THE MANITOBA WATER
SERVICES BOARD
Unit 1A - 2010 Currie Blvd., Brandon, Manitoba, Canada R7B 4E7
T 204-726-6076 F 204-726-7196

June 27, 2017

Sustainable Development
Environmental Approvals
123 Main Street, Suite 160
Winnipeg, MB R3C 1A5

Attention: Ms. Tracey Braun, M.Sc., Director

Dear Ms. Braun:

Re: Class 1 Environment Act Licence Proposal – Rural Municipality of Alexander (Great Falls water treatment plant upgrade)

On behalf of the Rural Municipality of Alexander, please find enclosed an Environment Act Licence proposal (4 hard copies and 1 electronic copy) for membrane concentrate process water disposal due to proposed upgrade of the Great Falls water treatment plant. Enclosed is a cheque payable to the Minister of Finance in the amount of $1000.00.

If you require further information, please contact the undersigned.

Yours truly,

Travis Parsons, M.A.Sc., P.Eng.
Chief Engineer

c: Scott Spicer, CAO, Rural Municipality of Alexander

Enclosure

Environment Act Proposal Form

Manitoba
Sustainable Development

Name of the development:	Rural Municipality of Alexander Water Treatment Plant
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):	Waste disposal
Legal name of the applicant:	Rural Municipality of Alexander
Mailing address of the applicant:	1 Sentier Bouvier Trail, Box 100
Contact Person:	Scott Spicer
City: St. Georges	Province: MB Postal Code: R0E 1V0
Phone Number: (204) 367-6170	Fax: email: cao@rmalexander.com
Location of the development:	Great Falls - see conceptual map in EAP
Contact Person:	Scott Spicer
Street Address:	
Legal Description:	Plan 32249
City/Town: Great Falls	Province: MB Postal Code: R0E 1V0
Phone Number: (204) 367-6170	Fax: email: cao@rmalexander.com
Name of proponent contact person for purposes of the environmental assessment:	Travis Parsons
Phone: (204) 726-6085 Fax:	Mailing address: Unit 1A - 2010 Currie Blvd., Brandon, MB, R7B 4E7
Email address: Travis.Parsons2@gov.mb.ca	
Webpage address:	
Date: 2017-06-27	Signature of proponent, or corporate principal of corporate proponent: Printed name: Travis Parsons

THE MANITOBA WATER SERVICES BOARD
505700 - Alex AT - 1,000.00
CERTIFIED CORRECT AS TO SERVICES PERFORMED
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2017-2018

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	$1,000
Class 2 Developments	$7,500
Class 3 Developments:	
Transportation and Transmission Lines	$10,000
Water Developments	$60,000
Energy and Mining	$120,000

Submit the complete EAP to:

Director
Environmental Approvals Branch
Manitoba Conservation and Water Stewardship
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:
Phone: (204) 945-8321
Fax: (204) 945-5229
http://www.gov.mb.ca/sd/eal

Environment Act Proposal Rural Municipality of Alexander Water Treatment Plant

June 2017

Prepared by: Paul Macaraeg, EIT

Reviewed by: Travis Parsons, M.A.Sc., P.Eng.

The Manitoba Water Services Board

Unit 1A – 2010 Currie Blvd.

Brandon, MB R7B 4E7

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Executive Summary

The Rural Municipality of Alexander has requested The Manitoba Water Services Board (MWSB) to submit an Environment Act Proposal for a Class 1 Development License under the Manitoba Environment Act to upgrade the Water Treatment Plant (WTP) in the community of Great Falls. The proposed development includes a complete WTP with a net output capacity of 8 L/s providing ultra-filtration and Nano filtration system, chlorine disinfection, distribution pumping, a standby generator, wetwell with pumps to draw water from Winnipeg River for conveyance to the WTP, a new intake pipe, inlet structure, and discharge pipeline and outlet structure. It is expected that the proposed system will meet the Guidelines for Canadian Drinking Water Quality (GCDWQ).

The community of Great Falls is located in the Rural Municipality (RM) of Alexander, just north of the Town of Lac du Bonnet. The community has a population of 210 in 2011 and is currently under a boil water advisory. The water is supplied by a treatment system located inside Manitoba Hydro's Great Falls generating station. Upon completion of proposed works, the old treatment system will no longer supply water to the distribution network. The proposed system is designed to serve about 270 people in a 20-year horizon with a projected average day demand of 81,000 L/d and a peak day demand of 162,000 L/d. Should local water co-ops connect, which are under boil water advisories, the system is able to service an additional 313,000 L/d.

Results from the raw water analyses showed parameters meet the GCDWQ, except for turbidity, colour, and possibly iron. In addition, the high Total Organic Carbon (TOC) content of 9 mg/L - 12 mg/L has a high DBP formation potential. The proposed treatment plant consists of an ultra-filtration and Nano filtration membranes and are expected to be effective in protection against viruses and cysts such as Cryptosporidium oocysts and Giardia lamblia cysts, and meet the other treatment objectives. Chlorination will also be provided for disinfection.

The proposed treatment system is designed to draw raw water at 11 L/s and it is expected that about 25% or 3 L/s will be membrane concentrate. The concentrate is proposed be discharged back to the Winnipeg River at Great Falls through a discharge pipe, drained onto either a rip-rap outlet structure adjacent to the river or a submerged weighted outlet with fish screen. During a Winnipeg River low-flow value of 278,000 L/s, the 3 L/s membrane concentrate is considered extremely negligible. Water used for flushing (cleaning the membranes) will be drained to the existing sanitary sewer system.

The RM is responsible for operation and maintenance of the WTP and will be responsible for maintaining the new raw water pipeline and wetwell inlet structure. An operator is required to maintain the membrane units, conduct Clean-In-Place (CIP) cleans, change pre-filters, carry out water and bacteriological testing, and other related duties to ensure system performance is maintained. 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*. The operator will be responsible to read water meters on a quarterly basis at a minimum and respond to maintenance issues related to the system.

List of Acronyms

AO	Aesthetic Objective
CIP	Clean-in Place
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
NF	Nano filtration
ODW	Office of Drinking Water
OS	Operational Statements
PR	Public Road
PVPF	Powerview-Pine Falls
RM	Rural Municipality
RO	Reverse Osmosis
TDS	Total Dissolved Solids
THM	Trihalomethane
TOC	Total Organic Carbon
UF	Ultra-filtration
UV	Ultraviolet
WTP	Water Treatment Plant
WRL	Water Rights License

1.0 Introduction

The RM of Alexander 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 a new Water Treatment Plant (WTP) in the community of Great Falls. This document provides the compiled information required on Manitoba Conservation's Environment Act Proposal (EAP) Report Guidelines and Supplementary Guidelines for Municipal Water Supply Systems. This EAP includes components of the proposed WTP upgrade, raw water intake, and membrane concentrate disposal to the river.

1.1 Background Information

The community of Great Falls is located in the RM of Alexander, north of the Town of Lac du Bonnet. Population in the community is about 210 (WSP, 2017) and about 2,983 in the RM based on 2011 Census (Statistics Canada, 2011). The Great Falls Townsite was constructed adjacent to Manitoba Hydro's hydroelectric generating station in the early 1900s to house workers and their families. The Great Falls water system was originally owned and operated by Manitoba Hydro but the distribution system was transferred to the RM in 1987. An agreement between Manitoba Hydro (Hydro) and the RM stated that Hydro would continue to supply water until December 31, 2012 at which time treatment would be the RM's responsibility. The current treatment system is located inside Manitoba Hydro's Great Falls generating station and continues to supply water to the community as the RM has yet to develop its own treatment system.

The current water system utilizes the Winnipeg River as a raw water source and treatment consists of a sand pressure filter and chlorination, and services 83 private connections and 9 Hydro properties via a RM distribution system consisting mainly of 25 mm to 150 mm mains of mostly cast iron pipe. The system does not include a coagulant system to support the filter, nor any means of reducing organics and effectively inactivating Giardia lamblia and cryptosporidium (WSP, 2017). Although the proposed WTP upgrade is for Great Falls, it will have the capacity to service additional connections from nearby co-ops that are also under a boil water advisory. The Great Falls community and generating station are serviced by a dedicated fire protection system including intake, pumping system, piping network, and fire hydrants throughout the station and community. Therefore, the new water treatment plant will not be required to provide fire storage or fire flows.

The water treatment system does not meet the requirements of Manitoba's Drinking Water Safety Act and related regulations. The community has been under a boil water advisory since 2006 and requires significant financial capital funding to address major operational and treatment problems (Manitoba Sustainable Development, 2017). In 2016 the RM entered into an agreement with MWSB to develop a new water treatment plant for the community of Great Falls.

1.1.1 Previous Studies

A concept design report was submitted on March 2012 for water supply options for the community of Great Falls generating station outlining a number of different infrastructure and supply options, including a status quo option (Manitoba Hydro, Associated Engineering, GENIVAR, 2012). The options presented were a permutation of location of the WTP, service connections to Hydro and RM, and funding sources. The options were only compared and no recommendation was made in the report. There was also an analysis of raw water source quality from 2000 referenced in this report and is consistent with the raw water quality testing results from 2012 to 2016, which is discussed further in Section 1.1.6.

A water system study (GENIVAR, 2012) assessed the development of a regional water supply system which will serve the Town of Powerview-Pine Falls (PVPF) and the northwest district of the RM of Alexander, including alternative scenarios to address the region's water supply challenges (WTP technology and piping routes). This study suggests the option of a WTP upgrade in either PVPF or St. Georges, Alexander extending service up to Great Falls, as majority of the communities along the Winnipeg River in this area are under a boil water advisory for at least 10 years now (Manitoba Sustainable Development, 2017). Note that the scope of the proposed WTP upgrade in Great Falls is only for the community of Great Falls (83 private connections), including homes in the Sunset Drive, Winnipeg River Drive and Granite Point developments, and 9 Hydro properties.

1.1.2 Population

Based on a 2011 estimate, the community of Great Falls and contiguous neighbouring area has a population of 210 (WSP, 2017). In reference, the RM of Alexander has an estimated population of 3,333 based on the 2016 Census (Statistics Canada, 2016), an 11.74% increase from 2,983 in 2011 (Statistics Canada, 2011).

Population projections for users of this WTP upgrade can occur in two different ways: one is from the growth in the Great Falls and neighbouring area and second is the possibility of extending the service to other communities in Alexander (St. Georges, Chevrefils District, and NW Alexander Rural) and possibly up to Powerview-Pine Falls. The 20-year population projection for Great Falls is 270 and about 632 for a potential service extension, shown in Table 1.2.

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 300 L/c/day and a peak day factor of 2.0 were used for this EAP. The projected treated water demands are summarized in Table 1.1.

TABLE 1.1 - PROJECTED TREATED WATER DEMAND FOR THE COMMUNITY OF GREAT FALLS

Parameter	Units	Quantity
Community of Great Falls Current Connections	ea.	83
Manitoba Hydro Property Connections	ea.	9
Total Connections		91
2011 Population	ca.	210
Projected 2037 population (@ 1% per year)		270
Average consumption/capita/day	L/c/day	300
Average Day Consumption	L/day	81,000
Peak Hour Factor		4.12
Peak Hour Demand	L/s	3.8
Peak Day Factor		2.0
Peak Day Demand (20 hr operating day)	L/s	2.25*
Peak Day Consumption	L/day	162,000

*Peak day demand includes 20% increase to factor in the 20-hr. operating day criterion, i.e. (81,000 * 2.0)/20 hr/3600 s/hr = **2.25 L/s**.

The future peak treated water demand for the community is 2.25 L/s based on Table 1.1. The WTP is being designed for 8 L/s net output to handle water demands from private co-ops under boil water advisory which are anticipated to connect sometime in the future but still have not made any commitments. This information is summarized in Table 1.2.

