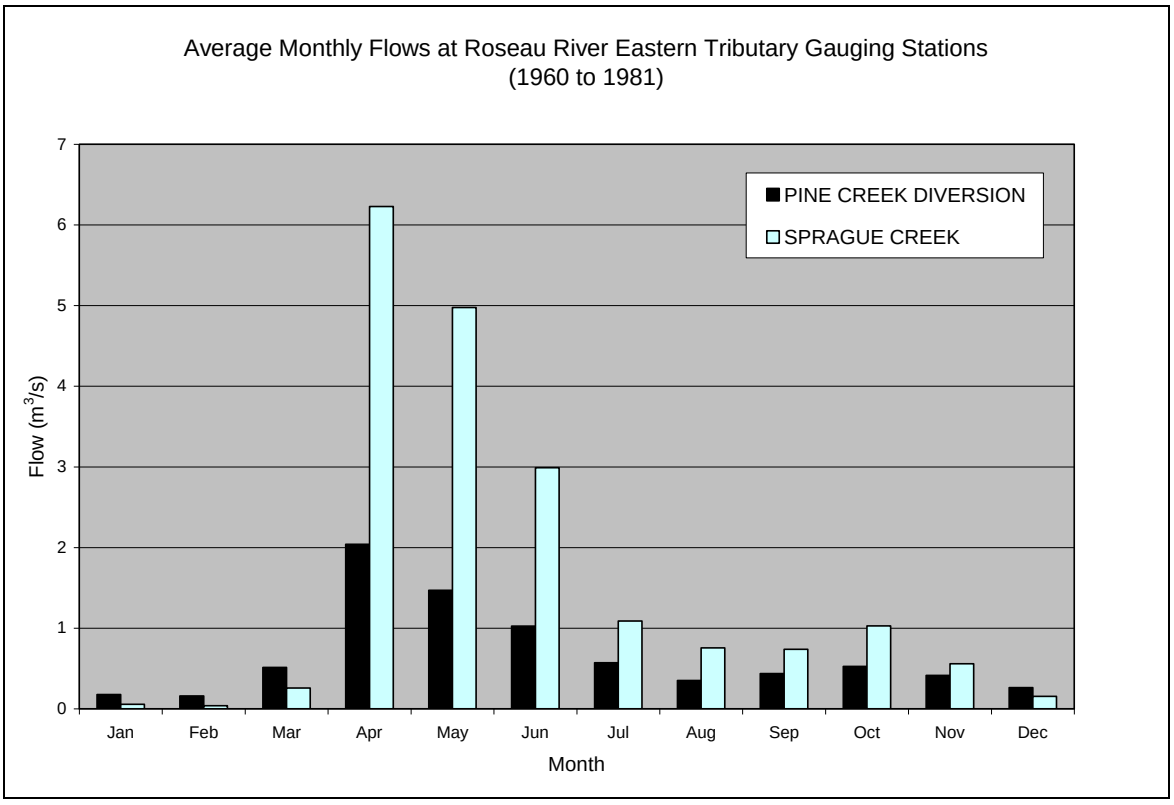


Figure 19: Average Monthly Flows at Main Drain 4A near Dominion City

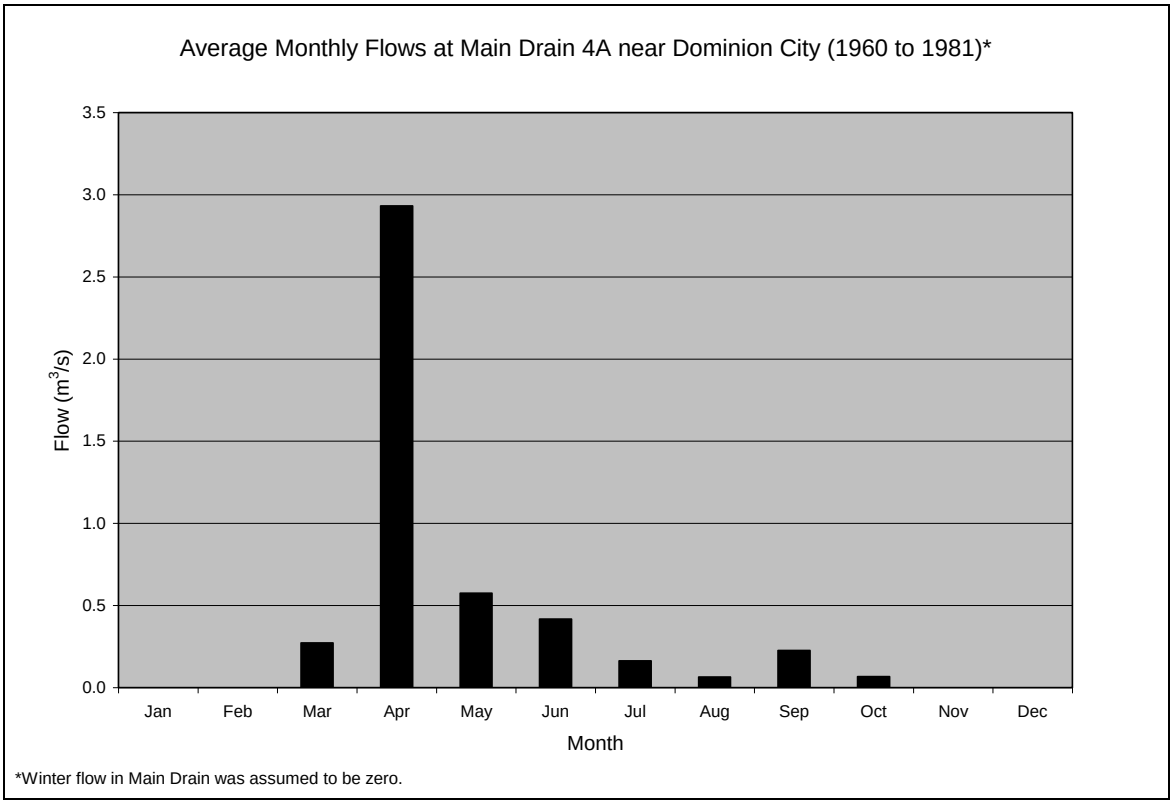
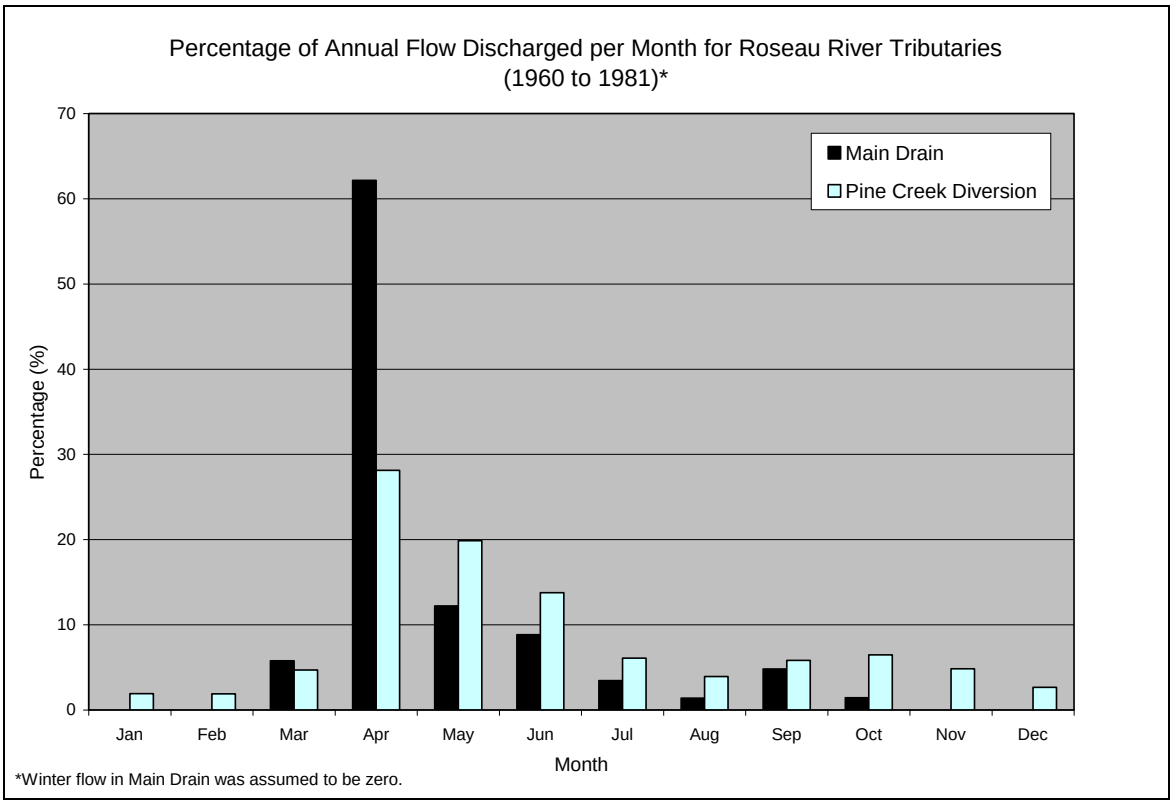


Figure 20: Percentage of Annual Flow Discharged per Month for Roseau River Tributaries



4.7.2 – Lakes

There are no lakes of significant size within the Roseau River Watershed. Whitemouth Lake exists to the immediate north of the eastern portion of the watershed and the Lake of the Woods system is situated to the east. Note that while Horseshoe Lake is discussed under this section as a "lake" due to the prevalence of open water, the IRREB (1975) classified Horseshoe Lake as a wetland and as such, it could be included under that section of the plan as well.

