


Manitoba Environment Act Proposal Town of Manitou

August 2013

Jaimee Schmidt, P.Eng



Environment Act Proposal Form

Name of the development: Town of Manitou WTP and Raw Water Pipeline Upgrades	
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88): Transportation and Transmission, Waste Disposal	
Legal name of the proponent of the development: Town of Manitou	Mailing address: Box 280 Manitou, MB R0G 1G0
Location (street address, city, town, municipality, legal description) of the development: Town of Manitou SW 30-03-08	
Name of proponent contact person for purposes of the environmental assessment: Jaimee Schmidt, P.Eng.	
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Date: August 19, 2013	Signature of proponent, or corporate principal of corporate proponent:  Printed name: Jaimee Schmidt, P.Eng.

A complete **Environment Act Proposal (EAP)** consists of the following components:

- **Cover letter**
- **Environment Act Proposal Form**
- **Reports/plans supporting the EAP** (see "Information Bulletin - Environment Act Proposal Report Guidelines" for required information and number of copies)
- **Application fee** (Cheque, payable to Minister of Finance, for the appropriate fee)

Per Environment Act Fees Regulation (Manitoba Regulation 168/96):

Class 1 Developments	\$500
Class 2 Developments	\$5,000
Class 3 Developments:	
Transportation and Transmission Lines.....	\$5,000
Water Developments	\$50,000
Energy and Mining.....	\$100,000

Submit the complete EAP to:

Director
Environmental Assessment and Licensing Branch
Manitoba Conservation
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:

Phone: (204) 945-7100
Fax: (204) 945-5229
Toll Free: 1-800-282-8069, ext. 7100
<http://www.gov.mb.ca/conservation/ea>

Table of Contents

Executive Summary.....	1
List of Acronyms.....	2
1.0 Introduction	4
1.1 Background Information	4
1.1.1 Previous Studies.....	4
1.1.2 Population.....	5
1.1.3 Current and Projected Water Use	5
1.1.4 Raw Water Source	6
1.1.5 Water Rights Act	7
1.1.6 Water Quality.....	7
1.1.7 Compliance Plan.....	8
2.0 Description of Proposed Development.....	8
2.1 Project Description	8
2.1.1 Operation and Maintenance.....	10
2.2 Certificate of Title	10
2.3 Existing and Adjacent Land Use	10
2.4 Land Use Designation and Zoning.....	10
2.5 Project Schedule	11
2.6 Project Funding.....	11
2.7 Regulatory Approvals.....	11
2.8 Public Consultation	11
2.9 Storage of Petroleum Products and Other Chemicals.....	11
3.0 Physical Environment.....	12
3.1 Physiographic Setting and Climate	12
3.2 Hydrogeology.....	12
3.3 Hydrology.....	12
3.4 Fish and Fish Habitat.....	13
3.5 Wildlife Habitat and Vegetation	13
3.6 Socioeconomic.....	14
3.7 Heritage Resources	14
4.0 Potential Environmental Effects	14
4.1 Air Quality	14
4.2 Soils	14
4.3 Surface Water, Fish and Fish Habitat.....	15
4.4 Water Quality.....	18
4.5 Groundwater Levels.....	18
4.6 Vegetation.....	18
4.7 Wildlife Habitat and Vegetation	18

4.8	Noise and Vibration	19
4.9	Employment/Economy	19
4.10	Human Health and Well Being	19
4.11	Climate Change	19
5.0	Environmental Management Measures	20
5.1	Air Quality	20
5.2	Soils	20
5.3	Surface Water	20
5.4	Groundwater.....	21
5.5	Vegetation and Wildlife	21
5.6	Fisheries	21
5.7	Noise and Vibration	21
5.8	Water Conservation.....	21
5.9	Socio-Economic Implications	21
6.0	References	22
	Appendix A – Site Plans.....	23
	Appendix B – Membrane Flow Diagram	26
	Appendix C – Fish Species	28
	Appendix D – Water Rights Licence	31
	Appendix E – MWSB Guidelines for Watercourse Crossings	34
	Appendix F – Certificate of Title.....	37
	Appendix G – Projected Reject Quality.....	39
	Appendix H – Water Quality	43

Executive Summary

The Town of Manitou requested The Manitoba Water Services Board (MWSB) to prepare an Environment Act Proposal for a Class 1 Development License under the Manitoba Environment Act for an upgrade to the water treatment plant (WTP) and raw water pipeline. This document provides the compiled information required on Manitoba Conservation's Environment Act Proposal Report Guidelines and Supplementary Guidelines for Municipal Water Supply Systems. This Environment Act proposal includes components for a raw water pipeline and a new water treatment plant including a membrane reject line.

The Town of Manitou Water Treatment Plant (WTP) which was originally constructed in 1963/64 by the Manitoba Water Supply Board who operated it until the early 2000's. The Manitou WTP receives raw water from the Mary Jane Reservoir, which was constructed on the Mary Jane Creek by the Prairie Farm Rehabilitation Administration (PFRA), and is approximately 10 km northwest of the Town. The existing plant consists of a lime and soda ash treatment process. The Town currently operates the WTP and distribution system.

Sludge produced during the treatment process is discharged to a lift station outside the WTP that is pumped to two clay lined sludge retention ponds which are located northeast of the plant. Environment Act Licence No. 2504 issued in May 2001 permits the Town of Manitou to operate the sludge dewatering cells.

The proposed development includes the construction of 10.5 L/s ultrafiltration and reverse osmosis WTP. The treatment system will be required to have a reject pipeline whereby highly mineralized reject water will be discharged to a nearby drain which flows into the Mary Jane Creek which flows into the Pembina River. A new WTP building will be constructed to house the new treatment equipment. Construction of a new building will allow for simplified construction during the equipment upgrading process and will allow the existing plant to provide the Town with treated water.

A new 250 mm raw water pipeline will be constructed from the Mary Jane Reservoir to the WTP. The length of the new pipeline will be approximately 11.5 km. A preliminary pipeline route can be found in Appendix A.

List of Acronyms

AO	Aesthetic Objective
DBP	Disinfection By-Product
DWSA	Drinking Water Safety Act
EAP	Environment Act Proposal
GCDWQ	Guidelines for Canadian Drinking Water Quality
GUDI	Groundwater Under Direct Influence of Surface Water
MWSB	Manitoba Water Services Board
ODW	Office of Drinking Water
RM	Rural Municipality
TDS	Total Dissolved Solids
THM	Trihalomethane
TOC	Total Organic Carbon
UV	Ultraviolet
WTP	Water Treatment Plant

1.0 Introduction

The Town of Manitou requested The Manitoba Water Services Board (MWSB) to prepare an Environment Act Proposal for a Class 1 Development License under the Manitoba Environment Act for an upgrade to the water treatment plant (WTP) and raw water pipeline. This document provides the compiled information required on Manitoba Conservation's Environment Act Proposal Report Guidelines and Supplementary Guidelines for Municipal Water Supply Systems. This Environment Act proposal includes components for a raw water pipeline and a new water treatment plant.

1.1 Background Information

The Town of Manitou is located in southern Manitoba on Provincial Trunk Highway #3, approximately 80 km south of the City of Portage la Prairie. The Town currently has a population of approximately 800 people.

The Town of Manitou Water Treatment Plant (WTP) was originally constructed in 1963/64 by the Manitoba Water Supply Board who operated it until the early 2000's. The Manitou WTP receives raw water from the Mary Jane Reservoir, which was constructed on the Mary Jane Creek by the Prairie Farm Rehabilitation Administration (PFRA), and is approximately 10 km northwest of the Town. The existing plant contains a lime and soda ash treatment process. The Town currently operates the WTP and distribution system.

Sludge produced during the treatment process is discharged to a lift station outside the WTP and is then pumped to two clay lined sludge retention ponds which are located northeast of the plant. Sludge retention in these cells allows particulate matter to settle. Supernatant is collected in an under-drainage piping system and allowed to discharge to a nearby 1st order drain which drains into the Mary Jane Creek. Environment Act Licence No. 2504 issued in May 2001 permits the Town of Manitou to operate the dewatering sludge cells.

1.1.1 Previous Studies

An engineering assessment for the Town of Manitou was conducted by AECOM in February 2009 to assess and review the existing infrastructure and water supply system in the Town of Manitou. The engineering assessment recommended major upgrades to the WTP in order to meet regulations.

A Water Treatment Plant Upgrading Study was written by MWSB in January 2012 for the Town of Manitou, to investigate the water supply system, water quality, design considerations and cost estimates for an upgrade to the existing treatment system. A rural water pipelines feasibility study was completed by MWSB for the RM of Pembina in August 2013.

1.1.2 Population

Based on 2011 Census data, the Town of Manitou has an estimated population of 808 residents. This was up from 718 in the 2006 Census. The population has been in general decline since the mid 1970's, however there have been times of growth such as in 2001 and 2008. An assumed 0.5% annual growth rate factor over 20 years results in a future population of 893.

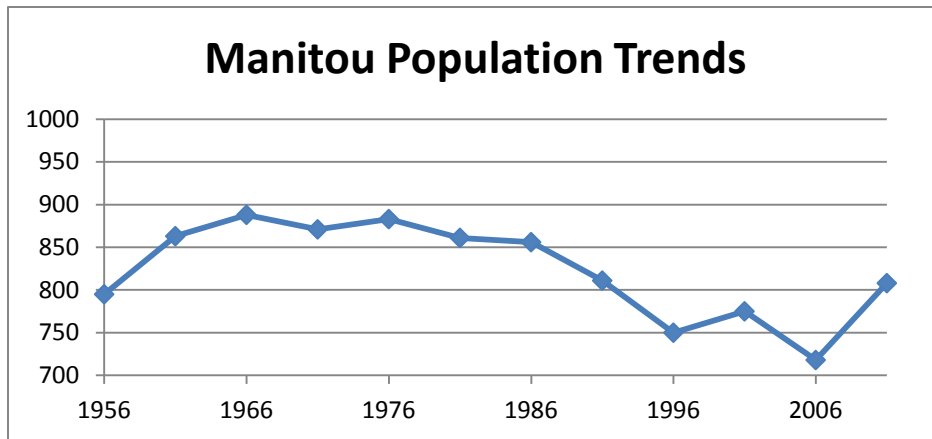


FIGURE 1 - POPULATION TRENDS

1.1.3 Current and Projected Water Use

A WTP is designed based on peak day demand. When calculating water consumption, typical average daily water usage ranges from 250 L/person/day to 300 L/person/day and peak day usage (peak day factor) is typically 1.5 to 2.0 times greater. Consumptions of 250 L/person/day and a peak day factor of 2.1 were used for this study. The projected treated water demands are summarized in Table 1.1. The projected treated water demand for the Town of Manitou is 6.51 L/s. The projected peak day water demand for the pipeline extensions in the RM of Pembina is 3.65 L/s. With a projected 25% reject for the treatment system, the total raw water demand for the town and the RM are approximately 14 L/s. This number will need to be verified when the design and connections are finalized.