Almost all of the communities along the Winnipeg River is under a boil water advisory and the area has historically struggled with regional water system proposals. In consideration of the potential that the proposed Great Falls WTP will extend service to St. Georges, Chevrefills, Northwest District, and Powerview-Pine Falls, the engineer estimated the 20-year total peak hour demand to be 24 L/s. The proposed Great Falls WTP will be designed for an 8 L/s net output but with easy upgradeability in the future by adding 2 additional trains of 8 L/s treatment system. This potential expansion is taken into account for the intake and raw water piping.

The community has a separate fire protection system and is not part of the current proposed project.

1.1.4 Raw Water Source

Raw water is currently drawn directly from the Great Falls generating station reservoir along the Winnipeg River. Intake system consists of 2 pumps, with one being on stand-by. Water quality analysis is detailed on Section 1.1.6.

TABLE 1.2 - PROJECTED DEMAND FOR NEARBY COMMUNITIES (CO-OPS)

Location	Status	Potential # of Connection	Estimated Peak Demand (L/d)*
Leisure Falls	BWA	57	102,600
Maple Creek	WRL No. 2010-031	28	50,400
Whitemud Falls	BWA	59	106,200
Requests of Others	no distribution	13	23,400
Poplar Avenue		17	30,600
		Total	313,200

*Assuming 3 individuals per connection, a 1% growth rate per year for 20-years, and the same *average day consumptions* and *peak day factors* with Great Falls, potential additional connections amount to a peak day consumption of about **4.35 L/s**.

1.1.5 Water Rights Act

Information on water rights license (WRL) to draw water from the Winnipeg River for treatment at the Great Falls generating station does not exist, and an application for licence to divert and use surface water will need to be submitted to Manitoba Sustainable Development. The requested allocation will meet the projected total raw water demand for the community of Great Falls, as summarized in Table 1.3. It is estimated that the community of Great Falls' 20-year demand for treated water will be 81,000 L/d on an average day. However, the treatment capacity will be designed for 8 L/s output to accommodate the potential expansion of servicing to the communities shown in Table 1.2.

Based on an equipment request for proposal, a UF-NF filtration system was chosen and will be proposed to be used for the WTP upgrade. Based on the supplier's estimate and the Board's experience with similar installations, approximately 25% of incoming water will be membrane concentrate and will be discharged away. Based on this information, the WRL will request for a 11 L/s pumping capacity. Figure 2.1 shows the schematic of the proposed water treatment and the membrane concentrate discharge.

The existing Great Falls Public Water System is in operation based on two operating licenses: one that is issued to Manitoba Hydro for the intake structures, treatment facilities, and water storage reservoirs (PWS-08-121); and one that is issued to Rural Municipality of Alexander for the distribution lines (PWS-08-122-01). The operating

licenses are shown in Appendix C. This proposal submission will be for a proposed water treatment plant upgrade (owned by RM of Alexander) that includes a new water treatment plant, raw water intake, and process water discharge. More discussion on project description can be found in Section 2.0.

TABLE 1.3 - PROJECTED TOTAL WATER DEMAND FOR THE COMMUNITY OF GREAT FALLS AND NEARBY CO-OPS

Location	Treated Water	Raw Water	Units
Great Falls	81,000	111,375	L/d
		40,652	m^3/yr
		40.652	**dam^3/yr**
Nearby Co-ops	156,600	215,325	L/d
		78.594	**dam^3/yr**
TOTAL		**119.25**	**dam^3/yr**

1.1.6 Water Quality

Detailed raw water quality analysis results were collected every year from 2012 to 2016, and can be found in Appendix.

Water quality parameters that exceed the GCDWQ include turbidity, colour, and iron. Results also showed high TOC content (9 mg/L - 12 mg/L) which is indicative of a high DBP formation potential (i.e. THMs which are known to be potential carcinogens).

The results also showed very low alkalinity, total dissolved solids, and hardness. Water with this characteristic tend to be aggressive after treatment, requiring addition of alkalinity in order to prevent corrosion of metallic piping and plumbing fixtures (WSP, 2017).

Although not included in the analyses is the known presence of pathogenic organisms, a review of bacteriological sampling records from 2006 to 2009 provided by Manitoba Hydro indicates that total coliform and E. coli exists in the raw water with total coliform levels often exceeding 200/100 mL and E. coli levels ranging from 0 to 38/100 mL. Total coliform levels are consistent with the historical average of 135/100 mL and, with the presence of E. coli, indicate that the raw water is bacteriologically unsafe. (Manitoba Hydro, Associated Engineering, GENIVAR, 2012)

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. Table 1.4 outlines some of the water quality parameters of concern including hardness, manganese, pH, sodium, true colour, sulfate, Total Dissolved Solids (TDS),

Trihalomethanes (THMs) and turbidity. Full chemistry analysis can be found in Appendix E. In addition, the operator tests chlorine residuals daily on the treated water.

TABLE 1.4 - WATER QUALITY RESULTS (5-YEAR AVERAGE FROM 2012 TO 2016)

Parameter	Unit	GCDWQ	Raw Water	
			Low	High
Arsenic	mg/L	≤ 0.01	0.000865	0.00113
Fluoride	mg/L	≤ 1.5	0.047	0.119
Hardness (Total) $CaCO_3$	mg/L	200/500[a]	46.6	49.7
Alkalinity (Total) as $CaCO_3$	mg/L	40-75	39.4	47
Iron	mg/L	≤ 0.3	0.23	**0.45**
Manganese	mg/L	≤ 0.05	0.00889	0.0161
Nitrate-N	mg/L	≤ 10	0.0389	0.0905
pH	pH units	7.0-10.5	7.63	7.95
Silicon	mg/L		1.8	3.0
Sodium	mg/L	200	2.1	2.66
Sulfate	mg/L	500	2.7	3.3
Total Dissolved Solids	mg/L	500	64	79
Total Organic Carbon[d]	mg/L	-	**9.41**	**12**
Total THMs	mg/L	≤ 0.1		
True Color	CU	15	**21**	**36**
Turbidity	NTU	≤ 0.3 / 0.1[c]	**5.4**	**75**
Uranium	mg/L	≤ 0.02	0.00011	0.00014
E. coli		none per 100 mL		
Cryptosporidium		3-log removal		
Giardia Lamblia		3-log removal		
Viruses		4-log removal		

[a] Hardness levels greater than 200 are considered poor but tolerable. Hardness levels greater than 500 are generally considered unacceptable. Hardness levels between 80 and 120 mg/L (as CaCO3) provide acceptable balance between corrosion and incrustation.

[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

[DLA] Detected Limit Adjusted for required dilution

[d] Total Organic Carbon objective of < 2 mg/L based on DBP formation potential

Raw water quality parameters exceeding the GCDWQ and proposed treatment objective include iron, total organic carbon (based on DBP formation potential), true colour, and turbidity. A treatment system upgrade is necessary to address all the parameters that exceed the treatment objectives and also address the softness of the water which could prove to be aggressive on the piping system. For regional water systems with long chlorine-organics contact time, TOCs less than 2 mg/L are preferred to prevent THM issues.

Considering the relatively good quality of the raw water and groundwater supplies needed for a municipal system are not available in the area, it is proposed that the WTP upgrade to continue to draw water from the Winnipeg River. More information on project description, including treatment process, is included in Section 2.0.

1.1.7 Compliance Plan

The community (and surrounding area) of Great Falls has been under a boil water advisory since 2006 and requires significant financial capital funding to address major operational and treatment problems (Manitoba Sustainable Development, 2017). The RM entered into an agreement with MWSB in 2016 to develop a new water treatment plant for the community.

This project involves the development of a new WTP, a wetwell intake structure, and a raw water pipeline. This EAP requests environmental approval to discharge membrane concentrate back to Winnipeg River downstream of the intake structure via a discharge pipeline and an outlet structure. The proposed location is at a site near the existing Great Falls generating station, site plan included in Appendix A.

2.0 Description of Proposed Development

2.1 Project Description

The proposed development includes a complete WTP with a net output capacity of 8 L/s providing appropriate treatment process to meet required quality standards, chlorine disinfection, distribution pumping, a standby generator, a new intake pipe, inlet structure, wetwell with pumps to draw water from the river for conveyance to the WTP, and discharge pipeline and an outlet structure for the membrane concentrate water discharge. The proposed development is to be located adjacent to the existing Great Falls generating station. The WTP will likely be immediately northwest of the service buildings on a 4 m to 5 m overburden, and the wetwell will be installed in the vicinity of the dyke 400 m south of the service buildings. Site selection is based on overburden availability and minimizing impacts to bedrock outcrops.

Based on the result of a water treatment equipment supply request for proposal, an ultra-filtration - Nano filtration water treatment system was selected as the treatment process to provide the community with water that meets the GCDWQ.

This EAP submission is for a Class 1 Development License under the Manitoba Environment Act for a new WTP in the community of Great Falls, which includes the development of a new water treatment plant, wetwell intake structure, raw water pipeline, and discharge pipeline and an outlet structure. This EAP requests environmental approval to discharge membrane concentrate back to Winnipeg River downstream of the intake structure via a discharge pipeline and an outlet structure. Conceptual proposed locations is shown in Appendix A.

2.1.1 Water Source

It is proposed to draw raw water from the Winnipeg River at the Great Falls generating station reservoir. The intake structure is proposed to be located in the vicinity of the dyke 400 m south of the Hydro service buildings.

Manitoba Hydro controls the river water elevations and maintains it between 247.193 m and 247.498, a range of 0.3 m. The top of the intake inlet is set at 244.0 m to provide a minimum 2 m in anticipation of drought conditions, and an additional metre for intake screen and support base. This will provide at least one metre of water clear under a metre of ice which can form in winter. The wetwell facility will be underground with submersible pumps.

2.1.1.1 Well Installations

The wetwell is proposed to be at a shoreline elevation one metre higher than maximum water level in anticipation of wind effects that can artificially raise water levels. This proposed elevation would provide accessibility to the well.

Also, rock excavation will be minimized for the gravity pipe intake trench by locating the wetwell close to shore.

2.1.1.2 Raw Water Quality

This project proposes to draw raw water from the Winnipeg River, and so is expected to have the same raw water quality as the existing system. Discussions on raw water quality can be found in Section 1.1.6.

2.1.1.3 Raw Water Pipeline

The raw water pipeline was sized using a 20-year projected water demand and membrane concentrate water discharge. As discussed in Section 1.1.3 the raw water pipeline is proposed to be oversized should the system expand up to PVPF. A raw water supply rate of 11 L/s is considered and the raw water pipeline is proposed to be 150 mm to 200 mm. The length of the piping will also have to be minimized to minimize rock excavation (rock outcrops typical in area) and will be limited to not more than 200 m. A schematic of the conceptual location of the plant is shown in Appendix A.

The pipeline will be high density polyethylene (HDPE) or poly vinyl chloride (PVC) installed in accordance with MWSB Standard Construction Specifications.