Lake Roseau

"Lake Roseau" is a very flat area west of Dominion City and adjacent to the Red River that retains floodwater in years when the Red River has high flood stages (Management Area 3). It has been termed "Lake Roseau" but the lake does not actually exist under normal weather conditions. This unique situation arises "as a result of water from the Red River backing up the Roseau River from the confluence of the Roseau River with the Red River near Letellier" (Bodnaruk, 2002, p.7). These precipitating conditions also result in an alteration in the flow of the Roseau River; rather than draining to the Red River via its natural channel, the Red River blockage causes Roseau River flow to be diverted into the Lake Roseau area. In flood years, after the floodwaters of the Red and Roseau Rivers have receded, Lake Roseau drains north over the watershed divide, by way of the Marsh River, to the Rat River (IRREB, 1975). In addition, as floodwaters recede they can also partly drain south to the main channel of the Roseau River via the Marsh River and east through St. Mary's Road to the Red River.

Horseshoe Lake

Horseshoe Lake is located on Sections 16 and 21, Township 2, Range 10E, in the RM of Piney (Management Area 2). The lake is approximately 6.5 kilometres (4 miles) east of Sundown, just across the Stuartburn-Piney municipal boundary, and can be accessed via a trail that runs approximately 3.2 km (2 mi.) north off Provincial Road #201. Ducks Unlimited Canada (DUC) originally developed Horseshoe Lake as an impoundment project and is currently responsible for maintaining and operating the lake.

According to a project sheet drafted by DUC, construction of the lake was completed in 1956 and it was originally known as the 'Sundown Duck Factory.' Several hundred years ago a natural lake existed at the site of the current man-made lake until a washout occurred through the ridge that caused the natural lake to drain. After the washout event, the temporary water bodies that remained were too small in size to have any value to waterfowl. As such, the original intent for the Sundown project was to construct a dam at the location where the washout had occurred several hundred years earlier and to restore the lake to its historical level for use by waterfowl.

The DUC project sheet noted that vegetation in the flooded area included bulrushes, carex, phragmites, willows, and alder. The IRREB (1975) described the impoundment as "a flooded fen developed upon deep peat" and noted that "[d]ue to the inundation of the deep peats, the shorelines have broken up, forming floating islands of peat" (p.8). A fen can be defined as "a marshy, low-lying wetland covered by shallow, usually stagnant, and often alkaline water that

originates from groundwater sources" (USGS, n.d.). The DUC project sheet also noted that conditions for waterfowl production would be suitable along parts of the southeastern side of the lake and along the western shoreline, but since most of the eastern shoreline was heavily forested it would have little value for waterfowl production. The Sundown project was expected to have heavy use during migration periods and since it was isolated, the project incurred no agricultural losses. The IRREB (1975) later affirmed the lake as a staging area for migratory waterfowl.

As described in the DUC project sheet, Horseshoe Lake was created via the construction of an earth fill dam across the outlet where the washout had occurred several hundred years prior. The earth fill dam was constructed to 240 metres (800 feet) in length with a maximum fill of 4 m (13 ft) and was originally constructed with a 3 m (10 ft) top, 3:1 rip-rapped front slope, and 2:1 back slopes. In the middle of the dam, a 3.5 m (12 ft) high reinforced concrete structure was built with an overflow width of 6 m (20 ft) to pass surplus waters and to control the water level on the lake. The last 0.3 m (1 ft) of the structure is controlled by a stop-log system. By the time construction of the dam was completed in 1956, the reservoir had filled to the level where it was overflowing through the structure. The approximate flooded area at a full supply level of 30 m (100 ft) covers 350 hectares (860 acres) and has a total shoreline length of 17 km (10.5 mi.).

4.7.3 – Wetlands

As noted by the IRREB (1975), there are extensive wetland areas throughout the Roseau River Watershed, particularly in the central and eastern areas (Management Area 1 and 2). A wetland can be defined as a low area regularly saturated by water from surface or groundwater sources (EPA, 1994) and often covered by a shallow layer of water. Wetlands are recognized as valuable natural resources because of their ability to help filter and purify water, prevent erosion, and absorb floodwaters (Ecohealth, n.d.). Common examples of wetlands include bogs, marshes, and swamps. Peatlands are defined as "lands where plants decompose only partially and accumulate to form brown to black organic material called peat" (Pukite, 1998). Two main types of peatland include bogs and fens.

Organics and peats make up the majority of soil composition in the wetlands of the Roseau River Watershed and vary in their depth and texture. Peatlands in the western part of the watershed tend to be shallow and open or shrub-covered, whereas in the east forested peatlands and bogs are more common (IRREB, 1975). Physiographically important peatlands in the watershed, as identified by the IRREB (1975), include the Vita, Caliento, Sundown, Pine Creek, South Junction, Sprague, Sprague South, and Moodie Peatlands.

The numerous wetlands and peatlands of the Roseau River Watershed are very important resources as they provide habitat for wildlife, assistance with the retention of flood-waters, and groundwater recharge during certain periods (IRREB, 1975). The most noteworthy wetlands of the watershed, as identified and described by the IRREB (1975), include:

A. **Caliento Bog** – located between Caliento and Sundown, this sedge dominated bog covers 246 square kilometres (95 square miles) and extends into the Rat River Watershed to the immediate north of the Roseau River Watershed. The IRREB (1975) concluded that the

hydrology of this bog is extremely complex and there are likely natural flood retention benefits in both the Roseau and Rat River watersheds from this bog. A more recent study conducted by the KGS Group (2001) reiterated the complexity of this wetland area and noted that it is a source of runoff for both the Roseau River and Rat River watersheds. The study further noted that there is uncertainty surrounding the direction of water seepage and overland flow in the bog, uncertainty about the exact location of the dividing line between the two watersheds, and during intense rainfall in the south portion of the bog there is likely flow transfer from the Roseau River Watershed into the Rat River Watershed (KGS Group, 2001).

B. **Sundown Bog** – located south of the villages of Sundown and Menisino, this bog is sedge dominated but has areas where trees dominate. According to the IRREB (1975), the bog has a drainage area of 220 km^2 (85 sq. mi.) within Canada that drains south into the Roseau River Wildlife Management Area in Minnesota.

C. **Vita Marsh** – located south of the community of Vita and adjacent to the Roseau River, this marsh is dominated by sedge on top of peat deposits, but also has mineral soils that support woody vegetation. The IRREB (1975) described the marsh as saucer-shaped, with the maximum depth and wetness in the central area and no defined drainage outlet for runoff.

It is worth noting that similar to the flow transfer through the Caliento Bog, the Big Swamp at the southern extent of the Roseau River Watershed in Minnesota is another wetland area where there is flow transfer into another watershed. According to the U.S. Roseau River watershed plan (RRWD, 2004), despite modifications by ditching and blocks in ditches, during high flow periods part the flow from the Roseau River Watershed crosses overland and makes its way into the Two Rivers Watershed system to the south.

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4.8 – Drainage System

There is an extensive network of drainage systems in the Roseau River Watershed that were developed for water management purposes related to settlement and agriculture. According to the Province of Manitoba, a drain can be defined as "a natural water course or channel constructed for the purpose of conveying water" (MNRE, 1983). The two primary areas where drainage works have been constructed are in the western portion of the watershed (Management Area 3), particularly within the RM of Franklin in the Red River Valley, and in the central portion of the watershed within the RM of Stuartburn in the Vita, Gardenton, and Stuartburn areas (Management Area 2). Drainage works also exist in the eastern portion of the watershed within the RM of Piney (Management Area 1), but these works are less extensive in comparison to the rest of the drainage infrastructure in the watershed.

In his historical account of the RM of Franklin, Waddell (1970) noted that the major long-term problem facing the Red River Valley portion of the municipality had been and always would be drainage. Waddell (1970) stated that when the area was originally surveyed, the surveyor had in fact suggested that the sections and road allowances be laid out in a northwest-southeast direction to accommodate the natural flow of water and to help ease local drainage problems. While this recommendation was not heeded, Waddell (1970) did make reference to "drainage of the flats east of Dominion City" and a "big ditch excavated in 1926 [that] was a god send to the farmers living between Ridgeville and Dominion City" (p.54).

Based on accounts such Waddell's, it is likely that construction of drainage infrastructure in the region likely began in the first half of the 20th Century and advanced notably as farming practices became more mechanized in the 1940's. Significant drainage improvements were initiated in the 1960's and 1970's through provincial funding mechanisms as the Provincial Waterways System was developed. From the 1980's onward very little additional provincial level drainage was established, but there was likely an increase in municipal level drainage (H. Buhler, personal communication, January 30, 2006). Drains are classified on a scale between First Order and Seventh Order, with the majority of drains in the Roseau River Watershed being classified as: First Order (i.e. a drain having a tributary drainage area of one square mile or less), Second Order (i.e. a drain having a tributary drainage area of more than one square mile), or Third Order (i.e. a drain below the confluence of two second order drains) (MNRE, 1983). Responsibility for drain maintenance varies, with drains designated as Provincial Waterways falling under Provincial jurisdiction and municipal level drains falling under municipal jurisdiction. Infrastructure related to drainage in the region includes various crossings and culverts.