TABLE 1.1 – FUTURE 20 YEAR WATER DEMANDS

	Unit	
Manitou Population		808
Manitou 20 Year Population		893
Average Demand		
Consumption/capita/day	L/c/day	x 250
Average Day Demand = 893 x 250	L/day	223,250
Peak Demand		
Average Day Demand	L/day	223,250
Peak Day Factor		x 2.1
Peak Day Demand	L/day	468,754
Average Day Flow (20hrs)	L/s	3.1
Peak Day Flow (20 hrs)	L/s	6.51
Rural Water Peak Day Demand	L/s	3.65
Treatment Capacity (20hrs)	L/s	10.5

1.1.4 Raw Water Source

The Mary Jane Reservoir located at NE 9-4-9 W is reported to have approximately 1,150 acre-feet of storage with an average annual inflow of 295 acre-feet from the surrounding watershed. The Town has a Water Rights Act Licence to withdraw 95 acre-feet of water from the reservoir annually. Raw water from the reservoir initially flows by gravity via a 250 mm (10") diameter pipeline to a wet-well located below the raw water pumphouse. Raw water is pumped from the wet-well via two alternating submersible pumps to the WTP via a 150 mm (6") diameter asbestos cement pipeline. Two submersible pumps with a rated power of 3.7 kW (5 HP) are located in the wet-well at the pumphouse.

A concrete overflow weir is located along the south shore of the reservoir. The reservoir level is regulated as excess water flows into the overflow weir and drains to a stream on the opposite side of the berm.

The reservoir is equipped with aeration equipment that operates during the winter to keep a portion of the reservoir free of ice.

1.1.5 Water Rights Act

The Town of Manitou Water Rights Act Licence No. 2009-085 indicates the maximum rate at which water may be diverted shall not exceed 5 L/s and the total quantity of water diverted in any one year shall not exceed 117.18 cubic decametres.

It is estimated that the Town of Manitou currently uses approximately 79 dam³/year and pumps at a rate of approximately 6.3 L/s on a peak day.

In order to meet peak day demands from a rural water system in the RM of Pembina as well as the projected 20 year population for the Town of Manitou an amendment to the current Water Rights Act Licence will be required. A raw water pumping rate of 14 L/s and a yearly withdrawal of 138 dam³ will be required. These numbers will be verified when final design of the WTP is completed.

1.1.6 Water Quality

The Office of Drinking Water (ODW) currently conducts annual audits of all public water systems which includes sampling and chemistry analysis every three years for secure groundwater sources and once per year for surface water and GUDI supply systems. The following table outlines water quality parameters including hardness, iron, manganese, trihalomethanes (THM), total dissolved solids (TDS), total organic carbon (TOC), colour, and turbidity. In addition the operator tests chlorine residuals daily on the treated water.

The raw water has high hardness, turbidity, total dissolved solids and total organic carbon. The existing treatment system does not reduce all parameters below the maximum acceptable concentration or the aesthetic objective. The proposed treatment system upgrade will address all the parameters that exceed the GCDWQ. At present, treated water quality parameters exceeding the GCDWQ include THMs, total dissolved solids, and turbidity.

Table 1.2 Water Quality Results (2009-2010 ODW Sampling)

Parameter	Unit	Raw Water	Treated Water	GCDWQ
Hardness (Total) as CaCO ₃	mg/L	301-358	170-213	≤ 200/500 ^a
Iron	mg/L	0.107-0.056	<0.02	≤ 0.3
Manganese	mg/L	0.299-0.253	0.003-0.0116	≤ 0.05
THMs	µg/L		149-198	≤ 100^b
Total Dissolved Solids	mg/L	584-638	560-652	≤ 500
Total Organic Carbon	mg/L	6.4-10.5	5.6-13.5	
True Colour	CU	30-60	<5.0-5.0	≤ 15
Turbidity	NTU	3.10-1.82	0.75-0.21	≤ 0.3 / 0.1^c

^a Hardness levels greater than 200 are considered poor but tolerable. Hardness levels greater than 500 are generally considered unacceptable

^b THM based on average of quarterly samples

^c Turbidity limits as follows: 1.0 NTU for slow sand or diatomaceous earth filtration, 0.3 NTU for chemically assisted filtration, and 0.1 NTU for membrane filtration

1.1.7 Compliance Plan

An engineering assessment was completed by AECOM in February 2009. The assessment concluded that the raw water source is generally good and only exceeds the potable water standards for turbidity, colour and manganese. Bacteriological standards are being met. The operating licence states that the compliance plan should be updated and re-submitted to address:

- a) total trihalomethanes and bromodichloromethane in the distribution system.
- b) 99.9% (3-log) reduction or inactivation of *Cryptosporidium* oocysts and *Giardia lamblia* cysts.
- c) turbidity

2.0 Description of Proposed Development

2.1 Project Description

The proposed development includes the construction of a 10.5 L/s ultrafiltration and reverse osmosis WTP. The treatment system will be required to have a reject pipeline whereby highly mineralized reject water will be discharged to a nearby drain. A new WTP building will be constructed to house the new treatment equipment. Construction of a new building will allow for simplified construction during the equipment upgrading process and will allow the existing plant to provide the Town with treated water. The new building will be constructed on a reinforced concrete foundation which includes an underground rapid mix tank, break tank,

reject water tank, as well as treated water storage and a distribution pumping well. It is beneficial to place the mixing tank, break tank, and reject water tank under the WTP as it reduces the building's overall footprint.



FIGURE 2.1 - LOCATION OF WTP

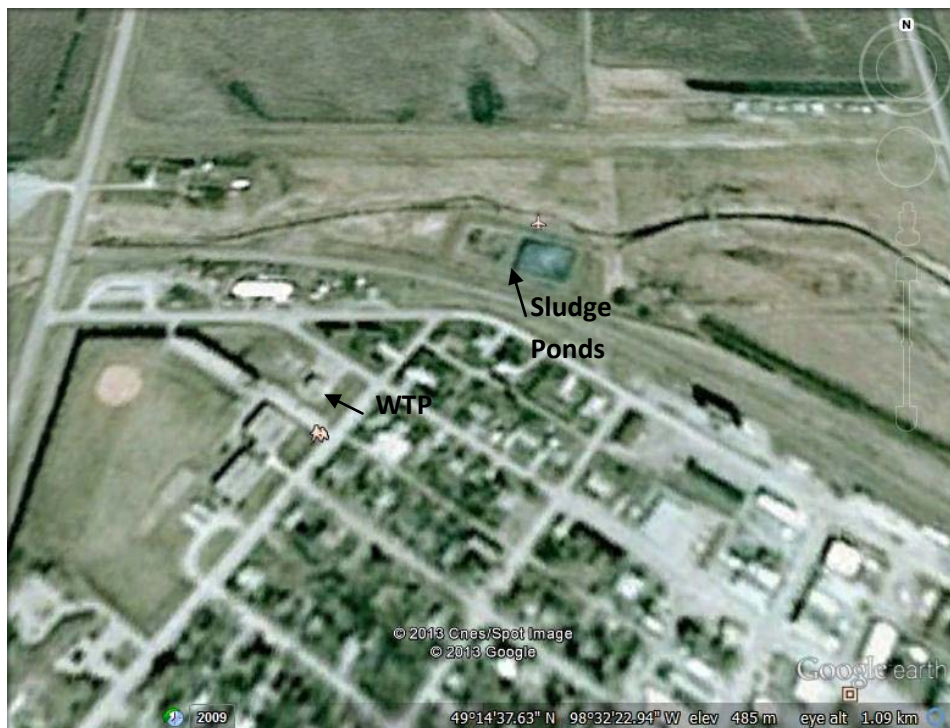


FIGURE 2.2 - LOCATION OF SLUDGE PONDS

This EAP pertains to the storage and discharge of the membrane unit reject to the storage pond and then to a 1st order drain which drains into Mary Jane Creek. Highly mineralized reject water generated from the membrane treatment will be pumped to the existing lime sludge ponds which will no longer be needed for their current purpose. The reject water will be discharged twice per year into the adjacent drain. Based on a reject stream of 3.42 L/s and an operating day of 20 hours with 4 hours for WTP maintenance, the total pond volume required for 6 months of reject is approximately 44,940 m³. The existing sludge ponds do not provide enough capacity to hold the required volume for 180 days, and will be deepened and expanded to the east. The existing forcemain from the WTP to the reject ponds is 100 mm which will be sufficient to handle the reject water.

A new 250 mm raw water pipeline will be constructed from the Mary Jane Reservoir to the WTP. The length of the new pipeline will be approximately 11.5 km. A preliminary pipeline route can be found in Appendix A.

2.1.1 Operation and Maintenance

The Town of Manitou will be responsible for operation and maintenance of the WTP. The RM of Pembina will be responsible for maintaining the rural water pipelines. In addition, the operator will be required to submit bi-weekly water samples for bacteriological testing in accordance with the Manitoba Drinking Water Quality Standards Regulation. An operator will also be required to read water meters on a quarterly basis and respond to maintenance issues related to the system.

2.2 Certificate of Title

The proposed raw water pipeline will be constructed in municipal and provincial right of ways and private easements if required. The WTP will be located on municipal owned land in 30-03-08 W, at the location of the existing WTP. This land is registered under Her Majesty The Queen. The Certificate of Title for the sludge ponds are provided in Appendix F.

2.3 Existing and Adjacent Land Use

The proposed land for the development will be on municipal owned land at the existing WTP property. Adjacent land is used for agriculture. Existing and adjacent land use will not change as a result of this development. The raw water pipeline will be constructed in municipal and provincial right of ways and private easements if required.

2.4 Land Use Designation and Zoning

Zoning designation for the pipelines on municipal owned land is not applicable.

2.5 Project Schedule

The project is scheduled to commence and be completed in the 2014/2015 construction year depending on the receipt of all approvals.

2.6 Project Funding

This project is eligible for cost sharing between the MWSB and the Town of Manitou subject to all approvals in place and availability of funding.

2.7 Regulatory Approvals

The following branches/departments will be provided with copies of plans and specifications for information purposes and for the purposes of approvals and agreements:

Manitoba Conservation and Water Stewardship
Office of Drinking Water
Manitoba Infrastructure and Transportation

The contractor will be required to contact MTS, Hydro and gas utilities for utility locations and approvals.

2.8 Public Consultation

A public consultation will be held in the near future to discuss the proposed plant upgrades to the citizens of the Town of Manitou. It is not expected that there will be major concerns forwarded to the municipality regarding the upgrades.

2.9 Storage of Petroleum Products and Other Chemicals

Fuel will not be stored on-site at any time or location along the proposed construction route or near any water source. Fuel will be supplied by fuelling trucks which are regulated under The Storage and Handling of Petroleum Products and Allied Products Regulation. Records of fuel volumes and an emergency response plan which includes spill prevention, notification and response will be implemented. No fuelling activities will be permitted within 100 m of watercourses during construction. During construction, the contractors will be required to ensure that all equipment is properly maintained to prevent leaks of fuel and motor fluids.

There will be no storage of petroleum products or other chemicals at the reservoir during operation of the proposed development. Maintenance activities for the wells do not require refuelling on-site. Chemicals associated with the operation of the plant (sodium hypochlorite & sodium hydroxide) will be stored in designated areas within the plant complete with spill containment. General household cleaning products will also be stored at this site.

3.0 Physical Environment

3.1 Physiographic Setting and Climate

The Town of Manitou is located in southern Manitoba on Provincial Trunk Highway #3, approximately 80 km south of the City of Portage la Prairie. The Town currently has a population of approximately 800 people.

Based on Environment Canada climatic data, the mean annual temperature in the area is 5.7 degrees Celsius with below zero average daily temperatures from November through March. Mean annual precipitation as recorded at Morden, MB, the nearest weather station, is approximately 343 mm.