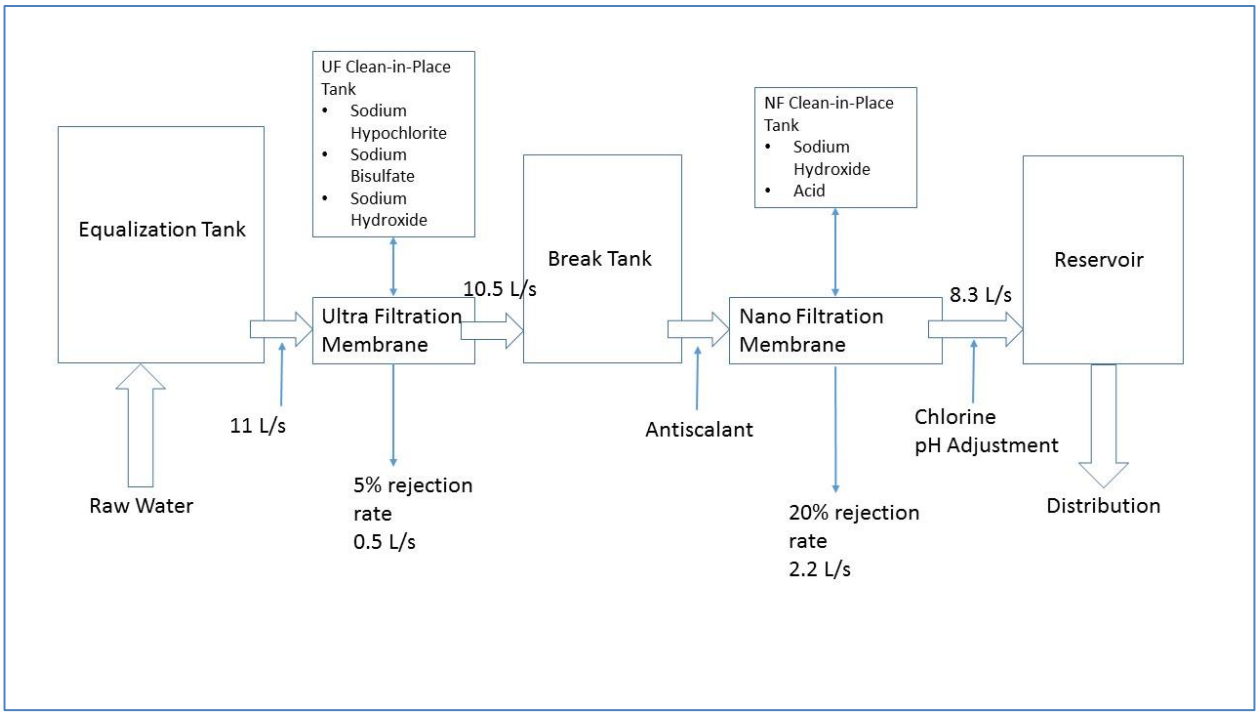
2.1.1.4 Water Treatment Plant

The proposed Great Falls WTP will likely be classified as a Class 2 Water Treatment Facility. The existing treatment system will be replaced with 8.0 L/s UF-NF membrane unit. The proposed membrane filtration process is effective in protecting against viruses and cysts such as Cryptosporidium oocysts and Giardia lamblia cysts as well as removing, nitrates, TDS, iron/manganese and softening the water to acceptable concentrations. The upgraded treatment system will supply the projected 20-year population demand of the community while treating water that meets the GCDWQ and the Drinking Water Safety Act.

Plans for the equipment layout of the UF-NF membrane unit for the proposed WTP will be designed by WSP, the Engineer for this project. The project will be tendered once environmental approval has been received and funding has been secured. The membrane system will be designed to meet and exceed GCDWQ requirements, supply water to the community that will meet the ODW requirements, and lift the boil water advisory imposed to the community. The conceptual schematic of the water treatment system is shown in Figure 2.1.

The water treatment system inside the Great Falls generating station will no longer feed water into the RM's distribution line and will be disconnected possibly decommissioned.

FIGURE 2.1 - SCHEMATIC OF PROPOSED UF-NF WATER TREATMENT PROCESS



2.1.1.5 Backwash and Concentrate Disposal

Membrane systems typically generate a mineralized concentrate stream. Concentrate streams vary between 10% and 30% of the total flow from membrane systems depending on the arrangement and type of membranes selected. The proposed membrane system was modeled for a 75% recovery with 25% of the flow through the membrane unit being rejected.

It is proposed that membrane concentrate be discharged back to the reservoir through a discharge pipeline, at least 100 m downstream of the intake pipe inlet. Manitoba Sustainable development have permitted disposal of membrane residual water back to the natural environment, such as rivers and lakes, as it is natural water with a higher concentration of natural minerals. Discussion on membrane concentrate water disposal and its effect to the environment can be found in Section 3.4

Some water will be used in membrane flushing cycles and clean-in-place (CIP) operations. It is proposed that CIP residual wastewaters be discharged into the existing sanitary sewer pipelines. This CIP residual wastewater will be low pH due to the cleaning acid and therefore cannot be returned to the natural environment directly unless neutralized.

2.1.1.6 Operation and Maintenance

The RM will be responsible for the operation and maintenance of the raw water pipeline, intake structure, the water treatment plant, and the distribution pipeline. An operator is required to periodically inspect flush outs, air releases, etc. to ensure system performance is maintained. 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*. Operators will read water meters on a minimum quarterly basis and respond to maintenance issues related to the system.

The operator(s) will be required to operate the facility in a safe and efficient manner in accordance with relevant operations manuals and Drinking Water Safety Act regulations. Operation requirements will include measurements, monitoring, sampling, testing, record-keeping and reporting. Operators will be required to do Clean-In-Place (CIP) maintenance and changing of pre-filters. In addition, the operator(s) must ensure the equipment is inspected and properly maintained. The operator(s) will receive training during the commissioning phase by the selected equipment supplier.

Other typical operating costs include chemicals, maintenance personnel, electricity costs, general repairs, water and bacteriological testing, and a reserve fund for future membrane replacement or expansion and staff certification and training. Operating and maintenance costs are recovered through the sale of water in the distribution system.

2.2 Certificate of Title

It is proposed to locate the proposed works on Public Reserve (Plan No. 32249) and/or Manitoba Hydro property. If necessary, private easements will be obtained to accommodate the works. The RM, Manitoba Hydro, and other agencies that may be involved is expected to work cooperatively on this matter.

2.3 Mineral Rights

No change is proposed to any and/or all mineral rights associated with lands for the existing and proposed works.

2.4 Existing and Adjacent Land Use

Existing and adjacent land use will not change as a result of this development.

2.5 Land Use Designation and Zoning

The location of proposed works will be on either a designated Natural Resource Area or Community Area according to the RM's Development Plan By-Law 68-10 (Manitoba Municipal Government, 2016). Land Zoning designation for this development is Hamlet Development Zone according to the RM's Zoning By-Law (Manitoba Municipal Government, 2017). The maps are shown in Appendix H.

2.6 Project Schedule

The project is scheduled to be tendered in Fall 2017 with construction depending on the availability of funding and the receipt of all approvals. The RM of Alexander has secured funding for this project through their borrowing by-law.

2.7 Project Funding

This project is eligible for cost sharing between the MWSB and the RM of Alexander subject to all approvals and the availability of funding.

2.8 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 Sustainable Development
Office of Drinking Water

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

2.9 Public Consultation

A number of public consultations has been conducted in the past, and as a result the RM of Alexander came to request the Manitoba Water Services Board (MWSB) for assistance to develop a new water treatment plant for the community of Great Falls. It is expected that there will be no further major concerns forwarded to the RM regarding the proposed upgrade.

2.10 Storage of Petroleum Products and Other Chemicals

Fuel will not be stored on-site at any time or location along the proposed construction area. 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 existing WTP or at the construction site. Chemicals associated with the operation of the new plant will be stored in designated areas within the plant complete with spill containment. General household cleaning products will also be stored on-site.

3.0 Physical Environment

3.1 Physiography

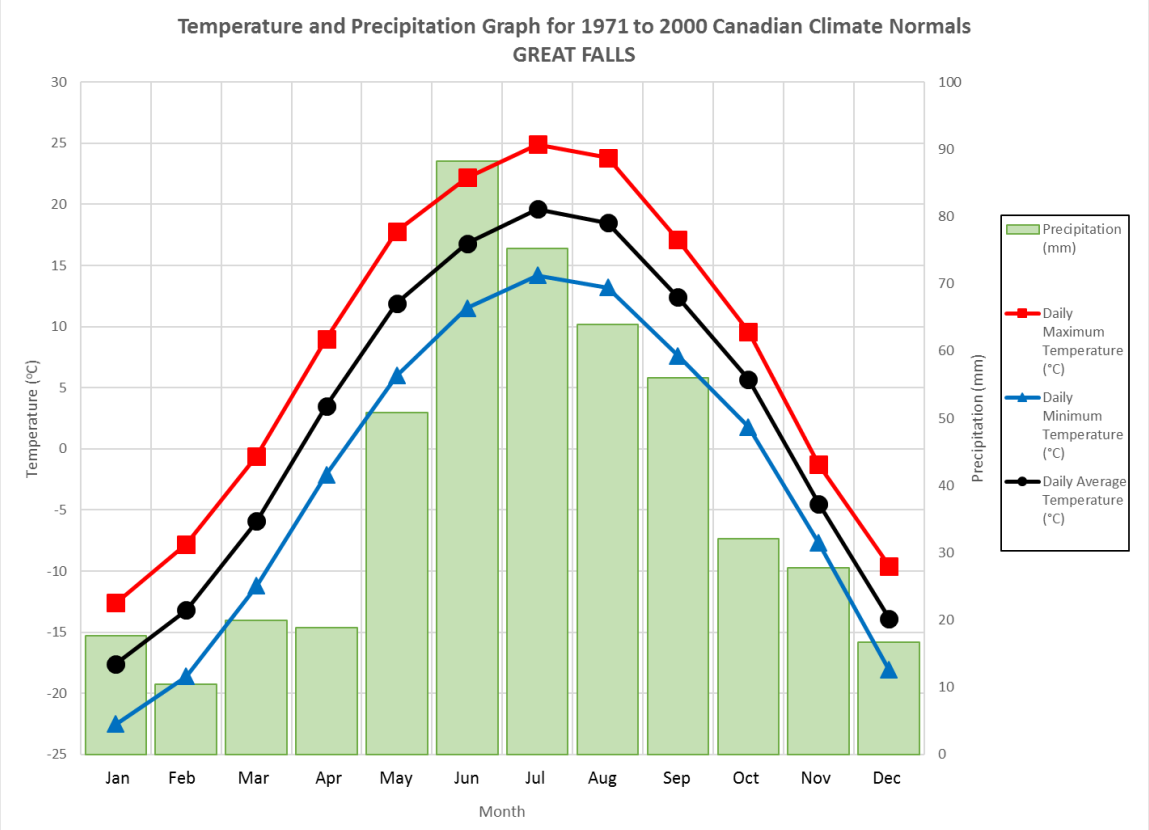
The community of Great Falls is located in the RM of Alexander, north of the Town of Lac du Bonnet. The topography of the area has little elevation changes varying between 244 m and 247 m (geodetic elevation). The community is located within the Canadian Shield, right on its southern west edge. This area can be characterized by thin layers of soil and bedrock outcrops with low reliefs. It is also dominated by the boreal forest ecosystem. There is some farming activity in the region, but not within the area of the proposed WTP site.

3.2 Weather and Climate

Based on climate data available (Environment Canada), the daily average annual temperature in the area is 2.6 °C. Average annual total precipitation is 473.2 mm. The climate normal precipitation and temperature values for great falls from 1971 to 2000 is shown in Figure 3.1.

Climate Normals are three-decade averages of climatological variables including temperature and precipitation. Values for 1981 to 2010 for the Great Falls station is not made available by Environment Canada, but the 1981 to 2010 Climate Normal for Pinawa (the closest station) has very similar characteristic and range values to Figure 3.1.

FIGURE 3.1 - CLIMATE NORMAL TEMPERATURE AND PRECIPITATION VALUES FOR GREAT FALLS



3.3 Hydrogeology

Groundwater conditions have not been considered for this project as the raw water is proposed to be drawn from the Winnipeg River. It is not expected that the groundwater regime will be affected.

3.4 Hydrology

The area is part of the Winnipeg River basin which drains to Lake Winnipeg and eventually drains to Hudson Bay watershed. Winnipeg River is also the only major waterway within the vicinity of the proposed WTP upgrade.

Winnipeg River water levels in this area is controlled by Manitoba Hydro through their Water Licenses for their generating stations. Water is proposed to be drawn at the generating station reservoir where water elevations are maintained between 247.193 m and 247.498 m (a range of only 0.3 m). Discussions on water source intake can be found on Section 2.1.