The total length of drainage works in the watershed can be interpreted from the Province's 'Designations of Drains' map series. In this series the Roseau River Watershed is divided into upper (Watershed 87) and lower (Watershed 2) areas – the upper area includes the drainage area for Pine Creek and Sprague Creek (Management Area 1) and the lower area includes the drainage area for the Roseau River after it enters Canada at Caribou, MN (Management Areas 2 and 3). According to the 'Plan of Upper Roseau River Area showing Designations of Drains' there are 37 kilometres (23 miles) of Provincial Waterways and approximately 185 km (115 mi.) of municipal drains (last updated in 1982) (H. Buhler, personal communication, January 30,

2006). According to the 'Plan of Lower Roseau River Area showing Designations of Drains' there are 145 km (90 mi.) of Provincial Waterways and approximately 595 km (370 mi.) of municipal drains (last updated in 1986) (H. Buhler, personal communication, January 30, 2006). *Note: all length figures for municipal drains are rough estimates subjectively interpreted from the 'Designations of Drains' maps and do not include drainage works constructed after the dates indicated (i.e. since the early to mid 1980's) and have not been scientifically ground-truthed.*

Major drains in the western part of the watershed (Management Area 3) include the Main Drain, Harlow Drain, Stewart Drain, Casson Drain, Jordan River, and the recently constructed Inter-municipal Drain. Major drains in the central part of the watershed (Management Area 2) include the Vita Drain and Arbakka Drain. Major drains in the eastern part of the watershed (Management Area 1) include the Pine Creek Diversion and Sprague Drain.

In a 2001 report on the Rat River Drainage Basin, the KGS Group noted that one of the features of the Vita Drain is that it blocks overflow from the Roseau River Watershed into the Rat River Watershed during times of severe floods. According to the KGS Group (2001), an essential part of the drain was the construction of a dike along the north bank to restrict severe flood overflows and retain them within the Roseau River Watershed. "Under natural conditions prior to the construction of the Vita Drain, some of the runoff that now collects in the Vita Drain would have flowed [north] into the Rat River" (KGS Group, 2001, p.3).

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4.9 – Diversions and Water Management Structures

There are three noteworthy man-made blockages or diversions in the Canadian portion of the Roseau River and its tributaries that have altered or impeded the natural flow. Modifications include: the Pine Creek Diversion in the eastern part of the watershed within the RM of Piney (Management Area 1); the Gardenton Floodway in the central part of the watershed within the RM of Stuartburn (Management Area 2); and the Dominion City Dam in the western part of the watershed within the RM of Franklin (Management Area 3).

Pine Creek Diversion

The Pine Creek Diversion was constructed in 1952 and put into operation in 1953 to provide a constant water supply to the wildlife impoundments that were constructed for the Roseau River Wildlife Management Area (RRWMA) in Minnesota along the Canada-U.S. border. The Master Plan for the RRWMA states that while the diversion project was requested and financed by the State of Minnesota, the actual construction work carried out in Canada was completed by the Province of Manitoba (MNDNR, 1980). The overall plan for the Roseau River Watershed District notes that the diversion was constructed in accordance with a written agreement between the Province of Manitoba and the State of Minnesota dated February 18, 1952 (RRWD, 2004).

The Pine Creek Diversion starts roughly 4.0 kilometres (2.5 miles) northeast of Piney Customs and runs for approximately 11 km (7 mi.) in Canada and the U.S. The diversion follows a southwesterly path in Canada for approximately 7 km (4.5 mi.) before turning south at the Canada-U.S. border and dispersing into Pool #1 of the RRWMA. The diversion is a passive system in which there is no dam structure at the inlet and no structure or definitive endpoint at its terminus in the RRWMA. The portion of the Pine Creek Diversion within Canada is classified as a Provincial Waterway and responsibility for its maintenance lies with the Province of Manitoba (Water Stewardship). Flow diverted through the Pine Creek Diversion eventually makes its way into the Roseau River channel in Minnesota after passing through the RRWMA pools and associated ditch systems. While flow from the original Pine Creek channel was significantly diverted, provisions were made to allow for a limited flow to continue moving south into the U.S. where the original Pine Creek channel meets the Roseau River channel.

Gardenton Floodway

The Gardenton Floodway was constructed in the late 1920's due to inadequate capacity in a stretch of the Roseau River channel just south of Vita for conveying high spring flows. The floodway was designed to contain increased flood flows in Canada that were caused by the construction of channel improvement works and drainage networks along the Roseau River in Minnesota between 1904 and 1918 (IRREB, 1975). At the time, agricultural land and a number of homesteads in the low lying area adjacent to the Roseau River channel, as well as the nearby community of Vita, were put at risk during the spring runoff period. By diverting the high spring flows through the floodway, area homes and the community of Vita were protected from floodwaters that would have naturally inundated the area.

The entrance to the Gardenton Floodway is located roughly 3.2 km (2 mi.) northwest of where the Roseau River crosses the International Border and follows a northwesterly direction for approximately 9.7 km (6 mi.) until it empties back into the Roseau River channel just upstream from the community of Gardenton. The floodway consists of an east and west dike constructed with local materials to contain flows. The Roseau River follows a defined channel through the floodway along the inside edge of the east dike. In order to divert the flow from the Roseau River a wooden control dam was constructed in the natural river channel in 1930. The original dam burned down and a new concrete structure – referred to as the Arbakka Dam – with a stop-log system was built in 1965 just to the east of the original dam location. The Gardenton Floodway is considered a Provincial Waterway and as such, responsibility for its maintenance lies with the Province of Manitoba (Water Stewardship).

The IRREB (1975) noted that original conveyance capacity of the floodway in 1930 was 150 cubic metres per second (5,300 cubic feet per second), but due to the deterioration of the dikes by 1975 the capacity had been reduced to 113 m^3/s (4,000 cfs). Given that another 30 years has passed with further deterioration and settlement of the dikes as well as vegetation growth within the floodway channel, the current channel conveyance is unknown but likely less than the 113 m^3/s (4,000 cfs) noted in 1975 (UMA, 2002). Due to the absence of a regular flow in the original Roseau River channel from the Arbakka Dam to just before Gardenton, the channel has become overgrown with vegetation. The IRREB (1975) noted that the original, albeit limited, flow of this stretch of the Roseau River prior to 1930 was 19.8 m^3/s (700 cfs) and UMA (2002) estimated that with the vegetative overgrowth the channel capacity in this stretch is now likely somewhere on the order of 3-6 m^3/s (100-200 cfs).

Dominion City Dam

The Dominion City Dam was constructed in 1957 by the Prairie Farm Rehabilitation Administration immediately downstream of Dominion City to establish a water supply reservoir for the community. The dam had been requested by the RM of Franklin council in a resolution dated July 14, 1953. After the community was connected to a water supply pipeline from Letellier in 1988, the dam was retained for irrigation, stock-watering, and recreation purposes (Gaboury et al., 1995). Dam construction involved a concrete slab and buttress-type weir directly in the natural river channel with a stop log system in place to allow for manipulation of the upstream reservoir levels. The dam is 1.2 metres (3.9 feet) high and has a storage volume of 148 dam^3 (120 acre-feet) at a summer target level of 213.9 m (761 feet) (Gaboury et al., 1995). The original storage capacity at full supply level was 419 dam^3 (340 acre-feet). The IRREB (1975) noted that during spring flood periods the dam becomes submerged, but has minimal backwater effect and little effect on the flow regime of the Roseau River.

As noted previously, due to the negative effect of the dam on fisheries resources in the Roseau River in 1992 the Province of Manitoba, with the support of the South East Border Wildlife Association, carried out the *Roseau River Fisheries Enhancement Project.* This project involved the addition of riprap on the downstream side of the dam to create a series of rapids (pool and riffle system) that allow for fish passage up and over the dam. Prior to the construction of this pool and riffle based system, fish passage to the Roseau River upstream of the Dominion City Dam was limited to times when there was high flow and the height of the dam was exceeded.

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4.10 – Surface Water Quality

While a comprehensive analysis of surface water quality for the Roseau River Watershed is not available in a published report format at this time, there are various studies and/or reports that do provide insight into some aspects of surface water quality in the watershed.

Surface Water Quality Status 1960-1974

The IRREB (1975) provided a summary of the physical, chemical, and bacteriological aspects of water quality for the Roseau River Watershed in the 1970's based on monitoring conducted by Environment Canada. From 1960 to 1972, Environment Canada, through what was then known as the Water Quality Branch, monitored water quality on the Roseau River at Gardenton on a monthly basis. In coordination with the IRREB's Roseau River studies in the early 1970's, Environment Canada continued to monitor water quality at Gardenton and also started to monitor water quality on the Pine Creek Diversion at PTH #89 and on Sprague Creek at Sprague. This additional sampling resulted in special studies on water quality for the Roseau River that were published in 1973 and 1974. The overall outcome was the establishment of a fourteen-year data set for the Roseau River at Gardenton (Management Area 2) that documented baseline conditions for some parameters and a two-year data set for the Pine Creek Diversion and Sprague Creek (Management Area 3).