TABLE 3.1 ENVIRONMENT CANADA HISTORICAL WEATHER – MORDEN, MANITOBA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Average
Temperature °C													
Daily Average	-8.6	-6.5	2.4	6.7	12.7	18	22.7	19.8	13.9	5	-4.8	-13.5	5.7
Daily Max	-3.9	-0.7	7.9	13.3	19	24.4	28.9	27.2	21.4	8.9	-1	-9.5	11.33
Daily Min	-13.3	-12.2	-3.1	-0.2	6.3	12	16.5	12.4	6.4	0.9	-8.5	-17.4	-0.017
Precipitation (mm)													Total
Precipitation	1.2	6.4	35.2	17.8	45.6	70	30.2	26.9	0.7	80	21	7.5	343

3.2 Hydrogeology

The investigations of the hydrogeology of the area have identified the main aquifer as Odanah shale in the Darlingford and Manitou North area. Test holes show the presence of clay, till, clay till, shale and sand. The three aquifer types in this area include bedrock shale, sand and gravel in the drift, and sand and gravel in a bedrock channel. The whole area in Manitou North is underlain by Odanah shale (Pedersen, Arnie).

3.3 Hydrology

The Little Pembina River and the Deadhorse Creek run through the RM. Within the immediate area of the reservoir and WTP site, all lands amenable to agricultural use have been cultivated.



FIGURE 3.1 – HYDROLOGY FEATURES NEAR THE PROPOSED DEVELOPMENT

3.4 Fish and Fish Habitat

Potential fish habitat in the project area includes the Little Pembina River, the Deadhorse Creek and associated tributaries. A list of fish species found in the Little Pembina River and the Deadhorse Creek has been included in Appendix B.

3.5 Wildlife Habitat and Vegetation

The project area is located within the Prairie Ecozone of the Southwest Manitoba Uplands and Aspen Parkland ecozones (Agriculture and Agri-Food Canada). The climate is continental, subhumid to semiarid with short hot summers, long cold winters, low levels of precipitation, and high evaporation. The Aspen Parkland is associated with groves of trembling aspen, balsam poplar, intermittent grasslands, and Black Chernozemic soils. The relatively high natural fertility and good moisture-holding capacity of the area's Chernozemic soils make them highly productive for agriculture. Characteristic mammals include mule deer, white tail deer, elk, coyote, pronghorn antelope, badger, white-tailed jack rabbit, Richardson's ground squirrel, and northern pocket gopher. Bird species include ferruginous hawk, Swainson's hawk, American avocet, and burrowing owl. Other birds include great blue heron, black-billed magpie, northern oriole, veery, and brown thrasher. (National Ecological Framework Report).

3.6 Socioeconomic

The project area is located within the Town of Manitou. The Town has an area of approximately 2.94 km² and a population of approximately 808 (2011 Census). The main economic base is agriculture.

3.7 Heritage Resources

Most project activities will occur in previously disturbed municipal and provincial right of ways. The proponent will work with Heritage Resources Branch to mitigate any concerns as required.

4.0 Potential Environmental Effects

An environmental effect includes any change that the project may cause to the environment. Environmental effects were identified from interactions between proposed project activities and environmental components. Mitigation measures and follow-up activities were identified for environmental effects determined to be adverse.

4.1 Air Quality

During construction, dust will be raised by construction equipment and there will be gaseous and particulate emissions from the construction equipment. Water spraying is an important, common and practical procedure that would be applied as required to alleviate potential dust problems. Emissions of gases and particulates would be minimized by keeping machinery in good working order. Any effects would be localized, temporary and insignificant. During operation of the development there will be no releases of pollutants to the air.

4.2 Soils

During construction, there is a risk of fuel or lubricant spills from heavy equipment and vehicle operation. The storage of fuel or lubricants within the area of the water supply will not be allowed. Therefore, the potential spills will be very small in size and standard construction spill clean-up procedures, including the removal of any impacted soil, will be used to prevent impact.

During operation, project activities are limited to regular monitoring and maintenance activities that have a negligible effect on soil disturbance and compaction because of low vehicle traffic and the use of established routes to access the wells and water treatment plant. Regular monitoring and maintenance activities will have a negligible effect on soil contamination since fuel trucks and other hazardous substances will not be brought on-site on a regular basis. The potential adverse effect on soil quality is assessed to be minor.

4.3 Surface Water, Fish and Fish Habitat

Minor and short term impacts on surface water may occur as a result of construction activity in road allowance ditches during runoff events. The impact on surface water would include sediment that may be eroded from excavation activities, minor engine leaks and potential fuel spills should runoff events occur during construction. Horizontal directional drilling will be conducted to install the pipeline at the drain and river outlets. This will eliminate excavation within the riparian zone and minimize impacts. There is potential for some loss of drilling mud to surface water. Impacts to fisheries and fish habitat are considered minor.

The Water Quality Management Section of Manitoba Conservation and Water Stewardship was contacted, and there is no water quality available for Mary Jane Creek or the Pembina River. However, raw water is taken from the Mary Jane Reservoir, which is upstream from the Mary Jane Creek where the membrane reject will be discharged. Raw Water Chemistry has been included in Appendix H.

Membrane concentrate consists mainly of hardness causing minerals such as calcium and magnesium. The projected concentrate water quality is summarized in Table 4.1 and the complete results are displayed in Appendix H. The annual estimated concentrate discharged to the 1st order drain is approximately 45,000 m³ (45 dam³). Membrane concentrate has been discharged to surface water bodies in other locations across Manitoba without having significant adverse effects to water quality. Concentrate discharged to the drain will cause slight increases in hardness to the surface water in the mixing zone at the point of discharge. The Town of Manitou will perform long term sampling of the drain water to verify water quality impacts.

Table 4.1 Water quality results

Parameter	Unit	Projected Reject	Mary Jane Reservoir
Hardness	mg/L as CaCO ₃	1789.5	358
TDS	mg/L	3437.3	638
Sodium	mg/L	308.0	61.9
Sulphate	mg/L	1336.9	268
Fluoride	mg/L	0.8	0.31
Chloride	mg/L	295.3	20.8

*2010 Raw Water Chemistry is reported as that is what reject projections were based on. 2012 Water Quality Results can be found in Appendix H.

Impacts to fisheries and fish habitat are considered minor.

No water level or inflow data was available for the drain that would be used for the disposal of reject water. The drain flows into the Mary Jane Creek which flows into the Pembina River. There is a hydrometric flow station (05OB001) located on the Pembina River near La Riviere, MB. Table 4.2 provides the monthly average flows from 1963-2011. As expected the flows are highest in April with an average flow of approximately 31,200 L/s and flows decrease in the fall and winter.

The operation of a RO membrane plant will result in minor impacts to the Pembina River as a result of concentrate being wasted during water production. The impacts are considered minor given the poor water quality of this drain and the low flow rate of the membrane concentrate. Based on the proposed design treatment capacity, the concentrate flow rate to the 1st order drain is estimated as 25% of the average raw water demand (0.25×14 L/s) which equals 3.42 L/s.

Table 4.3 provides the impact of the RO membrane concentrate disposal on Pembina River during periods of low and high flow. The low and high flows are based on the monthly averages over a 48 year period as previously shown in Table 4.2. During high flow conditions, the impact of concentrate discharge is negligible. During low flow conditions there is a small increase in TDS, Sodium, Chloride and Potassium.

Table 4.2 Monthly Mean Discharge at Pembina River (m³/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1963	-	-	0.717	3.22	3.83	3.88	2.1	2.98	1.6	0.686	0.346	0.036	-
1964	0	0	0	5.45	7.13	1.85	0.488	0.653	0.441	0.326	0.211	0.023	1.38
1965	0.002	0	0	8.7	15	10	3.2	1.45	1.67	1.84	1.17	0.603	3.65
1966	0.165	0	2.71	15.9	12.5	7.31	4.25	1.47	0.369	0.088	0.067	0.022	3.75
1967	0.047	0.081	0.438	7.88	11.1	4.61	0.954	0.286	0.119	0.075	0.092	0.032	2.15
1968	0	0	1.53	1.89	1.65	0.803	0.508	2.97	10.2	9.47	4	1.23	2.85
1969	0.282	0.334	0.68	89.1	37.8	11.9	6.72	3.6	2.35	1.47	1.12	0.532	12.9
1970	0.249	0.114	0.089	16.2	39.4	22.5	13.6	4.9	2.64	1.91	1.04	0.199	8.61
1971	0.021	0.014	0.015	30.8	27.5	9.32	7.75	6.48	3.38	2.01	1.13	0.558	7.44
1972	0.524	0.099	2.92	25.6	18.1	6.91	4.77	4.04	2.49	1.31	0.769	0.064	5.62
1973	0.003	0.002	0.515	1.9	1.18	0.797	1.42	1.47	1.24	1.33	0.88	0.611	0.951
1974	0.25	0.31	0.579	70.5	76.4	35.6	9.1	2.39	1.49	0.746	0.392	0.178	16.5
1975	0.11	0.016	0.024	4.92	33.1	13	4.97	1.74	0.93	0.668	0.348	0.186	5.04
1976	0.216	1.74	0.652	68	38.2	10.2	2.19	0.826	0.479	0.259	0.106	0.021	10.2
1977	0.013	0.013	0.037	0.158	0.925	0.303	0.046	0.007	0.221	0.085	0.033	0.022	0.156
2001	-	-	0.524	39.8	32.2	10.5	3.76	2.07	0.877	0.44	-	-	-
2002	-	-	-	-	0.698	2.59	1.44	0.659	1.72	1.13	-	-	-
2003	-	-	0.581	2.41	2.25	0.939	0.391	0.316	0.225	0.123	-	-	-
2004	-	-	-	-	12.5	11.6	6.13	2.83	2.76	2.56	-	-	-
2005	-	-	1.22	35.4	21.1	14.8	63.6	26.7	9.18	4.53	-	-	-
2006	-	-	2.06	97.1	31.7	9.7	2.26	0.943	-	-	-	-	-
2007	-	-	-	13.4	7.52	7.15	10.7	6.41	2.22	1.03	-	-	-
2008	-	-	-	1.58	-	1.53	0.555	0.746	0.758	0.632	-	-	-
2009	-	-	1.38	89.6	36	13.5	6.45	2.93	1.24	0.923	-	-	-
2010	-	-	2.22	13.7	10.4	6.61	9.05	5.44	6.77	7.96	-	-	-
2011	-	-	3.07	106	69	60.7	32.5	13.6	4.9	1.91	-	-	-
Mean	0.135	0.194	0.998	31.2	21.9	10.7	7.65	3.77	2.41	1.74	0.78	0.287	5.8
Max	0.524	1.74	3.07	106	76.4	60.7	63.6	26.7	10.2	9.47	4	1.23	16.5
Min	0.000*	0.000*	0.000*	0.158	0.698	0.303	0.046	0.007	0.119	0.075	0.033	0.021	0.156

Table 4.3 Effects of Reject on River Quality

Parameter	Reject	Mary Jane Reservoir	Low Flow	High Flow
	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Hardness	1789.5	358	393	358
TDS	3437.3	638	707	638
Sodium	308.0	61.90	68	62
Potassium	49.3	9.94	11	10
Sulphate	1336.9	268.00	294	268
Chloride	295.3	20.80	28	21
Fluoride	0.8	0.31	0	0

4.4 Water Quality

Raw water quality can be impacted by surface activities. Mitigation measures are necessary to protect water quality during construction activities. The proposed activities are unlikely to result in adverse changes to water quality.

4.5 Groundwater Levels

Since the water source is surface water, no groundwater monitoring is required.