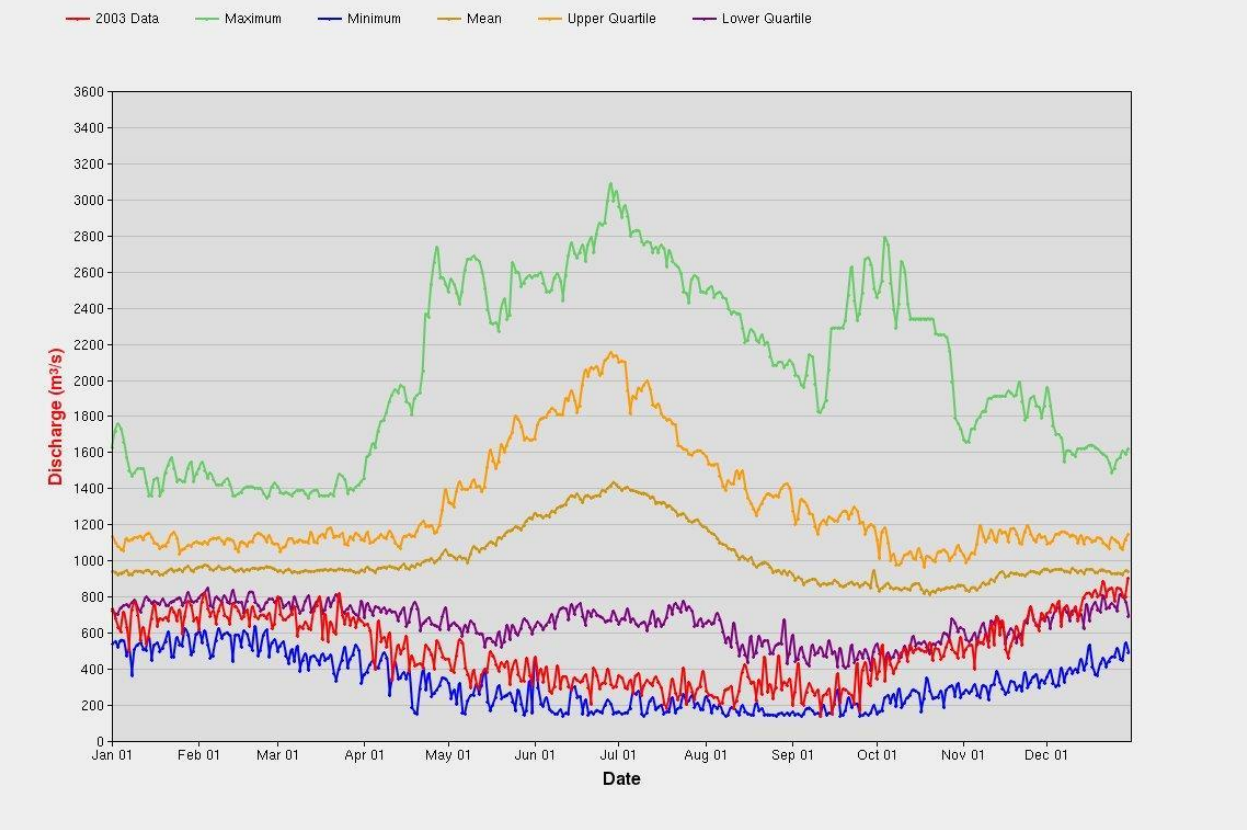
There are one or two ephemeral streams in this area that eventually drains to the Winnipeg River but they are not expected to be impacted by the proposed development as the plant would be more than a kilometre away.

General drainage in this area is towards the Winnipeg River and is usually good, i.e. soil is not water saturated. The gross drainage area for the Winnipeg River basin is 135,000 km^2. Based on available data (Water Survey of Canada), a request returned water level data at the Great Falls Generating Station Tailrace (Station 05PF048) and discharge flow data at McArthur Generating Station (just upstream of Great Falls, Station 05PF068). Winnipeg River is a relatively closed system so it is assumed that the same flow data at McArthur Generating Station would apply to Great Falls. Based on analysis of flow data available, the year 2003 showed relatively low flows and so this is considered in the discharge rate analysis. A table of the flows for 2003 is shown in TABLE 3.1 and a hydrograph for the same station corresponding to data from 1987 to 2014 is shown in Figure 3.2.

TABLE 3.1 - MCARTHUR FALLS MEAN DISCHARGE (2003)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean flow (L/s) (000)	667	704	673	508	406	336	298	300	278	474	582	777

FIGURE 3.2 - DAILY DISCHARGE GRAPH FOR WINNIPEG RIVER AT MCARTHUR GENERATING STATION (05PF068) CORRESPONDING TO DATA RECORDED FROM 1987 TO 2014



The projected discharge concentrate flow rate for the RO membrane unit is 3 L/s. Compared to the lowest flow recorded during a low-flow year, this concentrate discharge is extremely negligible. The concentrate will be discharged back to the Winnipeg River at Great Falls through a discharge pipe, drained onto a riprapped area and will eventually drain to the river. Water chemistry analysis is shown in TABLE 3.2 for comparison.

The membrane concentrate results were based on the water treatment supplier's projections for a 15 °C water after 5 years of service, and can be found in Appendix . Sapphire Water International Corp. proposes to supply HYDRAcap® MAX 80 ultra-filtration membranes and ESNA1-LF2-LD Nano filtration membranes.

TABLE 3.2 - WATER CHEMISTRY ANALYSIS

Parameter	Raw Water (mg/L)	Membrane Concentrate (mg/L)	Winnipeg River (mg/L)
Flow rate (L/s)	11	3	298,000
Hardness, as CaCO3	46.58	198.5	46.58
Ca	12.50	51.8	12.50
Mg	3.74	16.8	3.74
Na	2.42	7.0	2.42
K	0.98	2.1	0.98
NH4	0.09	0.2	0.09
Ba	0.011	0	0.011
Sr	0.025	0.1	0.025
H	0	0	0
CO3	0.10	1.6	0.10
HCO3	52.20	203.5	52.20
SO4	2.83	13.2	2.83
Cl	1.65	5.2	1.65
F	0.05	0.1	0.05
NO3	0	0	0
PO4	0	0	0
OH	0	0	0
SiO2	2.77	9.7	2.77
B	0	0	0
CO2	2.23	2.23	2.23
TDS	79.36	311.62	79.36
pH	7.63	8.20	7.63

3.5 Fish and Fish Habitat

Potential fish habitat in the project area includes the Winnipeg River, North Coca Cola Creek, and a number of unnamed small waterways. Existing and/or planned fish habitat is not expected to be impacted by the proposed WTP upgrade. Discussion on membrane concentrate water disposal can be found in Section 3.4. A search of the Manitoba Conservation Data Centre's rare species database found no occurrences at this time for this area (Manitoba Sustainable Development, 2017).

3.6 Wildlife Habitat and Vegetation

The project area is located within the Lake of the Woods Ecoregion (a sub-division of) within the Boreal Shield Ecozone. Characteristic vegetation includes a succession from trembling aspen, paper birch, and jack pine to white spruce, black spruce, and balsam fir. Warmer portions of the

ecoregion support red and eastern white pine. Cooler and wetter sites support black spruce and tamarack. Characteristic wildlife includes moose, black bear, wolf, lynx, snowshoe hare, and woodchuck. Bird species include ruffed grouse, hooded merganser, pileated woodpecker, bald eagle, turkey vulture, herring gull, and waterfowl (Environment Canada, 2017). A search of the Manitoba Conservation Data Centre's rare species database found no occurrences at this time for this area (Manitoba Sustainable Development, 2017).

3.7 Socioeconomic Overview

The Rural Municipality of Alexander is situated in eastern Manitoba, and is located on the southwest basin of Lake Winnipeg, the largest lake in Manitoba. The municipality is approximately 100 kilometres north east of Winnipeg, and can be accessed from the south by Provincial Trunk Highway(PTH) 59, PTH 12, or from the east by Provincial Road 317 (RM of Alexander, 2017).

The project area is located within the Rural Municipality of Alexander and Great Falls is a community that is situated near the Great Falls generating station. The RM has an estimated population of 3,333 based on the 2016 Census (Statistics Canada, 2016).

The RM is a full service region complete with a number of industries such as Auto Services, Food, Medical and Health Services, and Recreation and Travel, among others (RM of Alexander, 2017). Manitoba Hydro owns the Great Falls generating station which generates and supplies power to the Manitoba Hydro power grid.

3.8 Heritage Resources

Most project activities will occur in previously disturbed municipal and provincial right-of-ways and public reserve. 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 advising contractor to keep machinery in good working order. Any effects would be localized and temporary. During construction there will be no releases of pollutants to the air. In the event of an emergency pollution incident, in addition to following emergency response plans, the Manitoba Ministry of Sustainable Development will also be notified as necessary.

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 well construction site 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 applied to prevent or mitigate impact. In the event of an emergency pollution incident, in addition to following emergency response plans, the Manitoba Ministry of Sustainable Development will also be notified as necessary.

4.3 Surface Water, Fish and Fish Habitat

Proposed WTP upgrade includes a new WTP building will be located sufficiently away from the Winnipeg River, while the proposed WTP water intake structure is proposed to be near the existing Great Falls Hydroelectric Generating Station reservoir.

Fish screens will be used at the intake structure inlets to avoid killing fish. It will be of nickel-zinc or copper plated wedge wire construction for zebra mussel resistance. The screen will be provided with a pair of 25 mm nipples to which a potassium permanganate feed line and an “air burst” line can be connected for zebra mussel mitigation.

As the proposed water intake structure and membrane concentrate water outlet is anticipated to have negligible effect to the water levels and flows upstream and downstream of the existing reservoir, DFO (Department of Fisheries and Oceans) review is not required.

For any work conducted near the river, measures to avoid causing harm to fish and fish habitat including aquatic species at risk will be applied as necessary to avoid or mitigate impact. In the event of an emergency pollution incident, in addition to following emergency response plans, the Manitoba Ministry of Sustainable Development will also be notified as necessary.

Minor and short term impacts on surface water may occur as a result of construction activity in the area 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.

Water quality samples were taken and results were analyzed. The impacts of disposing the membrane concentrate water on wildlife habitat are considered negligible. The analysis can be found in Section 3.4.

4.4 Groundwater Quality

Groundwater quality can be impacted by surface activities and surface water quality. Mitigation measures during construction activities will be applied as necessary to protect groundwater quality. The proposed activities are unlikely to result in adverse changes to the groundwater regime, if any.

4.5 Groundwater Levels

Groundwater conditions have not been considered for this project as the raw water is proposed to be drawn from the Winnipeg River. It is expected that the groundwater regime will not be affected, if any.

4.6 Vegetation

Construction will occur primarily within municipal right-of-way or easement that are previously disturbed, regularly managed, and comprised primarily of grasses. The construction work is expected to take place in or near a built environment, and the amount of vegetation disturbance is expected to be minimal.

During operation, monitoring and maintenance activities 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 hydro infrastructure, urban, or agricultural uses. The potential adverse

effects of wildlife habitat loss were assessed to be negligible to minor. A search of the Manitoba Conservation Data Centre's rare species database found no occurrences at this time for this area (Manitoba Sustainable Development, 2017).

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 (e.g. 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.

Before construction begins, the contractor will be required to coordinate with the RM to notify residents of the upcoming construction activity and any other arrangements appertaining to the construction.

4.9 Employment/Economy

Socio-economic implications are not expected as a result of environmental impacts as these impacts are considered minor and short-term. Some economic implications may exist for the RM due to the cost of upgrading their water system, however, the RM will have a sustainable potable water supply to meet future demands. There may be some local economic benefits as well during construction. The proposed project will address various issues of the existing water system, the boil water advisory will be lifted, and will bring the community in compliance with the Office of Drinking Water. The potential effects of the project on employment and the economy are 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 is 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 the water treatment plant upgrade designed and operated to produce a treated water supply that meets current water quality standards. This will produce a higher quality of living in Great Falls. 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 proposed works.

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 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. In the event of an emergency pollution incident, in addition to following emergency response plans, the Manitoba Ministry of Sustainable Development will also be notified as necessary.

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. In the event of an emergency pollution incident, in addition to following emergency response plans, the Manitoba Ministry of Sustainable Development will also be notified as necessary.