The IRREB (1975) study concluded that surface water quality in Roseau River Watershed, as of 1974, was acceptable for most water users. Specifically, the study stated that surface water quality was generally suitable for irrigation and other agricultural applications, as well as for industrial and domestic uses as long as conventional treatment procedures were performed. It was also noted that while the bacterial content was too high for raw water consumption, the Roseau River and its tributaries were likely safe for recreational swimming.

However, the IRREB (1975) stated that parameters such as colour, iron, nutrients, and dissolved oxygen may reach unacceptable levels at certain times of the year. Nitrogen and phosphorus were identified as nutrients of potential concern (few samples prevented the provision of definitive conclusions) and dissolved oxygen levels during the winter season were noted as less than acceptable (summer dissolved oxygen levels were noted as acceptable). The IRREB (1975) classified the Roseau River as a low sediment producing stream based on results from a suspended sediment survey program that examined two locations on the Roseau River (one at Gardenton and one near Dominion City). Specific data and figures for the measured parameters are available in the IRREB (1975) final report.

Surface Water Quality Status 1996-1999

More recently, the Province of Manitoba examined water quality in the Roseau River Watershed during a study from 1996 through 1999. "The objective of the study was to conduct a comprehensive water sampling program to characterize the existing water quality regime in the Roseau River and to aid local authorities/agencies in future management in the watershed" (Ralley, 1998, p.1). The study involved collaboration between the Water Quality Management

Section of Manitoba Environment, Manitoba Agriculture, the Stuartburn Piney Agricultural Development Association (SPADA), and the RMs of Franklin and Stuartburn. A study report was produced by Ralley (1998) that detailed the analysis and conclusions reached based on the data gathered in the 1996-1997 period.

The study report by Ralley (1998) stated that, at the time, very little current water quality data existed for the Roseau River and only one site on the river was being actively monitored by the Province. The report noted that while Manitoba Environment had started sampling at a few sites on the Roseau River in 1973, most of those were discontinued after a few years and Environment Canada had discontinued sampling at a single site where approximately 20 years of data had been collected. Consequently, twelve sites along the Roseau River mainstem and major drains were selected (all within Management Areas 2 and 3) and parameters including nutrients, general chemistry, and microbiologicals were analyzed from samples collected over the two-year period.

The study found that water quality in the drains was poorer than the water quality in the Roseau River mainstem. The report noted that the Main and Jordan drains had the poorest water quality and contained significantly higher numbers of dissolved minerals and salts (including: potassium, sodium, total dissolved solids, conductivity, chloride, and sulfate) and phosphorus (total phosphorus and dissolved phosphorus). It was also noted that the Main and Jordan drains exhibited the lowest concentrations of dissolved oxygen out of all the sample sites. Groundwater influences, soil characteristics, and land-use practices in the Red River Valley area were cited as possible causes of the water quality differences between the drain sites and the Roseau River mainstem sites (Ralley, 1998).

Overall, the report concluded that for the 1996-1997 period water quality in the Roseau River mainstem was comparable to other water courses in the region and water quality in the Main and Jordan drains was poor. Conversely, water quality in the Vita Drain was described as good due, in part, to factors including drainage contributions from nearby wetlands, soil types, and less intensive agricultural practices in the areas adjacent to the drain. The report also suggested that the poorer water quality contributions from the drains may have a cumulative impact on the Roseau River, but due to limited access and prevailing conditions consistent sampling downstream of the Main Drain was not possible and as such, this conclusion could not be verified (Ralley, 1998).

Sampling at the Roseau River mainstem and drain sites was continued through the 1998-1999 period following the same study parameters that had been carried out during the 1996-1997 period. Although no report was produced for the 1998-1999 period, the data collected indicated the same general trends and verified the conclusions that had been reached in the 1996-1997 study report (W. Ralley, personal communication, March 29, 2006).

Surface Water Quality Status 2004

Most recently, a study was carried out by Manitoba Water Stewardship in 2004 with assistance from the Stuartburn Piney Agricultural Development Association (SPADA) to analyze surface water quality in the Roseau River Watershed. The study examined water quality parameters in both the Roseau River mainstem and in several of the major drains that empty into the Roseau

River. From SPADA's perspective the purpose of the study was to help determine some of the farming practices that contribute to surface water problems in the watershed. This section reflects the results of the study adapted from a summary report to SPADA by Wendy Ralley (Water Quality Management Section, Manitoba Water Stewardship).

A total of seventeen different sample sites within the Roseau River Watershed were chosen, including nine sample sites on the Roseau River mainstem from the Canada-U.S. border to the Red River and eight sample sites on drains in this same part of the watershed (strictly within Management Areas 2 and 3).

Sample sites on the Roseau River mainstem included:

1. Roseau River at Jackrabbit Bridge.
2. Roseau River Downstream of PR #200.
3. Roseau River Upstream of Dominion City.
4. Roseau River at PR #218.
5. Roseau River at PTH #59.
6. Roseau River at Roseau River Park.
7. Roseau River at Stuartburn.
8. Roseau River at Gardenton.
9. Roseau River at Gardenton Diversion (near Canada-U.S. border).

Sample sites on drains in the Roseau River Watershed included:

10. Main Drain at Dominion City.
11. Main Drain at Fredensthal.
12. Main Drain at U.S. Branch.
13. Harlow Drain at PR #201.
14. Stewart Drain.
15. Jordan Drain at PR #218.
16. Jordan Drain at PR #201.
17. Vita Drain.

Samples were collected frequently during the spring runoff period (April and May) and on a monthly basis during the summer period. Data from sites along the Roseau River mainstem were compared and likewise, data from the drain sites were compared. Comparisons were also made between the spring runoff and summer periods. Although a number of variables were analyzed, only nutrients were analyzed during the spring runoff period. During the summer period (June, July, August, and September), nutrients as well as other variables (including general chemistry and dissolved minerals and salts) were measured.

Surface Water Quality Observations from the Roseau River Mainstem

Statistically, there were no differences in ammonia, nitrite/nitrate nitrogen, total Kjeldahl nitrogen, and dissolved phosphorus between all nine sample sites on the Roseau River mainstem. Particulate phosphorus and total phosphorus were statistically higher at the two most

downstream sites along the Roseau River (at the Jackrabbit Bridge and downstream of PR #200 sample sites – see Figure 21). Consequently, there appears to be cumulative concentrations of phosphorus in the Roseau River moving downstream. This is further evidenced by the cumulative increase in concentrations of total suspended sediments and steady increases in turbidity moving downstream (see Figure 22 and 23).

In comparing the spring and summer seasons, total Kjeldahl nitrogen and dissolved phosphorus were found to be statistically higher during the summer period. All other nutrient variables showed no significant seasonal difference, which may have been a result of the fact that only 4 data points were used to represent the summer samples – i.e. the majority of data were collected in April and May.

Surface Water Quality Observations from Roseau River Watershed Drains

Statistically, there were no significant differences in ammonia and nitrite/nitrate nitrogen between all eight sample sites on drains in the watershed. Total Kjeldahl nitrogen was found to be significantly higher at the Harlow Drain site and total, dissolved, and particulate phosphorus were all significantly higher in the Main Drain at Dominion City site (see Figure 24).

The concentration of phosphorus is considerably higher in the drains, particularly the drains downstream in the Red River Valley area in comparison to the drains further upstream. This higher concentration of phosphorus in the drains may, in part, explain or account for the cumulative concentrations of phosphorus in the Roseau River mainstem. Total phosphorus and dissolved phosphorus were statistically higher during the summer period in comparison to the spring runoff period. Once again, this may be a result of the fact that very few data points (4) were used to represent the summer period.

The Stewart Drain, Harlow Drain, and Main Drain at Dominion City sites were consistently high in total suspended sediments and turbidity, indicating that these drains are carrying a substantially elevated sediment load at these sampling points (see Figures 25 and 26). This may be indicative of erosion, or a lack of adequate buffer zones around drains including field drains. This may also be, in part, contributing the cumulative concentrations of total suspended sediments in the Roseau River mainstem (see Figure 22). The Vita Drain appears to be contributing good water quality to the Roseau River in comparison to the contributions from the other drains and the other upstream Roseau River mainstem sample sites.

Other Surface Water Quality Observations in the Roseau River Watershed

Dissolved oxygen levels in most of the Roseau River mainstem sample sites and in all of the drain sites appears to be critically low to support aquatic life and wildlife. While a maximum of only 4 samples were collected from each site, the samples were collected in June, July, August, and September – a time period when dissolved oxygen levels should have been higher than the values that were reported.

Since publication of the IRREB (1975) study on the Roseau River Watershed, no further water quality monitoring has taken place and been published in a report format for the Pine Creek

Diversion and Sprague Creek (Management Area 1). As such, the current status of water quality in the Pine Creek Diversion and Sprague Creek is unknown.