4.6 Vegetation

Construction will occur primarily within municipal right of ways that are previously disturbed, regularly managed and comprised primarily of grasses. As the areas are already disturbed, they are unlikely to contain rare plant species. The amount of vegetation disturbance is expected to be minimal.

During operation, monitoring and maintenance activities including access to the well sites will be restricted to designated and previously disturbed areas. Potential effects to vegetation are considered to be negligible.

4.7 Wildlife Habitat and Vegetation

The construction and operation activities associated with this project will be limited to areas already developed for urban or agricultural uses. The potential adverse effects of wildlife habitat loss were assessed to be negligible to minor.

4.8 Noise and Vibration

During the construction phase of the project, there will be several sources of sound emissions including equipment used for construction. The types of noises heard due to construction are dominated by equipment engines. However, miscellaneous short term impact noises (ie: dump truck gates, back hoe buckets) are often heard. The noise will be in addition to regular community and highway activities, and the effects are considered minor.

Scheduling of various site activities can minimize the impact of noise. This would include scheduling construction for day-time hours to avoid sleep disturbance and the disruption of evening domestic activities. All equipment used on site will be fitted with appropriate mufflers and will be maintained in good working order to minimize noise levels.

4.9 Employment/Economy

Socio-economic implications are not expected as a result of environmental impacts as impacts are considered minor and short-term. Some economic implications may exist for the Town due to the costs of developing the water system, however, the Town will have a sustainable potable water supply to meet future demands. There may be some local economic benefit during construction.

The proposed project will address the issue of poor water quality and an aging WTP. The potential effects of the project on employment and the economy were assessed to be positive.

4.10 Human Health and Well Being

The potential adverse effects of the project on human health are assessed to be negligible to minor. Short term temporary increases in noise and dust emissions will occur during construction that are considered to be minor effects. During operation, there will be a minor increase in vehicular traffic associated with monitoring and maintenance activities. The potential effects are considered minor.

The project will result in the construction of a water treatment plant designed and operated to produce a treated water supply to meet current water quality standards. The effects of this on human health and well being are considered positive.

4.11 Climate Change

There are no predicted impacts to climate as a result of the project activities.

5.0 Environmental Management Measures

Environmental management practices proposed to prevent or mitigate environmental effects that were determined to be adverse are identified and described below.

5.1 Air Quality

Emissions resulting from construction and transportation equipment may be mitigated by the utilization of well maintained and operating vehicles while reducing unnecessary vehicle idling.

The impact of dust may be mitigated by the use of an approved dust suppressant, limiting construction during high wind periods, and re-establishment of vegetation as soon as possible.

5.2 Soils

Mitigation to potential impacts to soil by contamination from petroleum products include preparation of an emergency response plan for potential spills, use of spill clean-up equipment and materials, using properly maintained equipment, and using appropriate fuelling equipment.

Re-establishment of vegetation as soon as possible after disturbance will limit loss of soil due to wind or water erosion. Backfilling with soil stockpiles as soon as possible and minimizing the amount of soil disturbance can be implemented.

5.3 Surface Water

Mitigation of surface water issues may be achieved by limiting open cut trenching to within 30 m ahead or behind the pipe laying, redirecting surface water runoff, pumping accumulated water to adjacent ditches and providing erosion control practices as required.

Petroleum leaks or spills will be mitigated by use of properly maintained equipment, use of spill clean-up equipment and materials, and use of appropriate fuelling equipment. A prepared emergency response plan can be implemented in the event of a significant spill. In the event of a reportable spill, Manitoba Conservation and Water Stewardship will be notified through the emergency response line and appropriate measures will be taken according to Manitoba Conservation and Water Stewardship requirements.

A 100 m setback to watercourses will be maintained for fuelling activities. Horizontal directional drilling will be implemented at watercourse crossings. Vehicles will avoid entering the riparian zones. Re-establishment of vegetation will occur as soon as possible on areas of disturbed soil.

Chlorinated water used to disinfect pipelines will be de-chlorinated and not released to surface waters.

5.4 Groundwater

Mitigation of potential groundwater impacts from petroleum products can be mitigated as described in Section 5.3.

5.5 Vegetation and Wildlife

Re-establishment of vegetation will occur as soon as possible on disturbed areas. Impacts to wildlife habitat can be limited by minimizing the area of construction, soil disturbance and vegetation disturbance. Other impacts resulting from dust or smoke will be minimized as previously indicated. Noise disturbance will be limited by use of muffling vehicles and equipment, limiting idling and limiting the construction area.

5.6 Fisheries

Fisheries impacts will be minimized by implementing practices to reduce soil and contaminate runoff as previously mentioned in Sections 5.3 and 5.5. In addition, horizontal directional drilling will occur under all watercourses containing water. The required excavation needed to introduce the drilling equipment will be maintained outside watercourse riparian zones.

5.7 Noise and Vibration

Limiting any noise-creating activities, including regular maintenance and monitoring activities to normal working hours, and limiting unnecessary long-term idling can mitigate any potential increased noise and vibration effects.

5.8 Water Conservation

Water conservation measures include metering and pricing of water. Water conservation information in water bill mailings can be implemented. Leak detection will consist of reconciling on a quarterly basis the volume of water pumped and charged to ratepayers. Since these services are metered, abnormalities can be identified and rectified.

5.9 Socio-Economic Implications

There are no known negative environmental socio-economic impacts that need mitigation. Since the proposed development would provide a reliable healthy drinking water supply, it would be expected to enhance quality of life and economic viability for the Municipality. The proposed project may provide some economic benefits to the area for local businesses and employment opportunities during construction phase.

6.0 References

Agriculture and Agri-Food Canada. A National Ecological Framework for Canada 13 June 2012
<<http://sis.agr.gc.ca/cansis/nsdb/ecostrat/index.html>>

Environment Canada. Historical Weather, Climate Normals and Averages, Morden Manitoba. 26 July 2013. < http://climate.weather.gc.ca/climateData/dailydata_e.html?StationID=29593>

Environment Canada. Real Rime Hydrometric Data. Pembina River Near La Riviere, MB. 30 July 2013.
<http://www.wateroffice.ec.gc.ca/graph/graph_e.html?stn=05OB001>

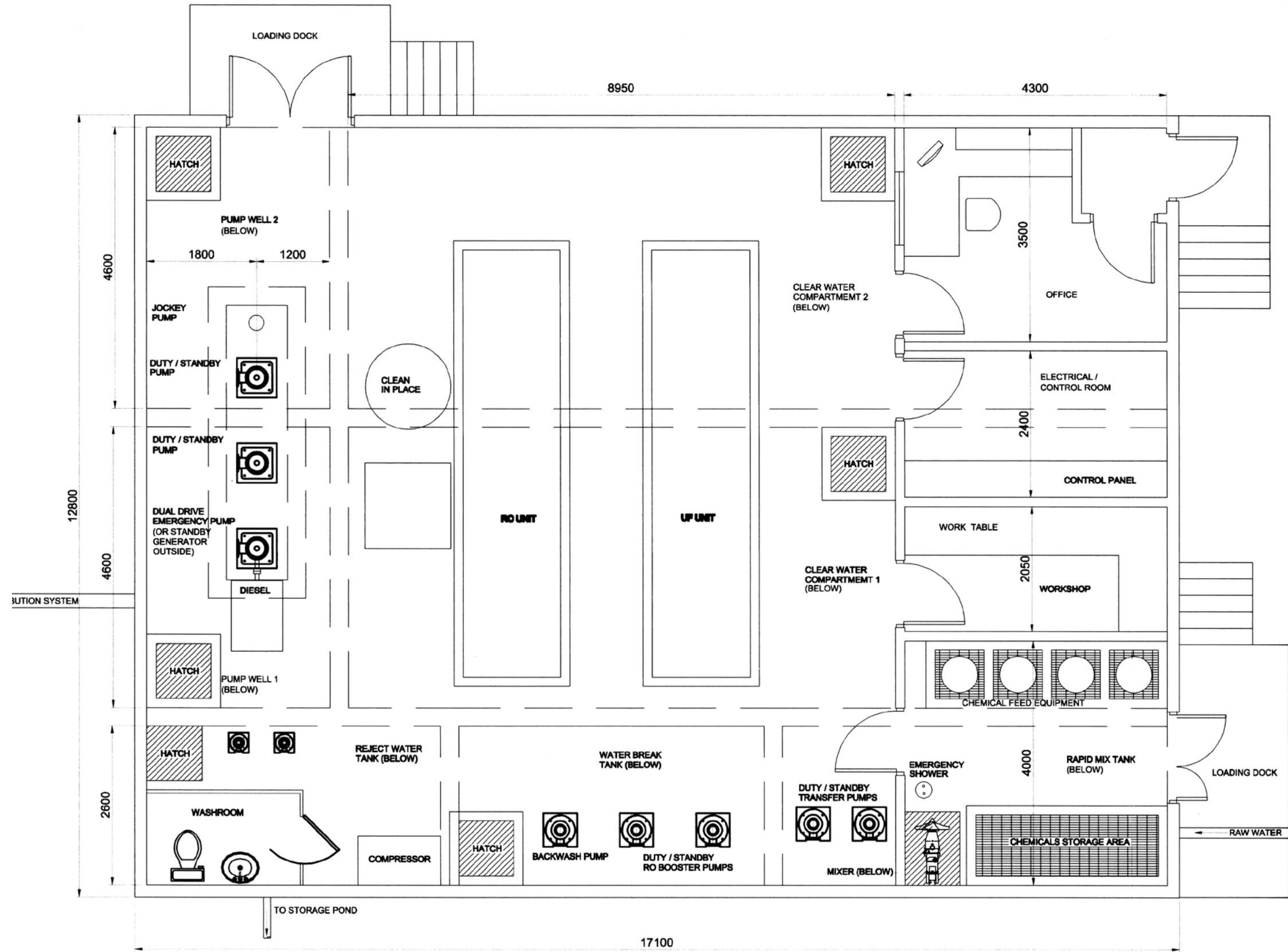
Pedersen, Arnie, P.Eng. RM of Pembina Test Drilling Report. Manitoba Water Services Board files, 2005.