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 measures 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 an emergency pollution incident, in addition to following emergency response plans, the Manitoba Ministry of Sustainable Development will also be notified as necessary.

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

5.4 Groundwater

Groundwater is primarily protected by the natural hydrogeology in the area. Mitigation of potential groundwater impacts from petroleum products can be mitigated as described in Section 5.3. It is expected that the groundwater regime will not be affected, if any.

5.5 Vegetation and Wildlife

A search of the Manitoba Conservation Data Centre's rare species database found no occurrences at this time for this area (Manitoba Sustainable Development, 2017). Disturbance on other plant species will be minimized and 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 and controlling access to the designated construction area. 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.

Any potential loss and disturbance to vegetation and wildlife during operation may be mitigated by restricting vehicular traffic to designated and previously disturbed areas, and by limiting monitoring and maintenance activities to previously disturbed areas.

5.6 Fisheries

Fisheries impacts will be minimized by implementing practices to reduce soil and contaminate run-off as previously mentioned in Section 5.3.

The impact of disposing the membrane concentrate water back into Winnipeg River has been deemed insignificant, as discussed in Section 3.0. So long as the quality of incoming raw water and the treatment process does not change, the output is also expected to remain close to the analysis made in this proposal.

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. Residents, businesses, and other stakeholders in the area will be notified of when the construction will happen.

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 require 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 community. The proposed project may provide some economic benefits to the area for local businesses and employment opportunities during construction phase.

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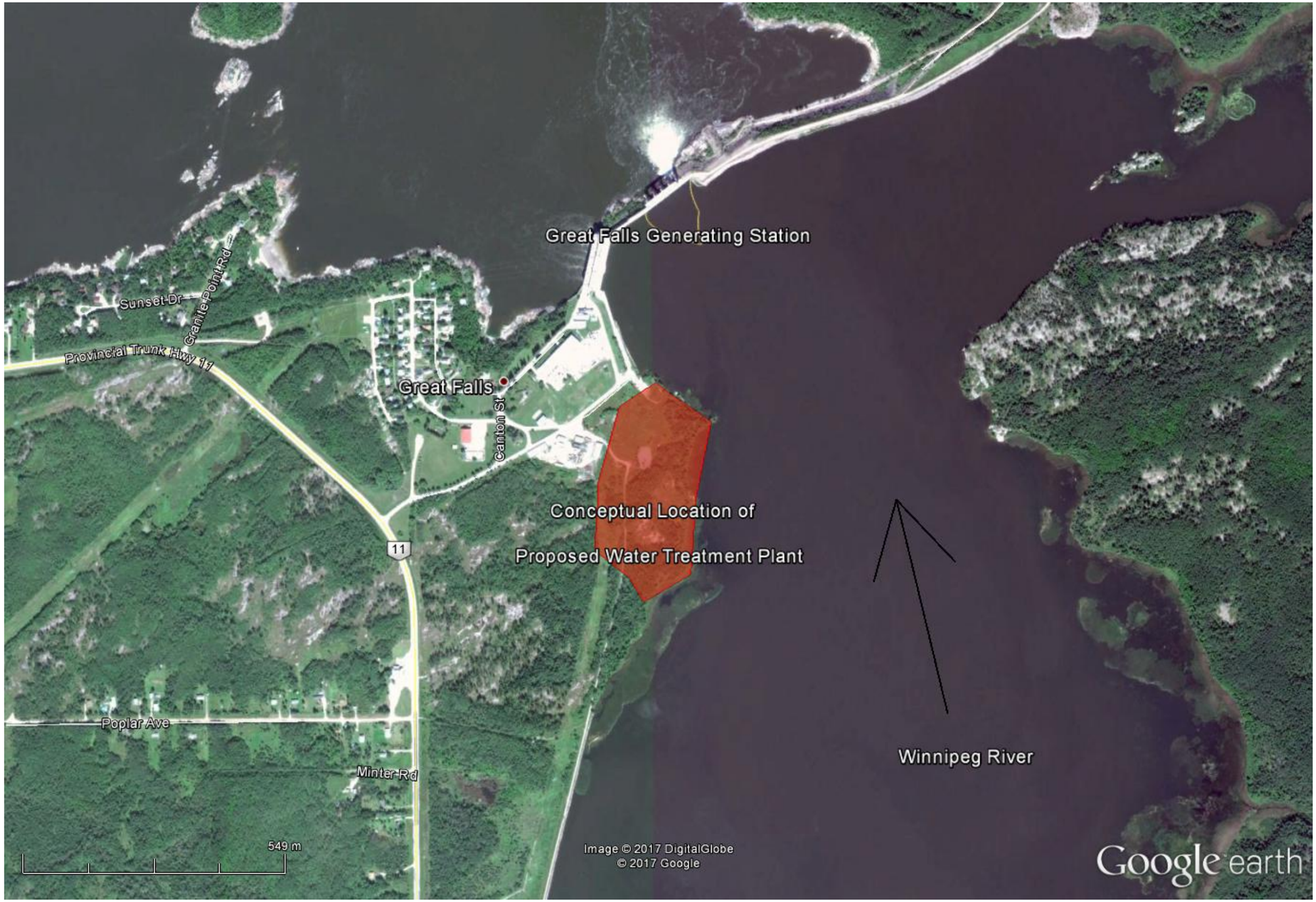
Appendix A

General Site Plan of Proposed Works


Great Falls Generating Station
Sunset Dr
Granite Point Rd
Provincial Trunk Hwy 11
Great Falls
Canton St
Conceptual Location of
Proposed Water Treatment Plant
11
Poplar Ave
Minter Rd
549 m
Winnipeg River
Image © 2017 DigitalGlobe
© 2017 Google
Google earth

Appendix B

Hydrology of Location of Proposed Works


GeoBase
N
North Coca Cola Creek
Great Falls
Winnipeg River
Provincial Trunk Hwy 11
11
2015 m
Image © 2017 DigitalGlobe
© 2016 Google
Google earth

Appendix C

PWS Operating Licenses

Manitoba Hydro – for treatment

RM of Alexander – for distribution

Manitoba

Water Stewardship

Office of Drinking Water
1007 Century Street, Winnipeg MB R3H 0W4

OPERATING LICENSE FOR
A PUBLIC WATER SYSTEM

LICENSE NUMBER: PWS-08-121

THE DRINKING WATER SAFETY ACT
CHAPTER D101, C.C.S.M.

WATER SYSTEM CODE:	**84.00**
OPERATION ID:	**6956**
EFFECTIVE DATE:	**JUNE 1, 2008**
EXPIRY DATE:	**MAY 31, 2012**

IN ACCORDANCE WITH *THE DRINKING WATER SAFETY ACT*, THIS OPERATING LICENSE IS ISSUED PURSUANT TO SUBSECTION 8(1) TO:

MANITOBA HYDRO: "THE LICENSEE"

FOR THE OPERATION OF THE **GREAT FALLS PUBLIC WATER SYSTEM**, WHICH INCLUDES INTAKE STRUCTURES, TREATMENT FACILITIES, WATER STORAGE RESERVOIRS, AND DISTRIBUTION LINES, SUBJECT TO THE ATTACHED TERMS AND CONDITIONS.

THIS LICENSE DOES NOT AFFECT THE LICENSEE'S OBLIGATIONS WITH RESPECT TO COMPLIANCE WITH ALL APPLICABLE MUNICIPAL, PROVINCIAL, AND FEDERAL LEGISLATION. THIS LICENSE SUPERSEDES ALL PREVIOUS LICENSES AND CERTIFICATES OF APPROVAL FOR THIS PUBLIC WATER SYSTEM.

DATE: May 30, 2008

Don Rocan, P.Eng.
Director

Page 1 of 6

TERMS AND CONDITIONS

1. General

1.1. The Licensee shall operate the public water system in accordance with all applicable requirements of *The Drinking Water Safety Act* and its regulations, and the requirements of this Licence. In the event that specific terms and conditions of this Licence imposed under the authority of subsection 8(3) of the Act exceed the general requirements of the Act and regulations, the specific requirements of this Licence shall apply.

1.2. The Licensee shall obtain approval from the Office of Drinking Water prior to making any significant alterations to the water source, the water treatment process, the water storage facilities or the water distribution system.

1.3. This Licence may be amended by the Director where, in the opinion of the Director, an amendment is necessary and the amendment will not negatively impact, a) the safety of water obtained from the water system; or b) effective environmental management.

1.4. The Licensee may request an amendment to this permit by submitting an amendment application to the Office of Drinking Water.

1.5. This Licence may be suspended or cancelled by the Director for any of the reasons identified in Section 11 of *Manitoba Regulation 40/2007, Drinking Water Safety Regulation* or due to a failure to comply with any term or condition of this Licence.

1.6. The Licensee shall provide written notice to the Office of Drinking Water of any change in title/ownership of the water system within 30 days of the transfer of title/ownership.

1.7. The Director of the Office of Drinking Water, Medical Officer of Health or Drinking Water Officer may enter any water system facility as necessary to carry out the provisions of *The Drinking Water Safety Act* and its regulations.

1.8. The Licensee shall post a copy of this Licence at the water treatment facility and ensure all operators are familiar with its terms and conditions.

1.9. The Licensee shall apply for renewal of this Licence at least 60 days prior to its expiry.

2. Operation - General

2.1. The Licensee shall operate all facilities, control systems and equipment as efficiently as possible, inspect them on a regular basis, and maintain them in good working order.

2.2. The Licensee shall ensure that all equipment used for filtration and disinfection is maintained in effective working order and keep available for immediate use all spare parts and chemical supplies as may be necessary to ensure continuous filtration and disinfection, including a spare disinfection unit, if necessary.

2.3. The Licensee shall protect the water system from contamination against such risks as cross connections as per the *Manitoba Plumbing Code 128/2006*.

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2.4. The Licensee shall ensure that all chemicals and components that may come into contact with potable water are certified safe for potable water use through AWWA Standards, ANSI/NSF Standard 60 or 61, Health Canada, or other standards acceptable to the Director.

2.5. The Licensee shall ensure that disinfection is undertaken following construction, repair or maintenance activities on the water system, in accordance with applicable AWWA standards, or other standards approved by the Director. A copy of all associated test results must be kept available for review by the Office of Drinking Water for a minimum of 24 months.

2.6. The Licensee shall submit an emergency response (contingency) plan in a form acceptable to the Director that addresses routine and major emergencies such as equipment malfunctions, upset conditions and contamination events by June 1, 2010.

2.7. The Licensee shall have an assessment of the water system infrastructure and water supply sources completed and submitted by a qualified professional engineer, who is not an employee of the water system, in a form satisfactory to the Director by September 1, 2008.

2.8. The Licensee shall submit a compliance plan in a form satisfactory to the Director by December 1, 2009 addressing the following water quality standards:
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.

2.9. The Licensee shall ensure that a filter-to-waste feature or other method approved by the Director, is installed at the time that new filtration equipment or alterations to existing filtration equipment are made that allows filtered water to be wasted until turbidity levels have stabilized to an acceptable level upon filter start-up or following a backwash cycle.

3. Water Quality Standards

3.1. The Licensee shall operate the water system in a manner that achieves the following water quality standards specified in Table 1, as determined through the monitoring requirements specified in Table 2:

Table 1: Water Quality Standards

Parameter	Quality Standard
Total coliform and E. coli	Less than one E. coli and total coliform bacteria detectable per 100 mL in all treated and distributed water
Chlorine residual	▪ A free chlorine residual of at least 0.5 mg/L in water entering the distribution system following a minimum contact time of 20 minutes. ▪ A free chlorine residual of at least 0.1 mg/L at all times at any point in the water distribution system
Turbidity	▪ Less than or equal to 0.3 NTU in 95% of the measurements in a month of the effluent from each operating particulate filter ▪ Not exceed 0.3 NTU for two consecutive daily measurements. ▪ Not exceed 1.0 NTU for any daily measurement.