According to the U.S. plan, insufficient data existed in the U.S. portion of the watershed to produce a detailed water quality analysis for the Roseau River when the plan was completed in 2004. The U.S. plan does state that based on changes to the natural hydrology and landscape of the watershed for agriculture and other land use purposes, and as indicated by data that does exist, surface water resources in the watershed have been impacted. Even though water quality studies have been carried out in the past and are currently being carried out, the extent of surface water degradation in the U.S. part of the watershed is unknown at this time. The Minnesota Pollution Control Agency identified the Roseau River in the U.S. as being impaired for dissolved oxygen and studies are currently underway to verify and explore the causes (RRWD, 2004).

Summary

Overall, the data gathered for 2004 support the conclusion of cumulative impacts to the Roseau River, particularly with respect to phosphorus and sediment loading. These findings are similar to conclusions that were reached based on water quality data collected from the period 1996-1999 at the same sample site locations (an analytical and statistical comparison of the 2004 and 1996-1999 data sets had not yet been undertaken as of the writing of this plan). The major drains in the watershed appear to be contributing poor water quality to the Roseau River mainstem. The exception to this is the Vita Drain, which for most water quality variables, contributes better water quality than is found in the Roseau River. The Main Drain appears to contribute the poorest quality water to the Roseau River.

SPADA (2005) reiterated that water quality in the Roseau River appears to deteriorate moving downstream into the more intensive cropping areas of the Red River Valley and noted that this is likely related to the fact that much of the farmland in this area has minimal vegetative cover along the banks of the drains and as a result, soil erosion and nutrient runoff are prevalent issues. Lands adjacent to drains upstream of this area, especially the Vita Drain which has good water quality, have more native or tame forage seeded along the banks (SPADA, 2005).

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Note: Wendy Ralley of Manitoba Water Stewardship provided information/data on which this section is based.

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Figure 21: Phosphorus Levels (2004) in Roseau River Mainstem