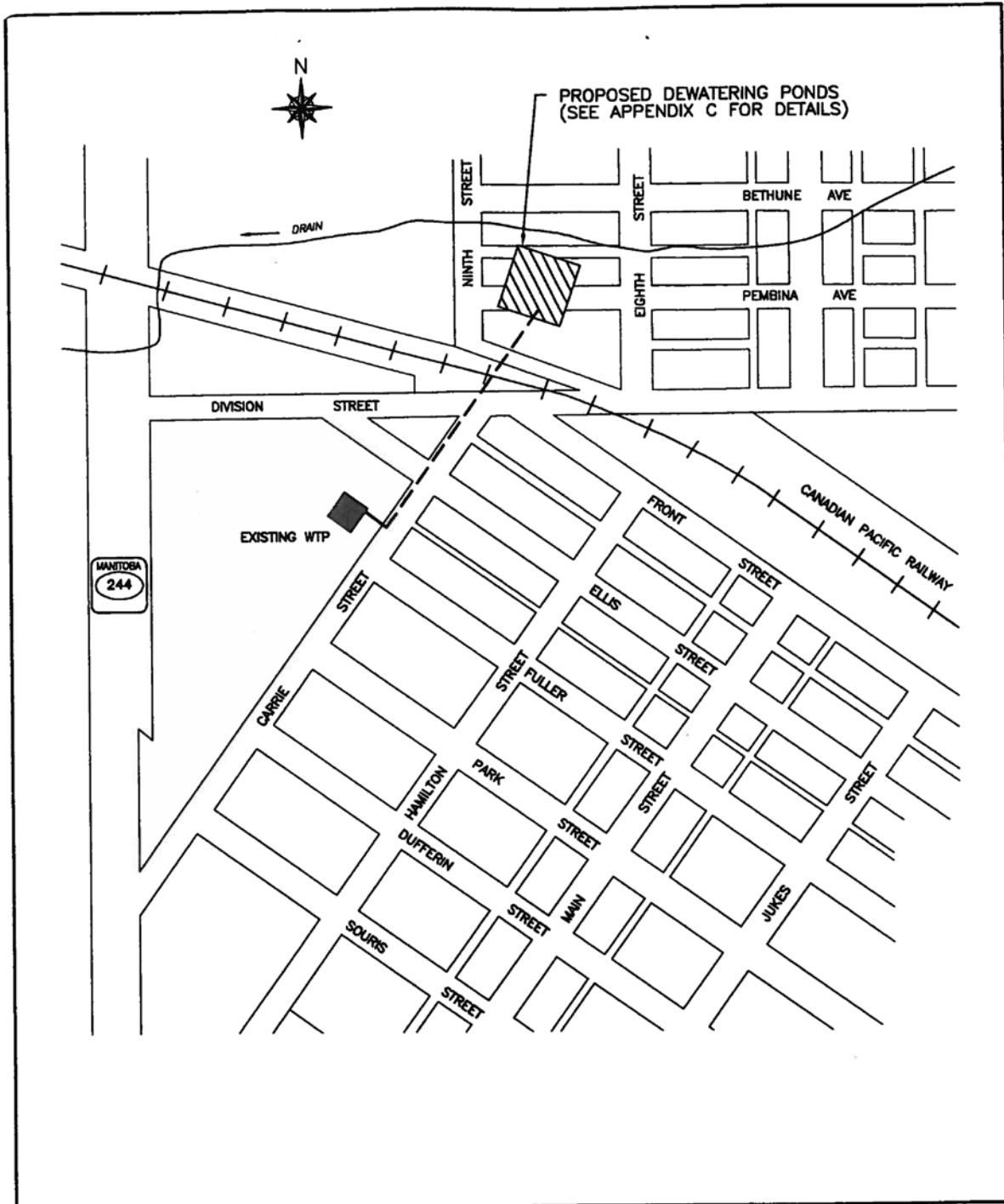
Appendix A

Preliminary Floor Plan

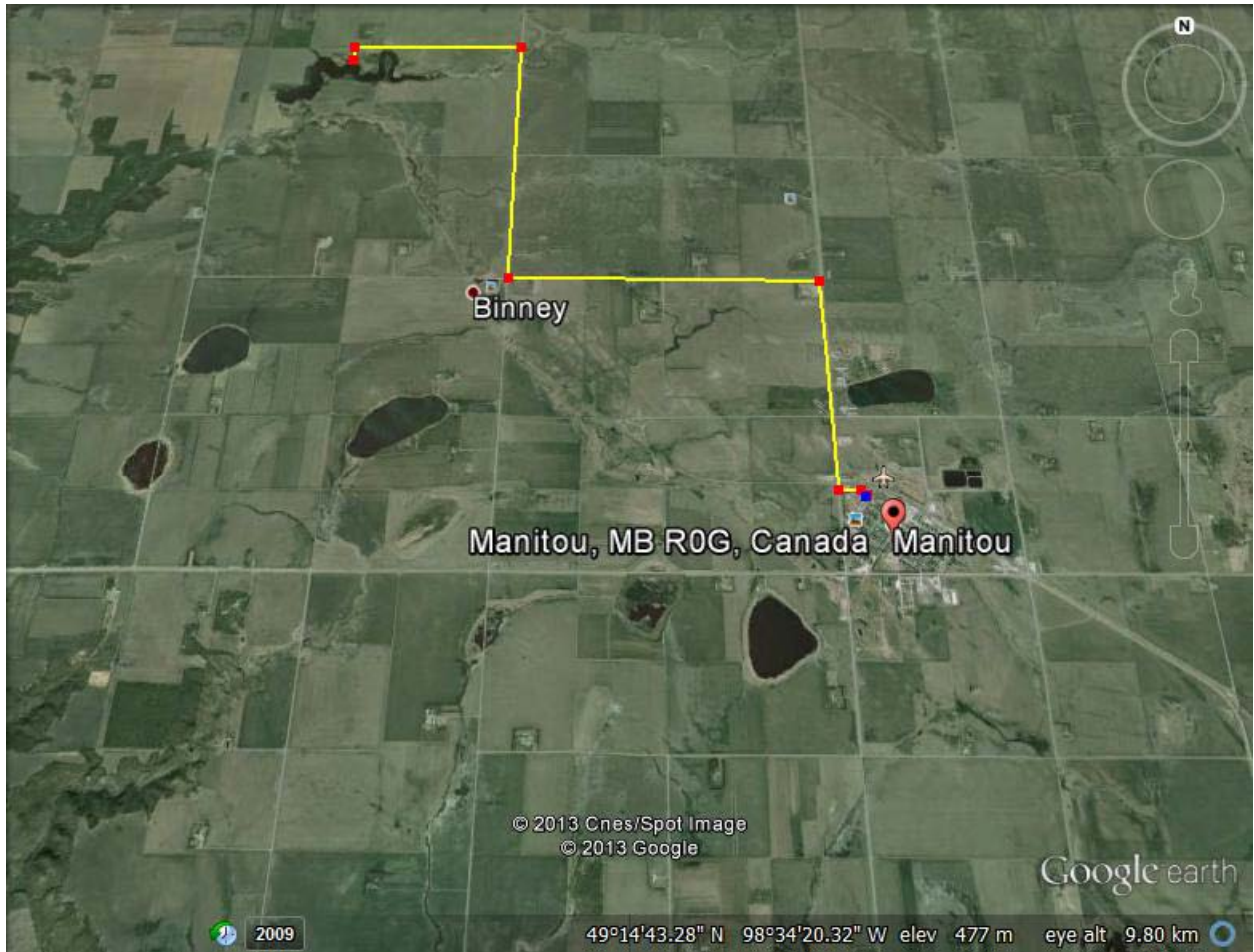
Existing Sludge Ponds Site Plan

Preliminary Raw Water Pipeline Route



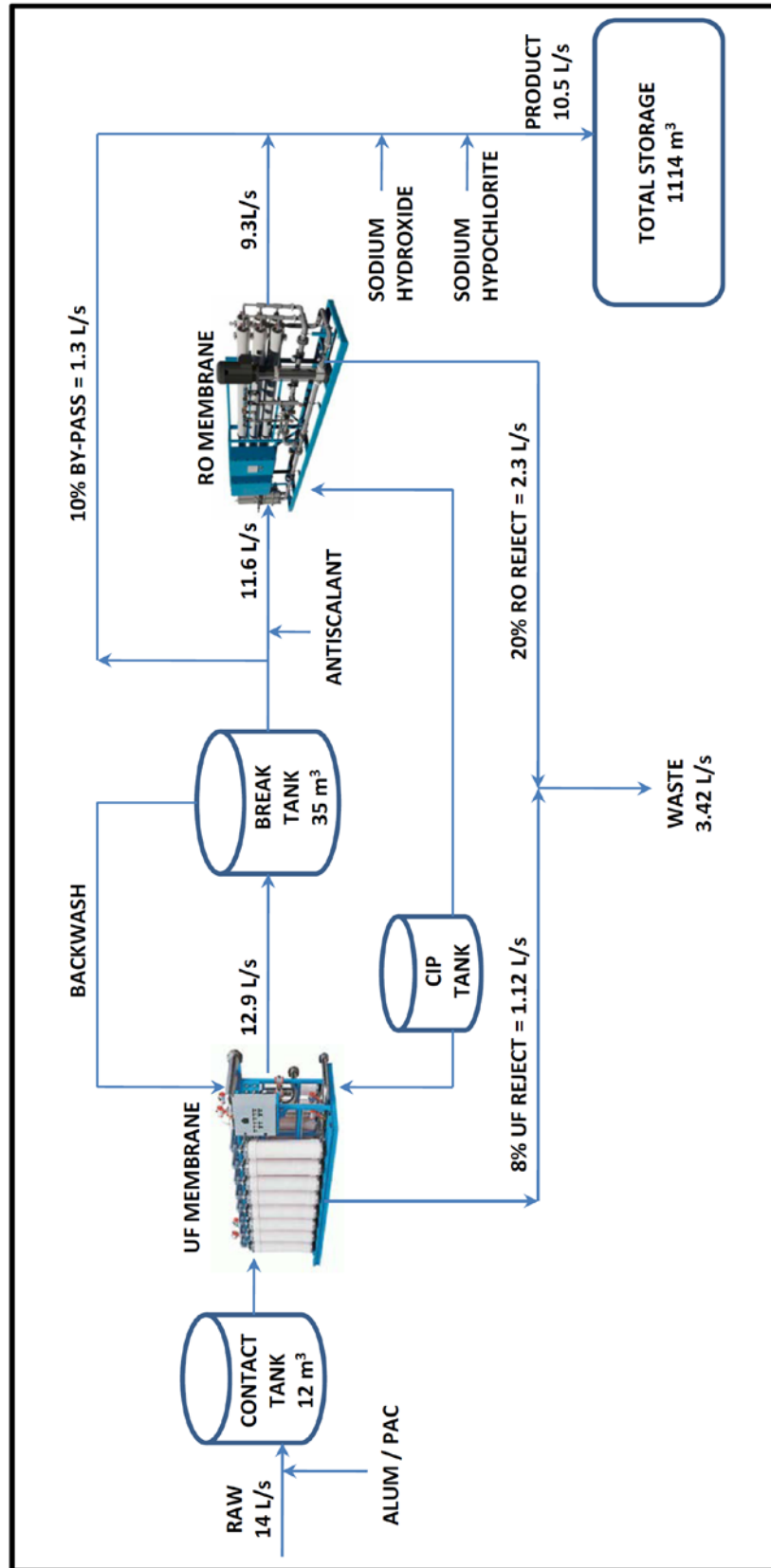


PROVINCE OF MANITOBA THE MANITOBA WATER SERVICES BOARD DEPARTMENT OF INTERGOVERNMENTAL AFFAIRS			TOWN OF MANITOU SITE PLAN PROPOSED SLUDGE PONDS		
DRAWN RWN	CHECKED R FOREMAN	DATE 00-10-04	SCALE NTS	DRAWING 1 of 1	FILE NO. APPENDIX B



Appendix B

Membrane Flow Diagram



Manitou Proposed Treatment Process – Flow Schematic

Appendix C

Fish Species in the Little Pembina River and Deadhorse Creek

Waterbody: Deadhorse Creek

Provincial Waterbody Id # 2574.00 Watershed 5OCC Region Central District Morris Map Sheet 62H03 Latitude: 49 14 42
 Longitude: 97 22 50

BIOLOGY

BLACK CRAPPIE <i>Pomoxis nigromaculatus</i>	Unknown
BLACKNOSE DACE <i>Rhinichthys atratulus</i>	Unknown
BROOK STICKLEBACK <i>Culaea inconstans</i>	Common
CREEK CHUB <i>Semotilus atromaculatus</i>	Common
FATHEAD MINNOW <i>Pimephales promelas</i>	Common
LAKE CHUB <i>Coesius plumbeus</i>	Common
NORTHERN PIKE <i>Esox lucius</i>	Unknown
SILVER REDHORSE <i>Moxostoma anisurum</i>	Unknown
WALLEYE <i>Stizostedion vitreum</i>	Common
WHITE SUCKER <i>Catostomus commersoni</i>	Unknown