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Parameter	Quality Standard
Total trihalomethanes (to include: bromodichloromethane, bromoform, chloroform, dibromochloromethane)	Less than or equal to 0.10 mg/L as annual average of quarterly samples
Bromodichloromethane	Less than or equal to 0.016 mg/L
Lead	Less than or equal to 0.01 mg/L

3.2. The Licensee shall have in place and maintain in effective working order, filtration and disinfection equipment and controls designed to provide reduction or inactivation of 99.9% (3-log) of *Cryptosporidium* oocysts and 99.9% (3-log) of *Giardia lamblia* cysts. This shall be demonstrated through the engineering assessment process, or compliance plan process, or both.

3.3. The Licensee shall have in place and maintain in effective working order, filtration and/or disinfection equipment and controls designed to provide reduction or inactivation of 99.99% (4-log) of viruses.

3.4. If a standard is not met, the Licensee shall immediately undertake the corrective actions as listed in Schedule A, or Schedule C of *Manitoba Regulation 41/2007, Drinking Water Quality Standards Regulation*, as applicable.

4. WATER QUALITY MONITORING

4.1. The Licensee shall immediately notify the Office of Drinking Water of any condition that may affect the ability of the water system to produce or deliver safe drinking water including treatment upsets or bypass conditions, contamination of the source water or treated water, a filtration or disinfection system failure or a distribution system failure.

4.2. Where water quality analysis is required to be undertaken by a laboratory, the Licensee shall ensure that laboratory is CAEAL accredited to undertake the analysis being requested, unless prior approval for submission to an alternate laboratory is obtained from the Director.

4.3. The Licensee shall ensure that all water quality monitoring equipment is properly maintained and calibrated according to manufacturer recommendations and that records are maintained to that effect.

4.4. Unless otherwise noted, the Licensee shall submit all monitoring results within seven days following the month during which the monitoring was conducted, in a form satisfactory to the Director.

4.5. The Licensee shall ensure that sampling within the distribution system takes place at locations acceptable to the Office of Drinking Water.

4.6. The Licensee shall ensure that raw water samples are taken on an alternating basis in instances where more than one water supply source is used.

4.7. The Licensee shall ensure monitoring is completed as set out in Table 2.

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Table 2. Monitoring Schedule

Parameter	Monitoring Requirement
Bacteriological (total coliform and E. coli)	▪ Bi-weekly sampling program with each set of samples consisting of one raw, one treated and a minimum of one distribution sample ▪ Consecutive sample sets to be separated by at least 12 days.
Free chlorine (treated water)	One sample per day of water entering the distribution system following at least twenty minutes of contact time.
Free chlorine (distribution system)	At the same time and location(s) as bacteriological distribution system sampling.
Total chlorine (treated water)	One sample per day of water entering the distribution system following at least twenty minutes of contact time.
Total chlorine (distribution system)	At the same time and location(s) as bacteriological distribution system sampling.
Turbidity	▪ One raw water sample per day. ▪ One sample per day of effluent from each operating rapid media filter.
General chemistry	One raw and one treated water sample once each year.
Trihalomethanes and Bromodichloromethane	One preserved distribution system sample taken on a quarterly basis during March, June, September, and December, every second year.
Lead	As per the instructions of the Drinking Water Officer

5. Record-Keeping and Reporting

5.1. The Licensee shall record disinfectant residual measurements on the monthly disinfection report form or other form satisfactory to the Director, keep one copy for records and forward the original copy to the Drinking Water Officer within seven days after the end of each calendar month.

5.2. The Licensee shall record distribution system disinfectant residual measurements on the chain of custody form (laboratory submission form) which accompanies the bacteriological sample bottles to the laboratory.

5.3. The Licensee shall record turbidity measurements on the monthly turbidity report form or other form satisfactory to the Director, keep one copy for records and forward the original copy to the Drinking Water Officer within seven days after the end of each calendar month.

5.4. Where corrective actions are required for total coliform, turbidity, and disinfectant residual compliance purposes (as per the *Operational Guidelines For Monitoring and Reporting Public and Semi-Public Water Systems,* ODW Guideline 2007-01), the Licensee shall complete a Corrective Actions Report form. The Licensee shall keep one copy for owner records and forward the original copy to the Drinking Water Officer along with the monthly disinfection, or turbidity report form.

5.5. The Licensee shall retain for a minimum of 24 months the following operational records for the water system: all laboratory analysis reports, monthly disinfection and turbidity report forms and corrective action forms.

5.6. The Licensee shall ensure that operational records are maintained in chronological order.

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5.7. The Licensee shall maintain in a secure location a copy of every order, permit, advisory and Licence that remains in effect for the water system.

5.8. The Licensee shall maintain in a secure location all construction drawings for the life of the water system components.

5.9. The Licensee shall ensure that all records and reports related to the water system are kept in a secure location and made available on request from the Office of Drinking Water.

5.10. The Licensee shall ensure the following information is available to the public for inspection: a copy of every water quality analysis result required to be performed over the last 24 months, a copy of every permit, order, advisory and licence in effect in relation to the water system.

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Manitoba
Conservation and Water Stewardship
Office of Drinking Water
1007 Century Street, Winnipeg, Manitoba R3H 0W4

OPERATING LICENCE FOR A PUBLIC WATER SYSTEM

LICENCE NUMBER: PWS-08-122-01

THE DRINKING WATER SAFETY ACT
CHAPTER D101, C.C.S.M.

WATER SYSTEM CODE:	**84.25**
OPERATION ID:	**36149**
EFFECTIVE DATE:	**JUNE 1, 2012**
EXPIRY DATE:	**NOVEMBER 30, 2017**

IN ACCORDANCE WITH *THE DRINKING WATER SAFETY ACT*, THIS OPERATING LICENCE IS ISSUED PURSUANT TO SUBSECTION 8(1) TO:

RURAL MUNICIPALITY OF ALEXANDER: "THE LICENSEE"

FOR THE OPERATION OF THE **GREAT FALLS (GREAT FALLS MANITOBA HYDRO) PUBLIC WATER SYSTEM**, WHICH INCLUDES DISTRIBUTION LINES, SUBJECT TO THE ATTACHED TERMS AND CONDITIONS.

THIS LICENCE DOES NOT AFFECT THE LICENSEE'S OBLIGATIONS WITH RESPECT TO COMPLIANCE WITH ALL APPLICABLE MUNICIPAL, PROVINCIAL, AND FEDERAL LEGISLATION. THIS LICENCE SUPERSEDES ALL PREVIOUS LICENSES FOR THIS PUBLIC WATER SYSTEM.

DATE: May 24, 2013

Kim Philip, P.Eng.
Director

Page 1 of 5

TERMS AND CONDITIONS

1. GENERAL

1.1. The Licensee shall operate the public water system in accordance with all applicable requirements of *The Drinking Water Safety Act* and its regulations, and the requirements of this Licence. In the event that specific terms and conditions of this Licence imposed under the authority of subsection 8(3) of the Act exceed the general requirements of the Act and regulations, the specific requirements of this Licence shall apply.

1.2. The Licensee shall obtain approval from the Office of Drinking Water prior to making any significant alterations to the water source, the water treatment process, the water storage facilities, or the water distribution system.

1.3. This Licence may be amended by the Director where, in the opinion of the Director, an amendment is necessary and the amendment will not negatively impact the safety of water obtained from the water system, or effective environmental management.

1.4. The Licensee may request an amendment to this licence by submitting an amendment application to the Office of Drinking Water.

1.5. This Licence may be suspended or cancelled by the Director for any of the reasons identified in Section 11 of *Manitoba Regulation 40/2007, Drinking Water Safety Regulation* or due to a failure to comply with any term or condition of this Licence.

1.6. The Licensee shall provide written notice to the Office of Drinking Water of any change in title/ownership of the water system within seven days of the transfer of title/ownership.

1.7. The Licensee shall provide written notice to the Office of Drinking Water of any changes in the operational status of the water system, such as a permanent cessation of service, or changing the length of service from year-round to seasonal or the opposite.

1.8. The Director of the Office of Drinking Water, Medical Officer of Health or Drinking Water Officer may enter any water system facility as necessary to carry out the provisions of *The Drinking Water Safety Act* and its regulations.

1.9. The Licensee shall post a copy of this Licence in its entirety at the head office and ensure all operators are familiar with its terms and conditions.

1.10. The Licensee shall apply for renewal of this Licence at least 60 days prior to its expiry.

2. OPERATION - GENERAL

2.1. The Licensee shall operate all water system facilities, control systems and equipment as efficiently as possible, inspect them on a regular basis, maintain them in good working order, and ensure that the water system is protected from the risks associated with cross-contamination.

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2.2. The Licensee shall ensure that all chemicals and components that may come into contact with potable water are certified safe for potable water use through AWWA Standards, ANSI/NSF Standard 60 or 61, Health Canada, or other standards acceptable to the Director.

2.3. The Licensee shall have a re-assessment of the water system infrastructure and water supply sources completed and submitted by a qualified professional engineer, who is not an employee of the water system, in a form satisfactory to the Director by March 1, 2016 and every five years thereafter.

2.4. The Licensee shall update and re-submit the compliance plan in a form and timeframe satisfactory to the Director if the contents and schedule of the plan have changed significantly and a revised plan has become necessary. The revised compliance plan is to address the following standards:
   a) total trihalomethanes in the distribution system

3. OPERATION – EMERGENCIES

3.1. The Licensee shall ensure that disinfection is undertaken following construction, repair or maintenance activities on the water system, in accordance with applicable AWWA standards, or Manitoba Water Services Board specifications, or any other standards approved by the Director. A copy of all associated test results must be kept available for review by the Office of Drinking Water for a minimum of 24 months.

3.2. The Licensee shall immediately notify the Office of Drinking Water of any condition that may affect the ability of the water system to produce or deliver safe drinking water including bypass conditions, contamination of the treated water, a disinfection system failure, or a distribution system failure as described in the most recent version of the Office of Drinking Water "Operational Guidelines for Public and Semi-public Water Systems".

3.3. If a Medical Officer of Health, the Director of the Office of Drinking Water, or a Drinking Water Officer issues a water advisory on the water system, the Licensee shall provide notice of the advisory to all water users by a method acceptable to the issuer.

4. WATER QUALITY/TREATMENT STANDARDS

4.1. The Licensee shall operate the water system in a manner that achieves the water quality/treatment standards specified in Table 1, as determined through the monitoring requirements specified in Table 2:

Table 1: Water Quality/Treatment Standards

Parameter	Quality Standard
Total coliform	Less than one total coliform bacteria detectable per 100 mL in all treated and distributed water
E. coli	Less than one E. coli bacteria detectable per 100 mL in all treated and distributed water
Chlorine residual	A free chlorine residual of at least 0.1 mg/L at all times at any point in the water distribution system
Total trihalomethanes (THMs)	Less than or equal to 0.10 mg/L as locational annual average of quarterly samples

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Parameter	Quality Standard
Lead	Less than or equal to 0.01 mg/L in the water distribution system

4.2. If a bacteriological standard is not met, the Licensee shall immediately undertake the applicable corrective actions as listed in "Schedule A" of Manitoba Regulation 41/2007, *Drinking Water Quality Standards Regulation*.

4.3. If a microbial, chemical, radiological, or physical standard is not met, the Licensee shall immediately undertake the applicable corrective actions specified in "Schedule C" of Manitoba Regulation 41/2007, the *Drinking Water Quality Standards Regulation*.

4.4. Where corrective actions are required for minor exceedances as described in the most recent version of the Office of Drinking Water "Operational Guidelines for Public and Semi-public Water Systems", a Corrective Actions Form must be completed and submitted to the regional Drinking Water Officer.

5. WATER QUALITY MONITORING

5.1. The Licensee shall ensure that all water quality monitoring equipment is properly maintained and calibrated by a qualified person according to manufacturer recommendations and that records are maintained to that effect.

5.2. The Licensee shall ensure that sampling within the distribution system takes place at varied locations acceptable to the Drinking Water Officer.

5.3. The Licensee shall ensure that all samples are collected, handled, and submitted in a manner that complies with the requirements of the laboratory undertaking the analyses.