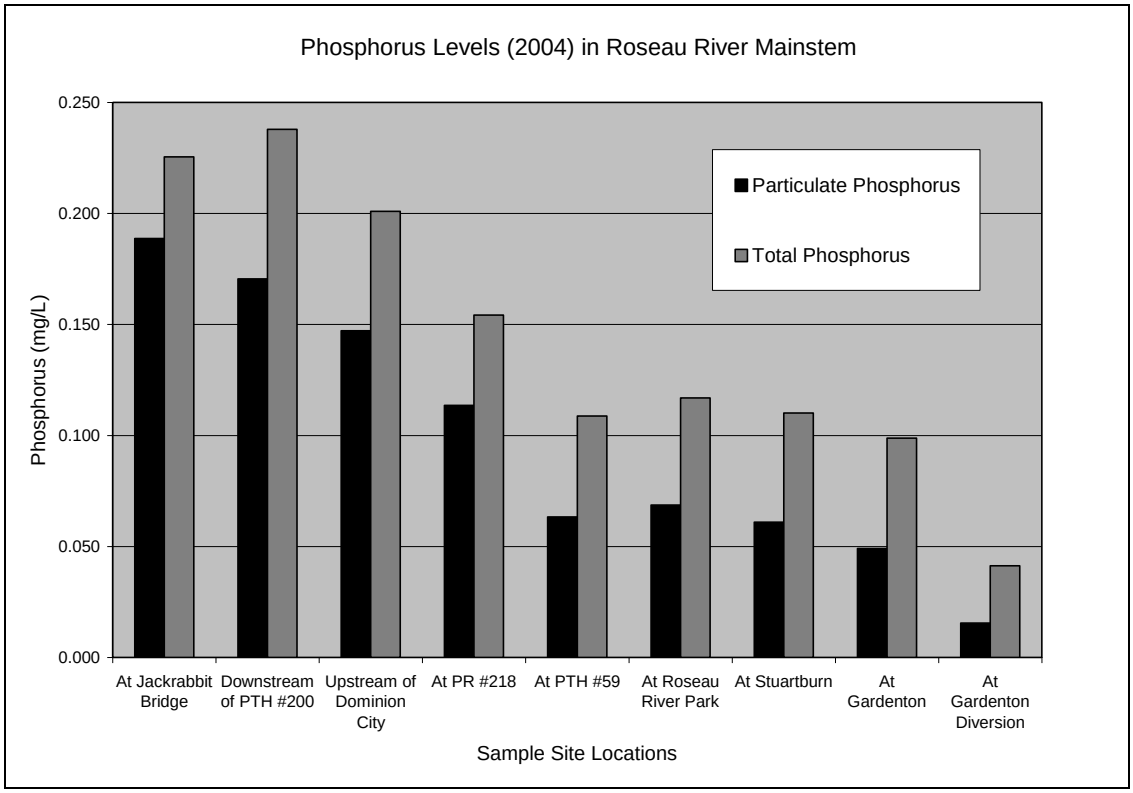


Figure 22: Levels of Total Suspended Sediments (2004) in Roseau River Mainstem

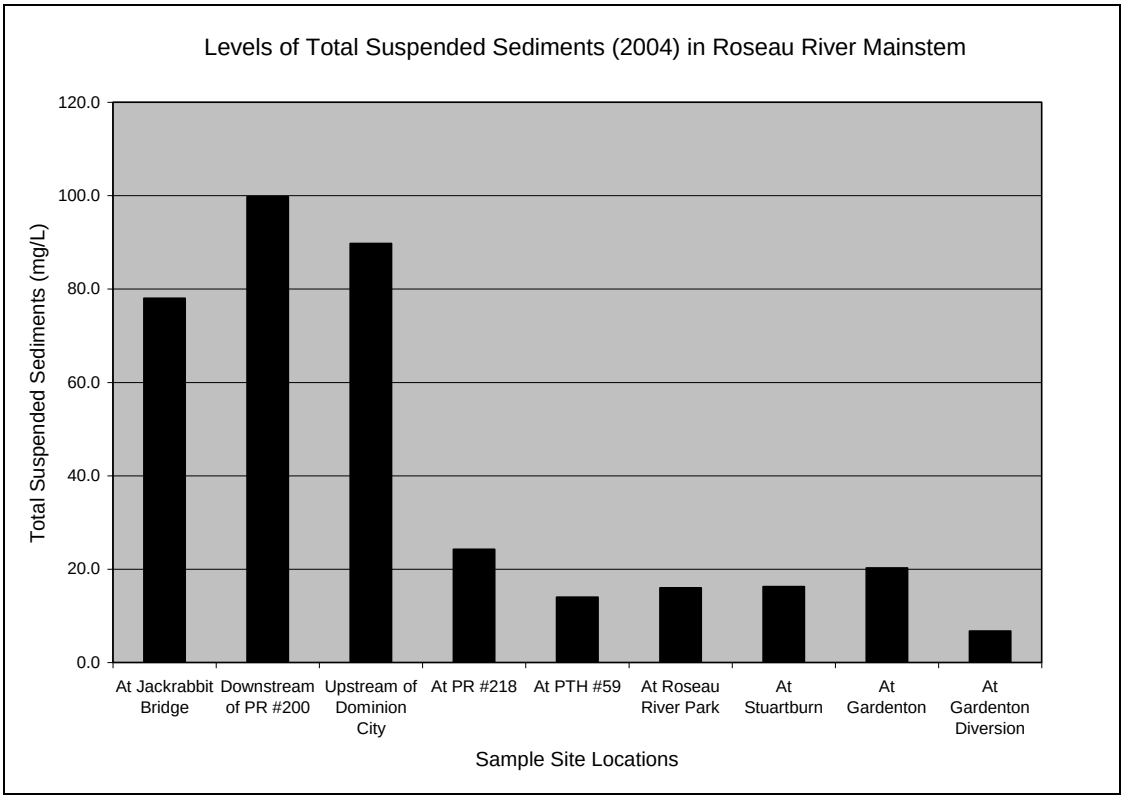


Figure 23: Turbidity Levels (2004) in Roseau River Mainstem

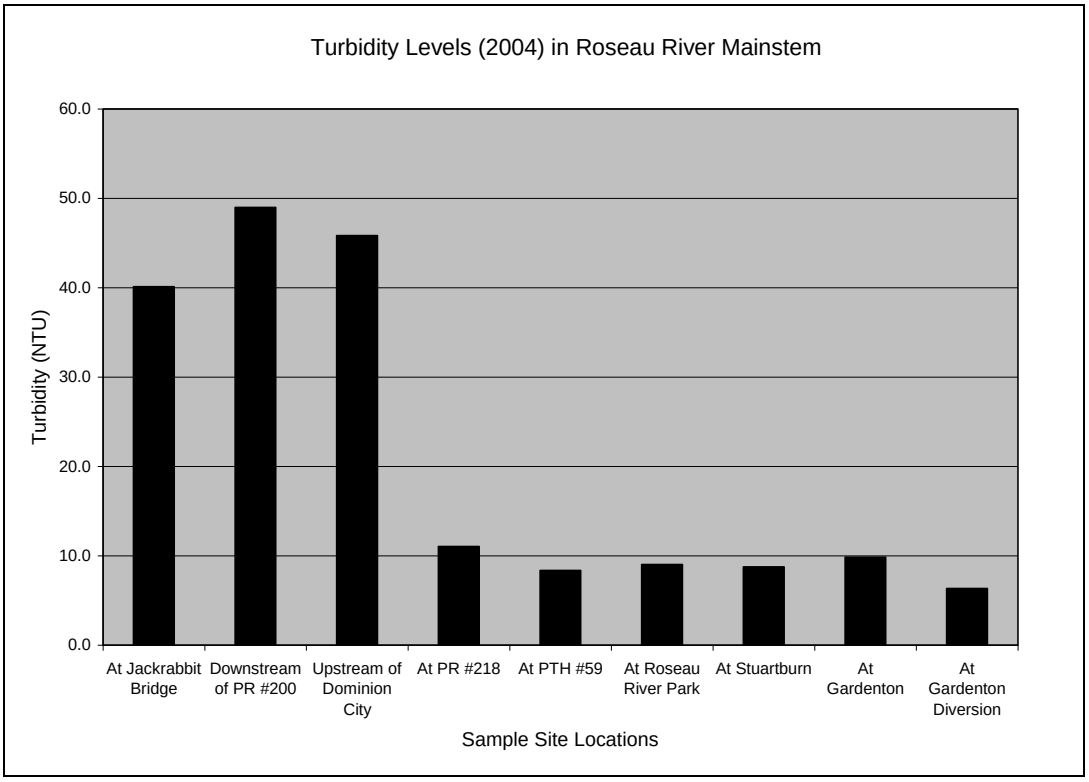


Figure 24: Phosphorus Levels (2004) in Roseau River Watershed Drains

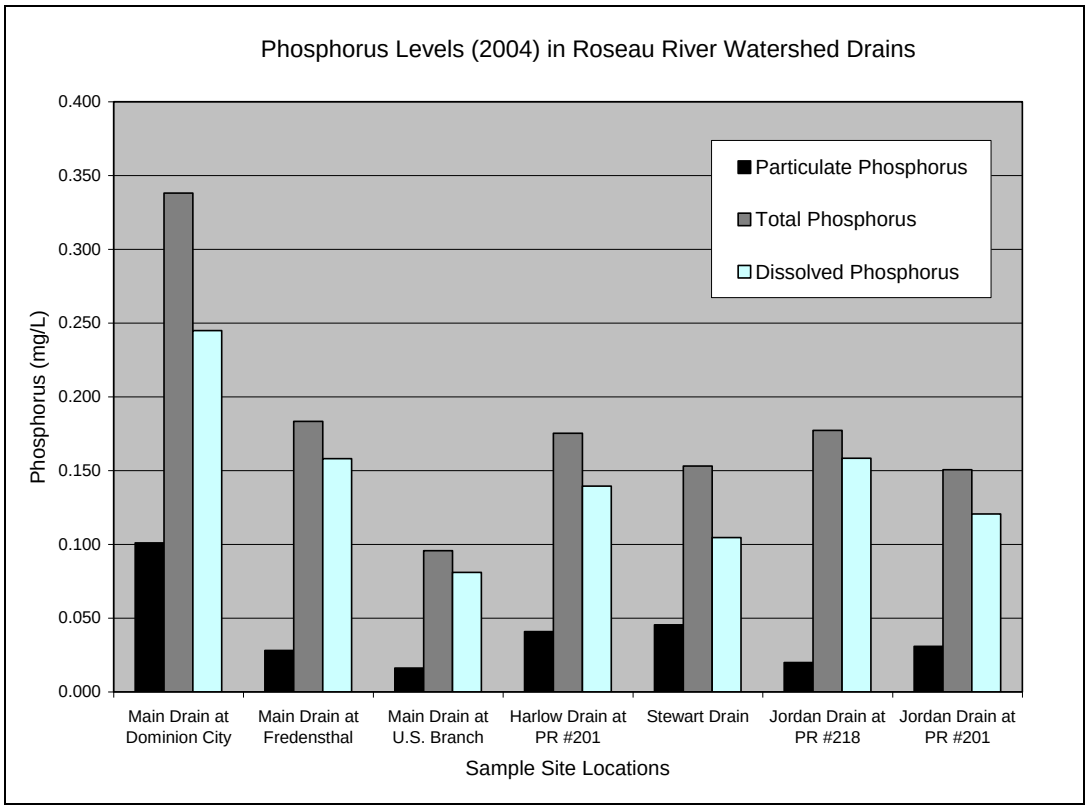


Figure 25: Levels of Total Suspended Sediments (2004) in Roseau River Watershed Drains

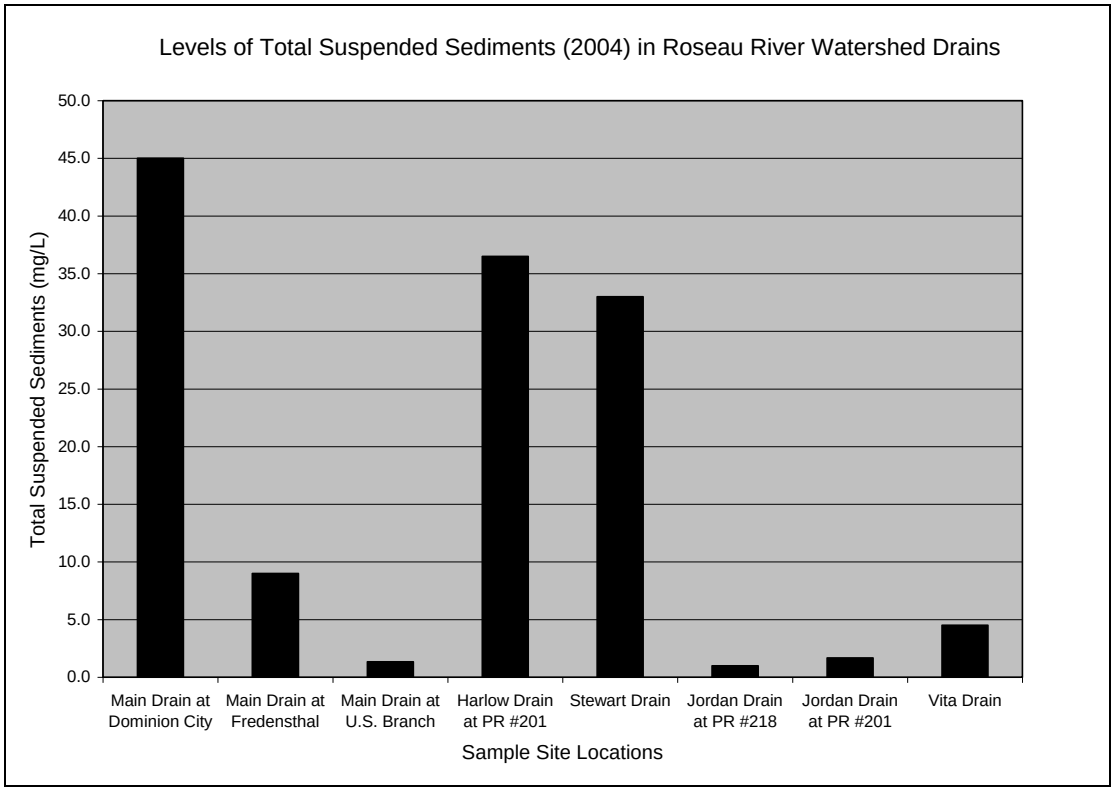
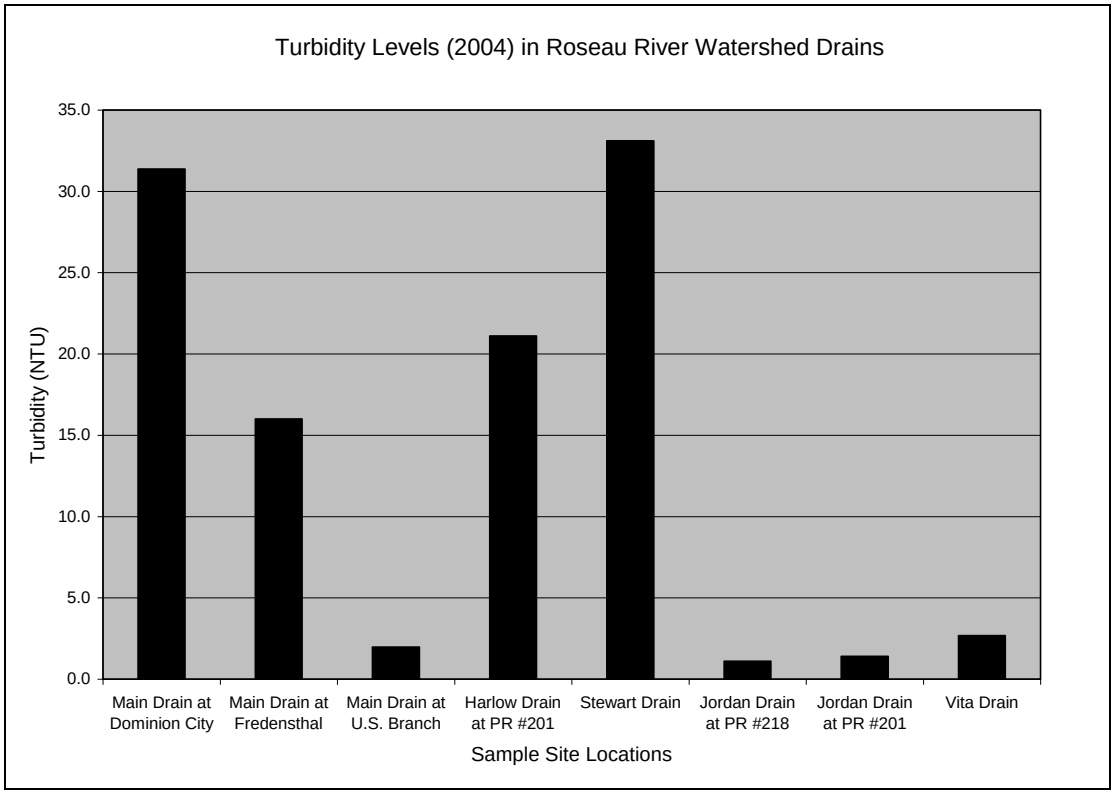