Creel

Year	Species	Catch/Unit Effort*
------	---------	--------------------

*Catch/Unit Effort = Catch/Hour

Waterbody: Little Pembina River

Provincial Waterbody Id # 2242.00 Watershed 5OBA Region Western District Manitou Map Sheet 62G01 Latitude: 49 5 1
 Longitude: 98 22 36

BIOLOGY

BLACKNOSE DACE <i>Rhinichthys atratulus</i>	Common
BROOK STICKLEBACK <i>Culaea inconstans</i>	Common
CENTRAL MUDMINNOW <i>Umbra limi</i>	Unknown
COMMON SHINER <i>Notropis cornutus</i>	Unknown
CREEK CHUB <i>Semotilus atromaculatus</i>	Common
FATHEAD MINNOW <i>Pimephales promelas</i>	Common
NORTHERN PIKE <i>Esox lucius</i>	Unknown
PEARL DACE <i>Semotilus margarita</i>	Unknown
WHITE SUCKER <i>Catostomus commersoni</i>	Unknown

Creel

Year	Species	Catch/Unit Effort*
------	---------	--------------------

*Catch/Unit Effort = Catch/Hour

Water Chemistry

Code	Samples	Low	High	Average	MSWQO LO	MSWQO HI	CWQG LO	CWQG HI
Sample Dates: 2004-06-04								
Inorganic								
Dissolved Oxygen	1			6.7200			5.000 mg/L	9.500 mg/L
Ph (Ph Units)	1			7.5500	6.500 unit	9.000 unit	6.500 unit	9.000 unit
Physical								
Conductivity (mho/cm)	1			613.0000				
Temperature (C)	1			17.1000				
Turbidity (NTU Or JTU)	1			0.0000				
Sample Dates: 2003-06-05								
Inorganic								
Dissolved Oxygen	1			6.1600			5.000 mg/L	9.500 mg/L
Ph (Ph Units)	1			8.1300	6.500 unit	9.000 unit	6.500 unit	9.000 unit
Physical								
Temperature (C)	1			16.8000				
Turbidity (NTU Or JTU)	1			3.9100				
MSWQO = Manitoba Surface Water Quality Objectives CWQG = Canadian Water Quality Guidelines								

Appendix D

Water Rights Licence

MG-14853 (English)

**Licence to Use Water for
Municipal
Purposes**



Project: Manitou, The Town of

Issued in accordance with the provisions of
The Water Rights Act and regulations made thereunder.

Licence No.: **2009-085**
(Original Lic. No.: 64-008)
U.T.M.: Zone 14 527698 E
5459913 N

Know all men by these presents that in consideration of and subject to the provisos, conditions and restrictions hereinafter contained, the Minister of Water Stewardship for the Province of Manitoba does by these presents give full right and liberty, leave and licence to **The Town of Manitou** of the **Rural Municipality of Pembina** in the Province of Manitoba (hereinafter called "the LICENSEE") to divert and impound water in the **Mary Jane Reservoir** for **municipal** purposes by means of a pumping installation and any other appurtenances (hereinafter called "the WORKS"), the WORKS to be placed on the following described lands:

the Northeast Quarter of Section 9, in Township 4 and Range 9, West of the Principal Meridian in Manitoba,

and more particularly shown on a plan file in the office of the Executive Director, Regulatory and Operational Services Division, a copy of which is hereto attached and marked Exhibit "A".

This licence is issued upon the express condition that it shall be subject to the provisions of The Water Rights Act and Regulations and all amendments thereto and, without limiting the generality of the aforesaid, to the following terms and conditions, namely:

1. The water shall be used solely for **municipal** purposes.
2. The WORKS shall be operated in accordance with the terms herein contained.
3. a) The maximum rate at which water may be diverted pursuant hereto shall not exceed **0.005 cubic metres per second (0.2 cubic feet per second)** .
b) The total quantity of water diverted in any one year shall not exceed **117.18 cubic decametres (95.00 acre feet)** .
4. The LICENSEE does hereby remise, release and forever discharge Her Majesty the Queen in Right of the Province of Manitoba, of and from all manner of action, causes of action, claims and demands whatsoever which against Her Majesty the LICENSEE ever had, now has or may hereafter have, resulting from the use of water for **municipal** purposes.
5. In the event that the rights of others are infringed upon and/or damage to the property of others is sustained as a result of the operation or maintenance of the WORKS and the rights herein granted, the LICENSEE shall be solely responsible and shall save harmless and fully indemnify Her Majesty the Queen in Right of the Province of Manitoba, from and against any liability to which Her Majesty may become liable by virtue of the issue of this Licence and anything done pursuant hereto.
6. This Licence is not assignable or transferable by the LICENSEE and when no longer required by the LICENSEE this Licence shall be returned to the Executive Director, Regulatory and Operational Services Division, for cancellation on behalf of the Minister.
7. Upon the execution of this Licence the LICENSEE hereby grants the Minister or the Minister's agents the right of ingress and egress to and from the lands on which the WORKS are located for the purpose of inspection of the WORKS and the LICENSEE shall at all times comply with such directions and/or orders that may be given by the Minister or the Minister's agents in writing from time to time with regard to the operation and maintenance of the WORKS.
8. This Licence may be amended, suspended or cancelled by the Minister in accordance with The Water Rights Act by letter addressed to the LICENSEE at **Box 280, Manitou, MB, R0G 1G0, Canada** and thereafter this Licence shall be determined to be at an end.
9. Notwithstanding anything preceding in this Licence, the LICENSEE must have legal control, by ownership or by rental, lease, or other agreement, of the lands on which the WORKS shall be placed and the water shall be used.
10. The term of this Licence shall be **twenty (20) years** and this Licence shall become effective only on the date of execution hereof by a person so authorized in the Department of Water Stewardship. The LICENSEE may apply for renewal of this Licence not more than 365 days and not less than 90 days prior to the expiry date.
11. This Licence expires automatically upon the loss of the legal control of any of the lands on which the WORKS are located or on which water is used, unless the Licence is transferred or amended by the Minister upon application for Licence transfer or amendment.
12. The LICENSEE shall keep records of daily and annual water use and shall provide a copy of such records to the Executive Director, Regulatory and Operational Services Division, not later than February 1st of the following year.
13. The LICENSEE shall install and maintain, on the pumping WORKS, a water measuring device acceptable to the Executive Director, Regulatory and Operational Services Division, that will accurately measure the instantaneous water flow and the accumulated annual volume of water diverted from the water source.

14. The LICENSEE shall comply with all instructions and specifications that may be issued by Fisheries and Oceans Canada under the fish habitat protection provisions of Canada's Fisheries and Oceans Act concerning the construction, maintenance, and operation of the WORKS.
15. The LICENSEE shall hold and maintain all other regulatory approvals that may be required and shall comply with all other regulatory requirements for the construction, operation, or maintenance of the WORKS or to divert or use water as provided by this Licence.

In witness whereof I the undersigned hereby agree to accept the aforesaid Licence on the terms and conditions set forth therein and hereby set my hand and seal this _____ day of _____ A.D. 20 ____ .

SIGNED, SEALED AND DELIVERED
in the presence of

_____ } _____ (Seal)
Witness Licensee

Canada, PROVINCE OF MANITOBA To Wit:

I, _____ of the _____
of _____ in the Province of Manitoba, MAKE OATH AND SAY:

1. That I was personally present and did see _____ ,
the within named party, execute the within Instrument.
2. That I know the said _____
and am satisfied that he/she is of the full age of eighteen years.
3. That the said Instrument was executed at _____
aforesaid and that I am subscribing witness thereto.

SWORN BEFORE me at the _____
in the Province of Manitoba this _____ day of _____ A.D. 20 ____ .

_____ } _____
A COMMISSIONER FOR OATHS Witness
in and for the Province of Manitoba

My Commission expires _____

Issued at the City of Winnipeg, in the Province of Manitoba, this _____ day of _____ A.D. 20 ____ .

The Honourable the Minister of Conservation and Water Stewardship

Appendix E

MWSB Guidelines for Watercourse Crossings

WATERCOURSE CROSSINGS

Mitigation Measure

1. All watercourse crossings will be directionally drilled.
2. A minimum undisturbed buffer zone of 15 metre will be maintained between directional drill entry/exit areas and banks of watercourse.
3. Heavy equipment (caterpillars, tractors) shall not be allowed within the buffer zone.
4. Enforce measures regarding fuelling or servicing equipment within 100 metre of watercourse.
5. Waste drill mud and cuttings will be prevented from entering surface water.
6. Should erosion control measures be implemented, post construction monitoring shall be conducted to ensure effectiveness.
7. Further erosion control measures will be implemented as necessary.

Reclamation

1. Restore all disturbed areas to original contours.
2. Install erosion control measures, if warranted, and maintain until vegetation becomes established.

Pressure Loss/Fluid Loss Response

To avoid or minimize the potential for drilling fluids and drill cuttings from entering watercourses because of a frac-out, the following monitoring and response plan will be followed:

1. A record of drilling progress will be maintained to always know the location of the drill head relative to the point of entry.
2. A record of drilling component usage (type and quantity) will be maintained throughout each drilling operation.
3. A record of drilling fluid volume used and returned will be maintained to detect any significant fluid losses. Drilling fluid pump pressure will be continuously monitored. Abnormal loss of returned fluids or loss of fluid pressure that may be indicative of a frac-out will be reported immediately to MWSB/PFRA construction field supervisor.
4. At watercourse crossings where water clarity permits, a view of the stream bottom, an observer will continuously check for signs of mud escapement to the watercourse.

Loss of Fluid and Frac-out Response Plan

1. If an abnormal loss of fluid, drop in pressure or visible plume is observed indicating a frac-out or possible frac-out, drilling is to stop immediately.

2. The contractor will notify the MWSB/PFRA construction field supervisor of the frac-out condition or potential condition and decide on the appropriate action as follows:
 - a) Assign a person to visually monitor for the presence of muddy plume.
 - b) Make adjustments to the mud mixture; add lost circulation material (LCM) to the drilling fluid in an attempt to prevent further loss of fluid to the ground formation and/or watercourse.
 - c) Where conditions warrant and permit (i.e., shallow depth, clear water, low water velocity, potentially sensitive habitat) and where a frac-out has been visually detected, attempt to isolate the fluid release using a large diameter short piece of culvert.
 - d) Under circumstances where a frac-out has occurred, and where conditions do not permit containment and the prevention of drilling fluids release to the watercourse, attempts to plug the fracture by pumping LCM are not to continue for more than 10 minutes of pumping time.
 - e) If the frac-out is not contained within this time, MWSB/PFRA construction supervisor will halt any further attempts until a course of action (either abandon directional drilling or further consultation with MWSB engineers) is decided upon.