5.4. The Licensee shall ensure monitoring is completed as set out in Table 2.

Table 2. Monitoring Schedule

Parameter	Monitoring Requirement
Bacteriological (total coliform and E. coli)	Bi-weekly sampling program with each set of samples consisting of a minimum of one distribution sample Consecutive sample sets to be separated by at least 12 days
Free chlorine (distribution system)	At the same time and location(s) as bacteriological distribution system sampling
Total chlorine (distribution system)	At the same times and location(s) as bacteriological distribution system sampling
Total trihalomethanes (THMs)	One preserved distribution system sample taken on a quarterly basis during February, May, August, and November, every second year beginning 2014
Total Haloacetic Acids (HAAs)	One preserved distribution system sample taken on a quarterly basis during February, May, August, and November, every second year at a location established by the Drinking Water Officer beginning 2014
Lead	As per the instructions of the Drinking Water Officer

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5.5. The Licensee shall ensure that an accredited laboratory, as specified in section 35 of Manitoba Regulation 40/2007 the *Drinking Water Safety Regulation*, undertake the following analysis required in Table 2:
   a) bacteriological (total coliform and *E. coli*)
   b) total trihalomethanes
   c) total Haloacetic Acids
   d) any other parameter required by the Drinking Water Officer

5.6. The Licensee shall ensure that parameters listed in Table 2 but not specified in clause 5.5 are measured utilizing water quality monitoring equipment and methods approved by the U.S. Environmental Protection Agency (EPA).

6. RECORD-KEEPING AND REPORTING

6.1. The Licensee shall ensure that water metering devices are maintained in good working order and that meter readings are recorded at least on a weekly basis and such records are made available for inspection by a Drinking Water Officer.

6.2. The Licensee shall record all distribution system measurements specified in *Table 2: Monitoring Schedule* on the chain of custody form (laboratory submission form) which accompanies the bacteriological sample bottles to the laboratory.

6.3. The Licensee shall record corrective actions for minor exceedances as discussed in clause 4.4 of this Licence and complete a Corrective Actions Report form. The Licensee shall keep one copy for records and forward the original copy to the Drinking Water Officer along with the monthly report forms.

6.4. The Licensee shall retain in chronological order for a minimum of 24 months the following operational records for the water system:
   a) all laboratory analysis reports
   b) corrective action forms
   c) other report(s) as specified in *Table 2: Monitoring Schedule* or as directed by the Drinking Water Officer

6.5. The Licensee shall maintain in a secure location all construction drawings for the life of the water system components.

6.6. The Licensee shall ensure the following information is available to the public for inspection: a copy of every water quality analysis result required to be performed over the last 24 months, a copy of every permit, order, advisory and licence in effect, in relation to the water system.

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Appendix D

Water Rights Licence

(not available – application pending)

Appendix E

Winnipeg River Raw Water Quality Analysis

(adopted from Engineer's Technical Memorandum #2)

Client Sample ID		GREAT FALLS 1 - RAW	GREAT FALLS HYDRO 1 - RAW	GREAT FALLS 1 - RAW	1-RAW	GREAT FALLS HYDRO 1-RAW			
Date Sampled		11/09/2012	04/11/2013	22/10/2014	17/11/2015	20/10/2016			
Time Sampled		0.458333333	0.4375	0.5	0.5625	0.458333333			
ALS Sample ID		L1207667-1	L1387172-1	L1536829-1	L1703775-1	L1846433-1			
Parameter		Water	Water	Water	Water	Water	Min	Avg	Max
Physical Tests (Water)	Units								
Colour, True	CU	26.3	21	31.2	34.9	36.2	21	29.92	36.2
Conductivity	umhos/cm	123	101	95	90.9	93.4	90.9	100.66	123
Hardness (as CaCO3)	mg/L	47	49.7	48.8	48	46.6	46.6	48.02	49.7
Langelier Index (4 C)	-	-0.84	-0.97	-0.89	-1.2	-1.2	-1.2	-1.04	-0.89
Langelier Index (60 C)	-	-0.17	-0.2	-0.11	-0.4	-0.43	-0.43	-0.262	-0.11
pH	pH units	7.95	7.8	7.92	7.67	7.63	7.63	7.794	7.95
Total Dissolved Solids	mg/L	76	64	66	88.3	79	64	70.26	79
Transmittance, UV (254 nm)	% T	46.8	52.3	45.6	45.5	48.3	45.5	47.7	52.3
Turbidity	NTU	10.6	5.43	75	5.45	5.63	5.43	20.422	75
Anions and Nutrients (Water)									
Alkalinity, Total (as CaCO3)	mg/L	45	47	43	39.4	42.8	39.4	43.44	47
Ammonia, Total (as N)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010			
Bicarbonate (HCO3)	mg/L	55	57	52	48.1	52.2	48.1	52.86	57
Bromide (Br)	mg/L	<0.10	-	<0.10	<0.10	<0.010			
Carbonate (CO3)	mg/L	<12	1.44	<12	<12	<0.60	1.44	1.44	1.44
Chloride	mg/L	1.6	0.041	1.42	1.43	1.65	0.041	1.2282	1.65
Fluoride	mg/L	0.119	<6.8	0.042	0.044	0.047	0.042	0.063	0.119
Hydroxide (OH)	mg/L	<6.8	-0.7	<6.8	<6.34	<6.34	-0.7	-0.7	-0.7
Iodide (I)	mg/L	<2.0	-	<2.0	<2.0	<2.0			
Nitrate and Nitrite as N	mg/L	0.041	-	0.0753	0.0905	-	0.041	0.06893333	0.0905
Nitrate-N	mg/L	0.041	0.0389	0.0753	0.0905	0.0889	0.0389	0.06652	0.0905
Nitrite-N	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010			
Total Kjeldahl Nitrogen	mg/L	0.44	0.29	0.51	0.43	0.42	0.29	0.418	0.51
Total Nitrogen	mg/L	0.48	-	0.58	0.52	0.42	0.42	0.5	0.58
Sulfate	mg/L	3.3	3.15	2.92	2.69	2.83	2.69	2.978	3.3
Anion Sum	me/L	1.02	1.05	0.96	0.89	0.97	0.89	0.978	1.05
Cation Sum	me/L	1.17	1.09	1.09	1.08	1.06	1.06	1.096	1.17
Cation - Anion Balance	%	6.8	1.9	Low EC	Low EC	Low EC	1.9	4.35	6.8
Langelier Index	-	-	-0.7	-	-	-	-0.7	-0.7	-0.7
Saturation pH	pH		8.53				8.53	8.53	8.53
Organic / Inorganic Carbon (Wate									
Dissolved Organic Carbon	mg/L	9.2	0	0	0	0			
Total Carbon	mg/L	-	10	10.6	11.1	9.34	9.2	10.048	11.1
Total Inorganic Carbon	mg/L	7.6	20.5	-	-	-	20.5	20.5	20.5
Total Organic Carbon	mg/L	10	10.7	9.3	7.9	8.67	7.6	8.834	10.7
	0		9.8	12	10.9	9.41	9.41	10.422	12
Bacteriological Tests (Water)									
Escherichia Coli	MPN/100mL	6					6	6	6
Total Coliforms	MPN/100mL	118					118	118	118
Total Metals (Water)									
Aluminum (Al)-Total	mg/L	0.518	0.287	0.441	0.3	0.315	0.287	0.3722	0.518
Antimony (Sb)-Total	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020			
Arsenic (As)-Total	mg/L	0.00109	0.00085	0.00103	0.00111	0.00113	0.00085	0.001042	0.00113
Barium (Ba)-Total	mg/L	0.0144	0.0107	0.0121	0.0102	0.0113	0.0102	0.01174	0.0144
Beryllium (Be)-Total	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020			
Bismuth (Bi)-Total	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020			
Boron (B)-Total	mg/L	<0.010	<0.010	0.013	<0.010	<0.010	0.013	0.013	0.013
Cadmium (Cd)-Total	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010			
Calcium (Ca)-Total	mg/L	12.8	13.4	13.4	13.4	12.5	12.5	13.1	13.4
Cesium (Cs)-Total	mg/L	0.00011	<0.00010	<0.00010	<0.00010	0.00018	0.00011	0.000145	0.00018
Chromium (Cr)-Total	mg/L	<0.0010	<0.0010	<0.0010	0.00049	0.00052	0.00049	0.000505	0.00052
Cobalt (Co)-Total	mg/L	0.00022	<0.00020	<0.00020	<0.00020	<0.00020	0.00022	0.00022	0.00022

Copper (Cu)-Total	mg/L	0.00189	0.00128	0.00148	0.00128	0.00148	0.00128	0.001482	0.00189			
Iron (Fe)-Total	mg/L	0.45	0.23	0.37	0.277	0.307	0.23	0.3268	0.45			
Lead (Pb)-Total	mg/L	0.000275	0.000142	0.000202	0.000153	0.00017	0.000142	0.0001884	0.000275			
Lithium (Li)-Total	mg/L	0.0021	0.00106	0.00193	<0.0020	<0.0020	0.00106	0.00166667	0.0021			
Magnesium (Mg)-Total	mg/L	3.65	3.99	3.72	3.54	3.74	3.54	3.728	3.99			
Manganese (Mn)-Total	mg/L	0.0161	0.00689	0.012	0.0108	0.0118	0.00689	0.011918	0.0161			
Molybdenum (Mo)-Total	mg/L	0.0002	<0.00020	<0.00020	<0.00020	<0.00020	0.0002	0.0002	0.0002			
Nickel (Ni)-Total	mg/L	<0.0020	<0.0020	<0.0020	0.00086	0.00095	0.00086	0.000905	0.00095			
Phosphorus (P)-Total	mg/L	<0.10	<0.10	<0.10	<0.050	<0.050						
Potassium (K)-Total	mg/L	1.05	0.904	0.99	0.956	0.983	0.904	0.9766	1.05			
Rubidium (Rb)-Total	mg/L	0.0023	0.00165	0.00214	0.00177	0.00216	0.00165	0.002004	0.0023			
Selenium (Se)-Total	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.00010						
Silicon (Si)-Total	mg/L	2.64	1.84	2.92	2.48	2.77	1.84	2.53	2.92			
Silver (Ag)-Total	mg/L	<0.00010	<0.00010	<0.00010	<0.000010	<0.000010						
Sodium (Na)-Total	mg/L	2.66	2.38	2.1	2.21	2.42	2.1	2.354	2.66			
Strontium (Sr)-Total	mg/L	0.0268	0.0235	0.0251	0.0237	0.0254	0.0235	0.0249	0.0268			
Tellurium (Te)-Total	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020						
Thallium (Tl)-Total	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010						
Thorium (Th)-Total	mg/L	0.00014	<0.00010	0.0001	<0.00010	<0.00010	0.0001	0.00012	0.00014			
Tin (Sn)-Total	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020						
Titanium (Ti)-Total	mg/L	0.0167	0.00788	0.0134	0.00879	0.00907	0.00788	0.011169	0.0167			
Tungsten (W)-Total	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010						
Uranium (U)-Total	mg/L	0.00014	<0.00010	0.00011	0.00011	0.00011	0.00011	0.0001175	0.00014			
Vanadium (V)-Total	mg/L	0.00166	0.00089	0.00132	0.00103	0.00107	0.00089	0.001194	0.00166			
Zinc (Zn)-Total	mg/L	<0.0020	<0.0020	0.0027	0.0012	0.0015	0.0012	0.0018	0.0027			
Zirconium (Zr)-Total	mg/L	0.00046	<0.00040	0.00043	<0.00040	<0.00040	0.00043	0.000445	0.00046			
Dissolved Metals (Water)												
Aluminum (Al)-Dissolved	mg/L	0.095	0.0784	0.012	0.0615	0.0544	0.012	0.06426	0.095			

Appendix F

Membrane Concentrate Water Quality Projection

(adopted from Sapphire's Supply Proposal)