Figure 26: Turbidity Levels (2004) in Roseau River Watershed Drains



4.11 – Groundwater Resources

Information about aquifers and groundwater in the Roseau River Watershed is available from three main sources: Aquifer Maps of Southern Manitoba (M. Rutulis, 1986), Groundwater Availability Map Series (Winnipeg Area, 1980 and Kenora Map Area, 1986), and the GWDrill database. The aquifer maps and groundwater availability map series are based on GWDrill database information up to the time of these map compilations. The maps provide general information on aquifer boundaries, groundwater production rates, and geochemistry.

Maps of the approximate boundaries of the sand and gravel and bedrock aquifers within the Roseau River Watershed are presented on Figures 27 and 28 respectively. While current as of the date of compilation, the maps do require updating to reflect additional geological, hydrogeological, and geochemical information that may have been collected during the period from about 1986 to 2005. Caution should be taken in using these maps to accurately define aquifer boundaries. Based on a review of current geological, hydrogeological, and geochemical information available in the GWDrill database, the following sections provide a summary of the groundwater resources within the Roseau River Watershed.

Aquifer Information

With the exception of Ranges 2E and 3E in the western area (Management Area 3), groundwater is generally available throughout the watershed. The principle aquifers in the watershed are glacial sand and gravel aquifers and consist of either lenses of sand and gravel or major buried sand and gravel aquifers. These aquifers occur in till and other surficial deposits, and vary considerably in thickness and areal extent. The quantity and quality of groundwater can also vary considerably from location to location. Generally, the quality of groundwater in the watershed decreases moving from the eastern area (Management Area 1) towards the western area (Management Area 3). Little groundwater is utilized from the underlying bedrock aquifers.

Sand and Gravel Aquifers

Throughout the watershed, the depth of the principal sand and gravel aquifers typically range from about 7 to 30 metres (25 to 100 feet), and to a lesser degree at depths ranging from about 30 to 60 m (100 to 200 ft). Well yields are typically low to moderate, and range from about 10 to 225 litres per minute (L/min) (2 to 50 imperial gallons per minute (Igpm)). Higher capacity wells may yield from 450 to >900 L/min (100 to >200 Igpm).

Shallow sand aquifers less than 7 m (25 ft) in depth also occur throughout areas of the watershed. These aquifers are less commonly exploited because: i) they are more susceptible to contamination from surface sources; ii) often have limited yield because of their shallow depth; and iii) reliable groundwater sources often occur in deeper underlying aquifers. Many of the wells completed in shallow aquifer situations are large diameter types which reflect the lower water producing capacity of these aquifers.

Based on available well information reports within the watershed, the chemical quality of groundwater in the sand and gravel aquifers is generally good to fair. Total dissolved solids

(TDS) typically range from about 200 to 600 milligrams per litre (mg/L). The water is generally hard and it is not uncommon for iron to exceed the Canadian Drinking Water Quality aesthetic objective guideline of 0.3 mg/L. Nitrate concentrations in the groundwater are typically low.

Bedrock Aquifers

Bedrock aquifers within the watershed consist of carbonate rocks (Ordovician Formations), sandstone and sand (Ordovician Winnipeg Formation), limestone, sandstone, and shale (Jurassic Formations), and Precambrian rocks. Of these, only the carbonate rock aquifer is utilized as a source for groundwater supply. The carbonate rock aquifer extends eastward from the Red River and underlies most of Management Area 3 and smaller portions of Management Areas 2 and 1. The eastern boundary of this aquifer terminates within Management Areas 2 and 1.

There is limited use of groundwater from the carbonate rock aquifer because of the adequate capacity and quality of groundwater that occurs at shallower depths within the overlying sand and gravel aquifers. Well information reports in the GWDrill database show that only a small number of production wells have been completed in the carbonate rock aquifer within Management Areas 3 and 2. The depth to the carbonate rock aquifer varies from about 15 to 91 m (50 to 300 ft). Well yields are variable and range from about 20 to 340 L/min (5 to 75 Igpm). The chemical quality of groundwater is generally poor (TDS >2,000 mg/L) and is saline within the western portion of Management Area 3 (TDS >10,000 mg/L).

Provincial Observation Wells

The province currently maintains a network of 19 active observation wells within the Roseau River Watershed, as shown on Figure 29. Five observation wells are located in the eastern half of Management Area 1 (two wells are located on NW32-1-13E) and are completed within sand and gravel aquifers ranging in depth from about 15 to 64 m (50 to 210 ft). These observation wells are used to monitor groundwater levels and collect groundwater chemistry data. One observation well is located in the western half of Management Area 1 and the rest of the observation wells are located throughout Management Areas 2 and 3. These wells were completed in 2001 to obtain baseline groundwater quality information from shallow aquifers, generally at depths less than 9 m (30 ft), within areas of the southeastern region of the province. Records of water level and chemical data for all observation wells are maintained within the provincial HYDATA database, a digital computer database designed for storing, checking, presenting, and analyzing hydrological data.

Recharge Areas

Little information is available regarding areas of groundwater recharge within the watershed. The Sandilands glaciofluvial complex is recognized as a major recharge area for the underlying sand and gravel and bedrock aquifers within southeastern Manitoba. The distribution of the Sandiland deposits within the Roseau River Watershed is illustrated on Figure 30 (Smith and Ehrlich, 1964). The southern portion of this complex covers major portions of Management Area 1 in the RM of Piney and a small portion of Management Area 2.

Flowing Well Areas

Major flowing well areas have been identified within sand and gravel aquifers located in Management Area 1, namely within portions of Townships 1 and 2 in Range 11E, Townships 1 and 2 in Range 12E, Township 1 in Range 13E, and Townships 1 and 2 in Range 14E in the RM of Piney. The approximate boundaries of these areas are provided in the Major Flowing Well Areas Map by Rutulis (1978) and the Generalized Aquifer Map by Betcher (1986), but generally involve the area in and around the community of Piney moving eastward through South Junction to the area in and around Sprague. These maps are available through the Province of Manitoba.

The Ground Water and Water Well Act

Groundwater resources are managed under *The Ground Water and Water Well Act* and *Well Drilling Regulation*. The Act applies to all sources of groundwater and all wells, whether drilled or developed before or after the Act was established in 1963. With the exception of controlling the flow from wells and the prevention of polluting groundwater and wells, the Act does not apply to a well that is drilled or developed by an owner on his land, using equipment owned by him, for the purpose of obtaining water solely for his domestic use. Specifically, the Act:

- licenses all persons engaged in the business of drilling water wells;
- allows access and inspection of all wells or operations, and to all records, plants or equipment;
- allows undertaking of surveys of groundwater resources and studies of the conservation, development, and utilization of groundwater;
- allows control of flow from wells;
- requires all reasonable precautions be taken to prevent contamination of groundwater via wells; and
- allows establishment of regulations related to the conservation, development, and control of groundwater resources and the drilling and operation of wells and the production of groundwater there from.

The *Well Drilling Regulation* provides regulation for:

- the terms of licensing;
- collecting well drilling and testing information, maintaining well logs, and submitting well reports;
- construction requirements;
- control of flow (artesian conditions);
- prevention of contamination of wells and aquifers; and
- sealing of abandoned wells.

Groundwater Contamination Concerns

With respect to the contamination of water wells or aquifers, any well or aquifer has the potential to become contaminated if measures are not taken to protect from or reduce the risk of

contamination. In considering development within the Roseau River Watershed, the following comments are offered.

Groundwater Sensitive Areas

Groundwater sensitive areas are defined as those areas with the greatest risk for contamination of groundwater from sources located at or near the surface, regardless of how local or extensive the aquifer may be. The degree to which aquifers are vulnerable to contamination from the surface largely depends on the thickness and properties of the material overlying the aquifer and the properties of the contaminant. Aquifers overlain by 6 m (20 ft) or more of low permeability material (such as clay or till) are considered as having low potential for contamination from surface activities. Aquifers consisting of sand and/or gravel or bedrock that are exposed at the surface are vulnerable to water degradation from surface activities. The degree of protection of groundwater will increase with increasing cover of low permeability material.

Within the Roseau River Watershed existing map information and water well logs can be used as a reconnaissance tool in identifying groundwater sensitive areas. For any proposed site development in the watershed, site specific investigations should be considered. The degree of detail for the site specific investigations would depend on the proposed site use and potential for contamination of underlying soil and groundwater.