Appendix F

Certificate of Title for Sludge Ponds

DATE: 1999/10/07
TIME: 09:22
PORT

MANITOBA
DUPLICATE TITLE

TITLE NO: 1678536
PAGE: 1

STATUS OF TITLE..... ACCEPTED
ORIGINATING OFFICE..... MORDEN
REGISTERING OFFICE..... MORDEN
REGISTRATION DATE..... 1999/10/04
COMPLETION DATE..... 1999/10/06
PRODUCED FOR: SELBY & JONES
BY: G.LILLIE
LTO BOX NO:
CONSOLIDATION..... NO

LEGAL DESCRIPTION:

VILLAGE OF MANITOU

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED
HEREON IN THE FOLLOWING DESCRIBED LAND:

PARCEL I
LOTS 1 TO 38 BLOCK 68 PLAN 25 MLTO
IN SECTION 30-3-8 WPM

PARCEL II
LOTS 1 TO 24 BLOCK 73 PLAN 25 MLTO
IN SECTION 30-3-8 WPM

CHARGES:

NO CHARGES EXIST ON THIS TITLE

ADDRESS(ES) FOR SERVICE:

EFFECT	NAME AND ADDRESS	POSTAL CODE	FIRM NUMBER
ACTIVE	MANITOU, VILLAGE BOX 280 MANITOU MB	ROG 1G0	1018

ORIGINATING INSTRUMENT(S):

REGISTRATION NUMBER	TYPE	REG. DATE	CONSIDERATION	SWORN VALUE
1023778 MOR	T	1999/10/04	7000.00	7000.00
PRESENTED BY: SELBY & JONES FROM: GARRY LEE GEORGE KESTIRKE TO: VILLAGE OF MANITOU				

FROM TITLE NUMBER(S):

1550912 MOR ALL

DUPLICATE PRODUCED FOR..... SELBY & JONES
ADDRESS..... BOX 279
MANITOU MB

POSTAL CODE..... ROG 1G0

ACCEPTED THIS 4TH DAY OF OCTOBER, 1999
BY E.ELIAS FOR THE DISTRICT REGISTRAR OF
THE LAND TITLES DISTRICT OF MORDEN.

DUPLICATE TITLE NUMBER 1678536 PRODUCED FROM THE LAND TITLES DATA
STORAGE SYSTEM ON 1999/10/07

x 
FOR THE DISTRICT REGISTRAR

***** END OF DUPLICATE TITLE FOR TITLE 1678536 MOR *****



Appendix G

Projected Reject Quality

Reverse Osmosis System Analysis for FILMTEC™ Membranes
Project: Manitou
Don Burgess, DWG Process Supply Ltd.

ROSA 8.0.3 ConfigDB U412142_201
Case: 1
7/25/2013

Project Information:

Case-specific:

System Details

Feed Flow to Stage 1	229.83 gpm	Pass 1 Permeate Flow	183.86 gpm	Osmotic Pressure:	
Raw Water Flow to System	229.83 gpm	Pass 1 Recovery	80.00 %	Feed	5.26 psig
Feed Pressure	257.32 psig	Feed Temperature	6.0 C	Concentrate	24.81 psig
Flow Factor	0.85	Feed TDS	622.47 mg/l	Average	15.03 psig
Chem. Dose (100% H2SO4)	0.00 mg/l	Number of Elements	36	Average NDP	209.19 psig
Total Active Area	14400.00 ft²	Average Pass 1 Flux	18.39 gfd	Power	32.16 kW
Water Classification: Well Water SDI < 3				Specific Energy	2.92 kWh/kgal

Stage	Element #	PV #	Ele	Feed Flow (gpm)	Feed Press (psig)	Recirc Flow (gpm)	Conc Flow (gpm)	Conc Press (psig)	Perm Flow (gpm)	Avg Flux (gfd)	Perm Press (psig)	Boost Press (psig)	Perm TDS (mg/l)
1	LE-400	4	6	229.83	252.32	0.00	99.08	215.46	130.74	19.61	0.00	0.00	2.34
2	LE-400	2	6	99.08	210.46	0.00	45.97	179.93	53.11	15.93	0.00	0.00	5.77

Name	Pass Streams (mg/l as Ion)		Concentrate		Permeate		
	Feed	Adjusted Feed	Stage 1	Stage 2	Stage 1	Stage 2	Total
	NH4+ + NH3	0.00	0.00	0.00	0.00	0.00	0.00
K	9.94	9.94	23.00	49.45	0.04	0.11	0.06
Na	61.90	61.90	143.24	307.96	0.26	0.69	0.38
Mg	33.50	33.50	77.60	167.00	0.08	0.22	0.12
Ca	88.30	88.30	204.54	440.22	0.21	0.56	0.31
Sr	0.43	0.43	0.99	2.12	0.00	0.00	0.00
Ba	0.05	0.05	0.11	0.24	0.00	0.00	0.00
CO3	2.89	2.89	8.84	23.10	0.00	0.00	0.00
HCO3	167.00	167.00	382.28	813.64	1.00	2.28	1.37
NO3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl	20.80	257.68	596.90	1284.77	0.60	1.60	0.88
F	0.31	0.31	0.72	1.54	0.00	0.00	0.00
SO4	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SiO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Boron	0.07	0.07	0.14	0.24	0.03	0.05	0.03
CO2	0.89	0.86	1.87	3.97	1.01	2.30	1.38
TDS	385.60	622.47	1439.05	3091.45	2.34	5.77	3.33
pH	8.54	8.54	8.51	8.46	6.38	6.37	6.37

*Permeate Flux reported by ROSA is calculated based on ACTIVE membrane area. DISCLAIMER: NO WARRANTY, EXPRESSED OR IMPLIED, AND NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, IS GIVEN. Neither FilmTec Corporation nor The Dow Chemical Company assume any obligation or liability for results obtained or damages incurred from the application of this information. Because use conditions and applicable laws may differ from one location to another and may change with time, customer is responsible for determining whether products are appropriate for customer's use. FilmTec Corporation and The Dow Chemical Company assume no liability, if, as a result of customer's use of the ROSA membrane design software, the customer should be sued for alleged infringement of any patent not owned or controlled by the FilmTec Corporation nor The Dow Chemical Company.

Reverse Osmosis System Analysis for FILMTEC™ Membranes
 Project: Manitou
 Don Burgess, DWG Process Supply Ltd.

ROSA 8.0.3 ConfigDB U412142_201
 Case: 1
 7/25/2013

Design Warnings

-None-

Solubility Warnings

Langelier Saturation Index > 0
 Stiff & Davis Stability Index > 0
 CaF2 (% Saturation) > 100%
 Antiscalants may be required. Consult your antiscalant manufacturer for dosing and maximum allowable system recovery.

Stage Details

Stage 1 Element Recovery		Perm Flow (gpm)	Perm TDS (mg/l)	Feed Flow (gpm)	Feed TDS (mg/l)	Feed Press (psig)
1	0.10	5.84	1.60	57.46	622.47	252.32
2	0.11	5.65	1.81	51.62	692.59	243.16
3	0.12	5.48	2.08	45.97	777.36	235.34
4	0.13	5.35	2.41	40.48	882.23	228.75
5	0.15	5.23	2.85	35.14	1015.89	223.30
6	0.17	5.14	3.45	29.91	1192.84	218.90
Stage 2 Element Recovery		Perm Flow (gpm)	Perm TDS (mg/l)	Feed Flow (gpm)	Feed TDS (mg/l)	Feed Press (psig)
1	0.10	4.93	3.82	49.54	1439.05	210.46
2	0.11	4.73	4.40	44.61	1597.56	203.02
3	0.11	4.53	5.12	39.88	1786.28	196.64
4	0.12	4.33	6.03	35.34	2014.34	191.22
5	0.13	4.13	7.22	31.01	2294.48	186.69
6	0.15	3.90	8.81	26.88	2644.82	182.95

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Scaling Calculations

	Raw Water	Adjusted Feed	Concentrate
pH	8.54	8.54	8.46
Langelier Saturation Index	0.70	0.70	1.92
Stiff & Davis Stability Index	1.36	1.36	1.91
Ionic Strength (Molal)	0.01	0.01	0.07
TDS (mg/l)	385.60	622.47	3091.45
HCO ₃	167.00	167.00	813.64
CO ₂	0.89	0.89	3.97
CO ₃	2.89	2.89	23.10
CaSO ₄ (% Saturation)	0.00	0.00	0.00
BaSO ₄ (% Saturation)	0.00	0.00	0.00
SrSO ₄ (% Saturation)	0.00	0.00	0.00
CaF ₂ (% Saturation)	1.13	1.13	138.86
SiO ₂ (% Saturation)	0.00	0.00	0.00
Mg(OH) ₂ (% Saturation)	0.14	0.14	0.48

To balance: 236.88 mg/l Cl added to feed.

Appendix H

Water Quality Results



Office of Drinking Water
ATTN: JARED MCNABB
25 Tupper Street N
Portage la Prairie MB R1N 3K1

Date Received: 27-JUL-12
Report Date: 18-AUG-12 14:40 (MT)
Version: FINAL

Client Phone: 204-239-3880

Certificate of Analysis

Lab Work Order #: L1185156
Project P.O. #: 15990
Job Reference: MANITOU - PWS 131.00
C of C Numbers:
Legal Site Desc:

Gail Hill
Account Manager

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ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721
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ANALYTICAL REPORT

L1185156 CONTD....
PAGE 2 of 8
18-AUG-12 14:40 (MT)

Physical Tests (WATER)

		ALS ID		L1185156-1	L1185156-2
		Sampled Date		26-JUL-12	26-JUL-12
		Sampled Time		11:00	11:15
		Sample ID		MANITOU 1 - RAW	MANITOU 2 - TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Colour, True	CU	15	-	30.1	<5.0
Conductivity	umhos/cm	-	-	1030	1130
Langelier Index (4 C)	No Unit	-	-	0.91	0.20
Langelier Index (60 C)	No Unit	-	-	1.7	0.96
pH	pH units	6.5-8.5	-	8.21	8.02
Total Dissolved Solids	mg/L	500	-	865	825
Transmittance, UV (254 nm)	% T	-	-	37.9	74.9
Turbidity	NTU	-	-	4.24	0.41

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Anions and Nutrients (WATER)

		ALS ID		L1185156-1	L1185156-2
		Sampled Date		26-JUL-12	26-JUL-12
		Sampled Time		11:00	11:15
		Sample ID		MANITOU 1 - RAW	MANITOU 2 - TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Alkalinity, Total (as CaCO3)	mg/L	-	-	247	163
Ammonia, Total (as N)	mg/L	-	-	1.05 ^{DLA}	0.021
Bicarbonate (HCO3)	mg/L	-	-	302	199
Bromide (Br)	mg/L	-	-	<0.10	<0.10
Carbonate (CO3)	mg/L	-	-	<12	<12
Chloride	mg/L	250	-	17.2	38.2
Fluoride	mg/L	-	1.5	0.260	0.706
Hydroxide (OH)	mg/L	-	-	<6.8	<6.8
Iodide (I)	mg/L	-	-	<2.0	<2.0
Nitrate and Nitrite as N	mg/L	-	10	0.0298	0.0394
Nitrate-N	mg/L	-	10	0.0138	0.0394
Nitrite-N	mg/L	-	1	0.0160	<0.0010
Total Kjeldahl Nitrogen	mg/L	-	-	2.75	0.62
Total Nitrogen	mg/L	-	-	2.78	0.66
Sulfate	mg/L	500	-	365	354
Anion Sum	me/L	-	-	13.0	11.7
Cation Sum	me/L	-	-	13.0	12.5
Cation - Anion Balance	%	-	-	0.0	3.0

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.

Analytical result for this parameter exceeds Guide Limit listed on this report.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.



ANALYTICAL REPORT

L1185156 CONTD....
 PAGE 3 of 8
 18-AUG-12 14:40 (MT)

Organic / Inorganic Carbon (WATER)

Analyte	Unit	Guide Limit		MANITOU 1 - RAW	MANITOU 2 - TREATED
		#1	#2		
Dissolved Organic Carbon	mg/L	-	-	15.0	8.9
Total Inorganic Carbon	mg/L	-	-	58.0	38.9
Total Organic Carbon	mg/L	-	-	15.7	9.4

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
 Analytical result for this parameter exceeds Guide Limit listed on this report.
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ANALYTICAL REPORT

L1185156 CONTD...
PAGE 4 of 8
18-AUG-12 14:40 (MT)

Total Metals (WATER)

Analyte	Unit	ALS ID		L1185156-1	L1185156-2
		Guide Limit #1	Guide Limit #2	Sampled Date Sampled Time Sample ID	Sampled Date Sampled Time Sample ID
Aluminum (Al)-Total	mg/L	0.1	-	<0.050 DLM	0.081 DLM
Antimony (Sb)-Total	mg/L	-	0.006	<0.0020 DLM	<0.0020 DLM
Arsenic (As)-Total	mg/L	-	0.01	0.0057 DLM	0.0032 DLM
Barium (Ba)-Total	mg/L	-	1	0.145 DLM	0.0212 DLM
Beryllium (Be)-Total	mg/L	-	-	<0.0020 DLM	<0.0020 DLM
Bismuth (Bi)-Total	mg/L	-	-	<0.0020 DLM	<0.0020 DLM
Boron (B)-Total	mg/L	-	5	0.11 DLM	<0.10 DLM
Cadmium (Cd)-Total	mg/L	-	0.005	<0.00010 DLM	<0.00010 DLM
Calcium (Ca)-Total	mg/L	-	-	121 DLM	52.7 DLM
Cesium (Cs)-Total	mg/L	-	-	<0.0010 DLM	<0.0010 DLM
Chromium (Cr)-Total	mg/L	-	0.05	<0.010 DLM	<0.010 DLM
Cobalt (Co)-Total	mg/L	-	-	<0.0020 DLM	<0.0020 DLM
Copper (Cu)-Total	mg/L	1	-	<0.0020 DLM	0.0045 DLM
Iron (Fe)-Total	mg/L	0.3	-	0.189 <1.0 DLM	<0.010 <1.0 DLM
Lead (Pb)-Total	mg/L	-	0.01	<0.00090 DLM	<0.00090 DLM
Lithium (Li)-Total	mg/L	-	-	0.080 DLM	0.079 DLM
Magnesium (Mg)-Total	mg/L	-	-	37.8 DLM	18.2 DLM
Manganese (Mn)-Total	mg/L	0.05	-	6.09 DLM	0.0268 DLM
Molybdenum (Mo)-Total	mg/L	-	-	0.0022 DLM	0.0024 DLM
Nickel (Ni)-Total	mg/L	-	-	<0.020 DLM	<0.020 DLM
Phosphorus (P)-Total	mg/L	-	-	1.4 DLM	<1.0 DLM
Potassium (K)-Total	mg/L	-	-	9.64 DLM	9.86 DLM
Rubidium (Rb)-Total	mg/L	-	-	0.0028 DLM	0.0034 DLM
Selenium (Se)-Total	mg/L	-	0.01	<0.010 DLM	<0.010 DLM
Silicon (Si)-Total	mg/L	-	-	8.78 DLM	5.65 DLM
Silver (Ag)-Total	mg/L	-	-	<0.0010 DLM	<0.0010 DLM
Sodium (Na)-Total	mg/L	200	-	82.2 DLM	186 DLM
Strontium (Sr)-Total	mg/L	-	-	0.601 DLM	0.300 DLM
Tellurium (Te)-Total	mg/L	-	-	<0.0020 DLM	<0.0020 DLM
Thallium (Tl)-Total	mg/L	-	-	<0.0010 DLM	<0.0010 DLM
Thorium (Th)-Total	mg/L	-	-	<0.0010 DLM	<0.0010 DLM
Tin (Sn)-Total	mg/L	-	-	<0.0020 DLM	<0.0020 DLM
Titanium (Ti)-Total	mg/L	-	-	0.0198 DLM	0.0081 DLM

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)
#1: GCDWQ - Aesthetic Objective
#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
 Analytical result for this parameter exceeds Guide Limit listed on this report.
 * Please refer to the Reference Information section for an explanation of any qualifiers noted.



ANALYTICAL REPORT

L1185156 CONTD....
PAGE 5 of 8
18-AUG-12 14:40 (MT)

Total Metals (WATER)

		ALS ID		L1185156-1	L1185156-2
		Sampled Date		26-JUL-12	26-JUL-12
		Sampled Time		11:00	11:15
		Sample ID		MANITOU 1 - RAW	MANITOU 2 - TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Tungsten (W)-Total	mg/L	-	-	<0.0010 ^{DLM}	<0.0010 ^{DLM}
Uranium (U)-Total	mg/L	-	0.02	0.0075 ^{DLM}	0.0023 ^{DLM}
Vanadium (V)-Total	mg/L	-	-	0.0053 ^{DLM}	<0.0020 ^{DLM}
Zinc (Zn)-Total	mg/L	5	-	<0.020 ^{DLM}	<0.020 ^{DLM}
Zirconium (Zr)-Total	mg/L	-	-	<0.0040 ^{DLM}	<0.0040 ^{DLM}

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Dissolved Metals (WATER)

		ALS ID		L1185156-1	L1185156-2
		Sampled Date		26-JUL-12	26-JUL-12
		Sampled Time		11:00	11:15
		Sample ID		MANITOU 1 - RAW	MANITOU 2 - TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Aluminum (Al)-Dissolved	mg/L	0.1	-	<0.0020	0.0553

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Trihalomethanes (WATER)

		ALS ID		L1185156-3
		Sampled Date		26-JUL-12
		Sampled Time		12:00
		Sample ID		MANITOU 3 - DIST (END)
Analyte	Unit	Guide Limit #1	Guide Limit #2	
Bromodichloromethane	mg/L	-	-	0.0600
Bromoform	mg/L	-	-	<0.00050
Chlorodibromomethane	mg/L	-	-	0.00772
Chloroform	mg/L	-	-	0.230
Total THMs	mg/L	-	0.1	0.298
Surrogate: Toluene-d8 (SURR)	%	-	-	101.5

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.

Analytical result for this parameter exceeds Guide Limit listed on this report.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution
DLM	Detection Limit Adjusted For Sample Matrix Effects

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TOT-WP	Water	Alkalinity	APHA 2320B
<p>Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. It is determined by titration with a standard solution of strong mineral acid to the successive HCO₃⁻ and H₂CO₃ endpoints indicated electrometrically.</p>			
BR-IC-WP	Water	Bromide by Ion Chromatography	EPA 300.1 (modified)
<p>Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.</p>			
C-TC,TIC,TOC-WP	Water	Carbons	APHA 5310 B-INSTRUMENTAL
<p>This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.</p> <p>The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC. TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.</p>			
C-TDC,DIC,DOC-WP	Water	Carbons Dissolved	APHA 5310 B-INSTRUMENTAL
<p>This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.</p> <p>The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC. TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.</p>			
CL-L-IC-WP	Water	Chloride by Ion Chromatography	EPA 300.1 (modified)
<p>Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.</p>			
COLOUR-TRUE-WP	Water	Colour, True	APHA 2120C
<p>True colour in water is analyzed by discrete analyzer using the platinum-cobalt colourimetric method. Colour is pH dependant; unless otherwise indicated, reported colour results pertain to the pH of the sample as received to within +/- 1 pH unit.</p>			
EC-WP	Water	Conductivity	APHA 2510B
<p>Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.</p>			
ETL-LANGELIER-4-WP	Water	Langelier Index 4C	Calculated
ETL-LANGELIER-60-WP	Water	Langelier Index 60C	Calculated
ETL-N-TOT-ANY-WP	Water	Total Nitrogen Calculated	Calculated
F-L-IC-WP	Water	Fluoride by Ion Chromatography	EPA 300.1 (modified)
<p>Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.</p>			
FE-T-L-ICP-ED	Water	Total Fe in Water by ICPOES (Low Level)	APHA 3120 B-ICP-OES
I-IC-AD	Water	Iodide in Water - Datachem Ohio	SEE SUBLET LAB RESULTS

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
IONBALANCE-OP03-WP	Water	Ion Balance Calculation	APHA 1030E
MET-D-L-MS-WP	Water	Dissolved Metals by ICP-MS	U.S. EPA 200.8-DL
Dissolved Metals by ICP-MS: This analysis is carried out using sample preparation procedures adapted from Standard Methods for the Examination of Water and Wastewater method 3030B for filtration through a 0.45 um filter and analytical procedures adapted from U.S EPA Method 200.8 for analysis of metals by inductively coupled-mass spectrometry.			
MET-T-L-MS-WP	Water	Total Metals by ICP-MS	U.S. EPA 200.8-TL
Total Metals by ICP-MS: This analysis is carried out using sample preparation procedures adapted from Standard Methods for the examination of Water and Wastewater Method 3030E and analytical procedures adapted from U.S EPA Method 200.8 for analysis of metals by inductively coupled-mass spectrometry.			
N-TOTKJ-WP	Water	Total Kjeldahl Nitrogen	Quickchem method 10-107-06-2-E Lachat
Samples are digested with a sulphuric acid solution, cooled, diluted with water, and analyzed for ammonia. Total Kjeldahl nitrogen is the sum of free-ammonia and organic nitrogen compounds which are converted to ammonium sulphate through this digestion process. Analysis is performed by Flow Injection Analysis (FIA). The pH of the digested sample is raised to a known, basic pH by neutralization with a concentrated buffer solution. This neutralization converts the ammonium cation to ammonia. The ammonia produced is heated with salicylate and hypochlorite to produce blue colour which is proportional to the ammonia concentration.			
NH3-COL-WP	Water	Ammonia by colour	APHA 4500 NH3 F
Ammonia in water samples forms indophenol when reacted with hypochlorite and phenol. The intensity is amplified by the addition of sodium nitroprusside and measured colourmetrically.			
NO2+NO3-CALC-L-WP	Water	Nitrate+Nitrite	CALCULATION
NO2-L-IC-WP	Water	Nitrite as N by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
NO3-L-IC-WP	Water	Nitrate as N by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
PH-WP	Water	pH	APHA 4500H
The pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.			
SO4-IC-WP	Water	Sulfate by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
SOLIDS-TDS-WP	Water	Total Dissolved Solids	APHA 2540 C (modified)
Total dissolved solids in aqueous matrices is determined gravimetrically after evaporation of the filtrate at 180 °C.			
THM-PRES-WP	Water	THM preserved	EPA 8260C / EPA 5030C (PRES)
THM concentration is determined using purge and trap techniques.			
THM-SUM-CALC-WP	Water	Total Trihalomethanes (THMs)	CALCULATION
Total Trihalomethanes (THMs) represents the sum of bromodichloromethane, bromoform, chlorodibromomethane and chloroform. For the purpose of calculation, results less than the detection limit (DL) are treated as zero.			
TRANSM-UV-WT	Water	Transmittance, UV (254 nm)	APHA 5910 B-Spectrophotometer
TURBIDITY-WP	Water	Turbidity	APHA 2130B (modified)
Turbidity in aqueous matrices is determined by the nephelometric method.			

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Reference Information

Chain of Custody Numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
AD	ALS DATACHEM LABORATORIES
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample
 mg/kg wwt - milligrams per kilogram based on wet weight of sample
 mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
 mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

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