Water Well Construction

All water wells should be properly constructed, maintained, and protected to help ensure a reliable and safe water supply. Some of the keys to reducing the risk of well water contamination include:

- Location (where the well is located).
- Construction (how the well is built).
- Maintenance (how the well is maintained).
- Management (how waste products and chemicals are managed).

The following measures are recommended to help reduce the risk of well water contamination:

- retain an experienced and licensed well drilling contractor for the drilling and construction of a water well;
- locate the water well at a safe distance from potential sources of contamination and in an area away from surface runoff from potential sources;
- ensure an experienced and licensed contractor completes the hook-up of the water well to the water distribution system (pitless well construction);
- after the water well has been completed, but before it is put into operation, ensure the well, pump, and water distribution system are disinfected to kill any bacteria that may be present; and
- ensure old wells are properly sealed to the standards recommended in *Manitoba's Guide for Sealing Abandoned Water Wells*.

Water Wells and Flooding

Water wells within any designated flood area should have adequate well head protection to ensure that floodwaters do not enter directly into the well, as this could cause contamination of the well water and possibly groundwater within the aquifer. Within a designated flood area, one of the following well head protection measures should be implemented:

- extend the top of the well casing above the expected elevation of the floodwater;
- flood proof the well cap and electrical conduit using a water tight well cap, check valve type of air vent and conduit cable seal. This assembly will help prevent floodwaters from entering the well casing;
- locate the well on a pad or structure that is elevated above any expected floodwater level; or
- locate the well within a ring dike whose top elevation is above any expected floodwater level.

Private Sewage Disposal Systems

Private sewage disposal systems are regulated by the *Onsite Wastewater Management Systems Regulation* under *The Environment Act*. Municipalities within the Roseau River Watershed should ensure the design and construction of private sewage disposal systems are suitable for the soil conditions encountered and lot size proposed for any development.

Livestock Operations

Livestock operations and manure spreading are regulated under the *Livestock Manure and Mortalities Management Regulation* under *The Environment Act*. As well, the Province has prepared Farm Practice Guidelines for Hog, Beef, Dairy, and Poultry Producers in Manitoba and provides a Technical Review process for new and expanded operations. These processes have been developed to reduce the potential risk of groundwater contamination.

Sand and Gravel Pits

A number of gravel pits are located throughout the watershed and are identified on maps available from Manitoba Industry, Economic Development and Mines (see Maps AR88-1-1 and AR88-1-2, Manitoba Energy and Mines, 1988). The establishment and operation of quarries are regulated by the *Quarry Minerals Regulation* under *The Mines and Minerals Act*. This regulation states that no operator shall contaminate groundwater, or permit the contamination of groundwater, through the establishment or operation of an aggregate quarry.

Other Contamination Considerations

Other potential sources of contamination that may be considered include: municipal sewage systems, waste disposal grounds, agricultural operations, industrial operations, pipelines, gas stations, and transportation spills.

Well head protection programs, at the private, municipal, or watershed level should also be considered to reduce the risk of contaminating water supplies.

Summary

Groundwater is an important source of water supply for private domestic use as well as municipal, agricultural, and industrial purposes within the Roseau River Watershed. There is adequate capacity and good quality groundwater occurring at shallower depths in sand and gravel aquifers throughout the watershed, including major flowing wells producing high quality water in the eastern area (Management Area 1). As such, the protection of essential groundwater recharge areas such as the Sandilands glaciofluvial complex is a pertinent issue. For any proposed site development in the watershed, site specific investigations should be considered to help address the potential for contamination of underlying soil and groundwater.

Further groundwater resource information for areas of the watershed is available from within the materials noted in the subsequent reference section. Data is also available from GWDrill, a provincial digital database containing geological, hydrogeological, geochemical, and well construction information for test holes and water wells from well driller's reports. GWDrill is administered by the Groundwater Management Section of the Water Science and Management Branch, Manitoba Water Stewardship.

References

Note: Laurie Frost of Manitoba Water Stewardship provided information/data and wrote a large portion of this section.

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4.12 – Licensed Water Use

Throughout Canada, water is a provincial Crown resource. In Manitoba, a water rights license is required to withdraw water in excess of domestic requirements. This provision applies to the use of both ground and surface waters. *The Water Rights Act* defines "domestic purposes" as being the use of water, obtained from a source other than a municipal or community water distribution system, at a rate of not more than 25,000 litres (5,500 Imperial gallons) per day, for household and sanitary purposes, for the watering of lawns and gardens, and the watering of livestock and poultry. Under the Act, anyone who wants to divert or use water for purposes other than for domestic purposes must obtain a licensed allocation or authorization to divert water. The licensable use categories recognized under the Act include: municipal, agricultural (including livestock watering), industrial, irrigation, and other purposes (for uses that do not fit into the other named categories). A license is required for agricultural and irrigation purposes if the extraction exceeds 25,000 litres (5,500 Imperial gallons) per day. Any amount of municipal or self-supplied industrial usage requires a license, as does any "other" use of water that does not fit into the above use categories.

At the time of writing, there are a total of 18 groundwater projects under license or application in the Roseau River Watershed. Of these projects, 15 are for agricultural purposes, one is for municipal purposes, one for irrigation purposes, and one for industrial (water bottling) purposes. The total volume of groundwater under allocation is 261 dam^3 (211 acre-feet). The licenses have been issued for terms varying from 5 to 20 years. All of the supply wells have been completed in overburden (e.g. sand and gravel) aquifers.

At the time of writing, there are a total of 6 surface water projects under license or application in the Roseau River Watershed. Of these projects, 2 are for agricultural purposes and 4 are for irrigation projects. The total volume of surface water under allocation is 633 dam^3 (513 acre-feet). The licenses have been issued for terms varying from 5 to 20 years. The surface water sources under licensed allocation include the Roseau Rivers and Sprague Creek.

Note: Rob Matthews of Manitoba Water Stewardship provided information/data and wrote a large portion of this section.

4.13 – Inventory of Public Water Supply Systems

There are no Public Water Supply Systems in Management Areas 1 and 2. The water supply for domestic use in these areas is obtained from private and/or community wells.

The water supply for domestic use in most of Management Area 3 is obtained from private and/or community wells. There is one Public Water Supply System for Dominion City, which draws approximately 120 cubic metres (4,240 cubic feet) of drinking water daily from the Red River Regional Water Treatment Plant in Letellier (operated by the Pembina Valley Water Cooperative Inc.) into the city reservoir (located at NW20-2-3E). This water is then re-chlorinated before being distributed throughout Dominion City. The community of the Roseau River Anishinabe First Nation also draws water from the Red River Regional Water Treatment Plant in Letellier and re-chlorinates the water before distribution. The overall capacity of the water system for the First Nation community is 220 m^3 (7,769 cubic feet) per day. The original source of the water obtained through the Water Treatment Plant in Letellier is the Red River.

Note: Sudhansu Majumbdar of Manitoba Water Stewardship provided information/data and wrote a large portion of this section.

4.14 – Inventory of Municipal Wastewater Treatment Systems

There are no municipal wastewater treatment facilities to dispose of residential sewage in Management Area 1. As such, private septic tanks/fields are utilized for sewage disposal in this part of the watershed.

There is one municipal wastewater facility in Management Area 2, which is known as the Vita Municipal Lagoon (NE 23-2-7E). There can be 5 to 6 discharges between June and October each year and discharges can range from 3,200 to 6,700 m^3 (113,000 to 237,000 cubic feet). The effluent discharge point is the Vita Drain which flows west and empties into to the Roseau River immediately upstream of the community of Roseau River. Private septic tanks/fields are utilized for sewage disposal for the areas not covered by the Vita Municipal Lagoon. Septic pump-out trucks also unload sewage into the Vita Municipal Lagoon from some of the homes and businesses in the area. The discharge quality is limited to < 1500 MPN/100 ml (TC) and < 30 mg/l (BOD).

There is one municipal wastewater facility in Management Area 3, which is known as the Dominion City Lagoon (NE 19-2-3E). The maximum discharge allowable from this lagoon to the Roseau River between June and October each year is 20,900 m^3 (738,100 cubic feet). There is another wastewater treatment lagoon owned by the Ridgeville Holding Company Limited, located on the southeast quarter of Section 5-2-4E. The discharge of treated effluent from this lagoon is into a farm drain that flows west across 5-2-4E to a municipal drain that flows north to the Harlow Drain and then into the Roseau River. The maximum discharge allowable from this lagoon to the Roseau River between June and October each year is 4,800 m^3 (169,500 cubic feet). The Roseau River Anishinabe First Nation also releases treated waters from their lagoon into the Roseau River during the springtime. The discharge qualities are the same for each of these lagoons and are limited to < 1500 MPN/100 ml (TC) and < 30 mg/l (BOD). Private septic tanks/fields are utilized for sewage disposal in the areas where municipal wastewater treatment facilities are not available.

Note: MPN = Most Probable Number, TC = Total Coliform, and BOD = Biological Oxygen Demand.

Note: Sudhansu Majumbdar of Manitoba Water Stewardship provided information/data and wrote a large portion of this section.