Integrated Membranes Solutions Design Software, 2016

Created on: 5/4/2017 03:45:36

Permeate Blending

Project name	Great Falls, MB				
Calculated by	AAN				
HP Pump flow	140.00	gpm	Permeate flow/train	112.00	gpm
Feed pressure	59.3	psi	Raw water flow/train	155.00	gpm
Feed temperature	15.0	°C(59.0°F)	Permeate recovery	80.00	%
Feed water pH	7.63		Blended flow	127.00	gpm
Chem dose, mg/l, -	None		Element age	5.0	years
Specific energy	0.70	kwh/kgal	Flux decline %, first year	7.0	
Pass NDP	50.8	psi	Fouling factor	0.86	
Average flux rate	11.1	gfd	SP increase, per year	7.0	%
			Inter-stage pipe loss	3.0	psi
			Feed type	Brackish Surface MF/UF	

Pass - Stage	Perm. Flow	Flow / Vessel Feed	Flow / Vessel Conc	Flux	DP	Flux Max	Beta	Stagewise Pressure Perm.	Stagewise Pressure Boost	Stagewise Pressure Conc	Perm. TDS	Element Type	Element Quantity	PV# x Elem #
	gpm	gpm	gpm	gfd	psi	gfd		psi	psi	psi	mg/l			
1-1	80.2	35	14.9	12	8.1	13	1.19	0	0	51.1	14.7	ESNA1-LF2-LD	24	4 x 6M
1-2	31.8	29.9	14	9.6	6.8	10.3	1.16	0	0	41.4	36.4	ESNA1-LF2-LD	12	2 x 6M

Ion (mg/l)	Raw Water	Feed Water	Permeate Water	Concentrate 1	Concentrate 2	Blended Product	Post Treatment
Hardness, as CaCO3	46.58	46.58	8.718	101.1	198.5	13.19	13.187
Ca	12.50	12.50	2.699	26.8	51.8	3.86	3.856
Mg	3.74	3.74	0.481	8.3	16.8	0.87	0.865
Na	2.42	2.42	1.267	4.4	7.0	1.40	2.410
K	0.98	0.98	0.702	1.5	2.1	0.73	0.735
NH4	0.09	0.09	0.064	0.1	0.2	0.07	0.067
Ba	0.011	0.011	0.002	0.0	0.0	0.00	0.003
Sr	0.025	0.025	0.004	0.1	0.1	0.01	0.007
H	0.00	0.00	0.000	0.0	0.0	0.00	0.000
CO3	0.10	0.10	0.008	0.4	1.6	0.02	0.084
HCO3	52.20	52.20	13.538	108.7	203.5	18.11	20.601
SO4	2.83	2.83	0.242	6.4	13.2	0.55	0.547
Cl	1.65	1.65	0.755	3.1	5.2	0.86	0.861
F	0.05	0.05	0.043	0.1	0.1	0.04	0.044
NO3	0.00	0.00	0.000	0.0	0.0	0.00	0.000
PO4	0.00	0.00	0.000	0.0	0.0	0.00	0.000
OH	0.00	0.00	0.001	0.0	0.0	0.00	0.001
SiO2	2.77	2.77	1.031	5.5	9.7	1.24	1.236
B	0.00	0.00	0.000	0.0	0.0	0.00	0.000
CO2	2.23	2.23	2.23	2.23	2.23	2.23	0.38
TDS	**79.36**	**79.36**	**20.84**	**165.49**	**311.62**	**27.75**	**31.32**
pH	**7.63**	**7.63**	**7.05**	**7.94**	**8.20**	**7.18**	**8.01**

Saturations	Raw Water	Feed Water	Concentrate	Limits
CaSO4 / ksp * 100, %	0	0	0	400
SrSO4 / ksp * 100, %	0	0	0	1200
BaSO4 / ksp * 100, %	9	9	53	10000
SiO2 saturation, %	3	3	8	140
CaF2 / ksp * 100, %	0	0	0	50000
Ca3(PO4)2 saturation index	0.0	0.0	0.0	2.4
CCPP, mg/l	-2.70	-2.70	12.54	
Langelier saturation index	-1.23	-1.23	0.49	2.5
Ionic strength	0.00	0.00	0.01	
Osmotic pressure, psi	0.6	0.6	2.4	

Integrated Membranes Solutions Design Software, 2016

Created on: 5/4/2017 03:45:36

Permeate Blending

Project name	Great Falls, MB			
Calculated by	AAN			
HP Pump flow	140.00	gpm	Permeate flow/train	112.00 gpm
Feed pressure	59.3	psi	Raw water flow/train	155.00 gpm
Feed temperature	15.0	°C(59.0°F)	Permeate recovery	80.00 %
Feed water pH	7.63		Blended flow	127.00 gpm
Chem dose, mg/l, -	None		Element age	5.0 years
Specific energy	0.70	kwh/kgal	Flux decline %, first year	7.0
Pass NDP	50.8	psi	Fouling factor	0.86
Average flux rate	11.1	gfd	SP increase, per year	7.0 %
			Inter-stage pipe loss	3.0 psi
			Feed type	Brackish Surface MF/UF

Pass - Stage	Perm. Flow gpm	Flow / Vessel Feed gpm	Conc gpm	Flux gfd	DP psi	Flux Max gfd	Beta	Stagewise Pressure Perm. psi	Boost psi	Conc psi	Perm. TDS mg/l	Element Type	Element Quantity	PV# x Elem #
1-1	80.2	35	14.9	12	8.1	13	1.19	0	0	51.1	14.7	ESNA1-LF2-LD	24	4 x 6M
1-2	31.8	29.9	14	9.6	6.8	10.3	1.16	0	0	41.4	36.4	ESNA1-LF2-LD	12	2 x 6M

Pass - Stage	Element no.	Feed Pressure psi	Pressure Drop psi	Conc Osmo. psi	NDP psi	Permeate Water Flow gpm	Permeate Water Flux gfd	Beta	Permeate (Passwise cumulative) TDS	Ca	Mg	Na	Cl
1-1	1	59.3	2.02	0.7	57.9	3.6	13	1.1	10.2	1.267	0.217	0.698	0.4
1-1	2	57.2	1.73	0.7	55.8	3.5	12.5	1.11	10.9	1.359	0.234	0.741	0.426
1-1	3	55.5	1.45	0.8	54.1	3.4	12.1	1.12	11.7	1.46	0.252	0.785	0.453
1-1	4	54.1	1.2	0.9	52.7	3.3	11.8	1.14	12.5	1.573	0.272	0.833	0.482
1-1	5	52.9	0.97	1.1	51.6	3.2	11.5	1.16	13.5	1.704	0.296	0.887	0.516
1-1	6	51.9	0.76	1.3	50.5	3.1	11.3	1.19	14.7	1.859	0.325	0.947	0.554
1-2	1	48.1	1.63	1.4	46.2	2.9	10.3	1.1	15.4	1.962	0.343	0.99	0.58
1-2	2	46.5	1.41	1.5	44.6	2.8	10	1.1	16.3	2.076	0.364	1.037	0.609
1-2	3	45.1	1.2	1.7	43.2	2.7	9.7	1.11	17.2	2.204	0.388	1.087	0.64
1-2	4	43.9	1.01	1.8	41.9	2.6	9.4	1.12	18.3	2.348	0.415	1.142	0.675
1-2	5	42.9	0.84	2.1	40.8	2.5	9.1	1.14	19.5	2.511	0.445	1.202	0.713
1-2	6	42	0.68	2.4	39.8	2.5	8.9	1.16	20.8	2.699	0.481	1.267	0.755

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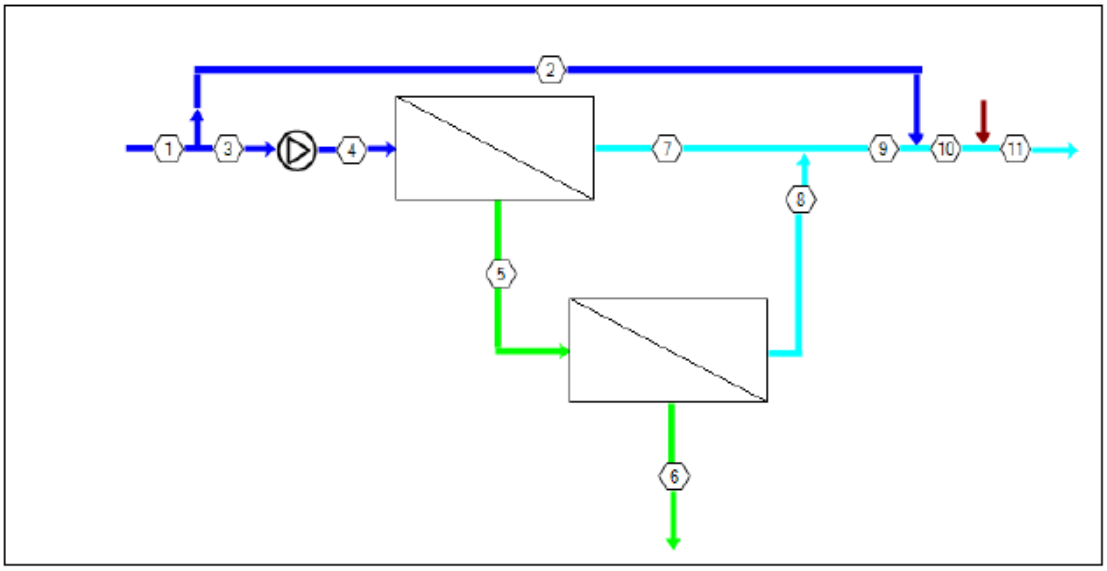
Created on: 5/4/2017 03:45:36

Permeate Blending

Project name Great Falls, MB Page : 3/4

Temperature : 15.0 °C Element age, P1 : 5.0 years



Stream No.	Flow (gpm)	Pressure (psi)	TDS (mg/l)	pH	Econd (µs/cm)
1	155	0	79.4	7.63	108
2	15.0	0	79.4	7.63	108
3	140	0	79.4	7.63	108
4	140	59.3	79.4	7.63	108
5	59.8	51.1	165	7.94	227
6	27.9	41.4	312	8.20	434
7	80.2	0	14.7	6.90	18.8
8	31.8	0	36.4	7.30	46.3
9	112	0	20.8	7.05	26.6
10	127	0	27.8	7.18	36.2
11	127	0	31.3	8.01	40.5

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Created on: 5/4/2017 03:45:36

Permeate Blending

Project name Great Falls, MB Page : 4/4

Appendix G

Manitoba Conservation Data Centre Information Request

Macaraeg, Paul (IMR)

From: Friesen, Chris (SD)
Sent: June-08-17 9:16 AM
To: Macaraeg, Paul (IMR)
Subject: Great Falls WTP Uprade

Paul

Thank you for your information request. I completed a search of the Manitoba Conservation Data Centre's rare species database and found no occurrences at this time for your area of interest.

The information provided in this letter is based on existing data known to the Manitoba Conservation Data Centre at the time of the request. These data are dependent on the research and observations of CDC staff and others who have shared their data, and reflect our current state of knowledge. An absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present; in many areas, comprehensive surveys have never been completed. Therefore, this information should be regarded neither as a final statement on the occurrence of any species of concern, nor as a substitute for on-site surveys for species as part of environmental assessments.

Because the Manitoba CDC's Biotics database is continually updated and because information requests are evaluated by type of action, any given response is only appropriate for its respective request. Please contact the Manitoba CDC for an update on this natural heritage information if more than six months pass before it is utilized.

Third party requests for products wholly or partially derived from Biotics must be approved by the Manitoba CDC before information is released. Once approved, the primary user will identify the Manitoba CDC as data contributors on any map or publication using Biotics data, as follows as: Data developed by the Manitoba Conservation Data Centre; Wildlife & Fisheries Branch, Manitoba Sustainable Development.

This letter is for information purposes only - it does not constitute consent or approval of the proposed project or activity, nor does it negate the need for any permits or approvals required by the Province of Manitoba.

We would be interested in receiving a copy of the results of any field surveys that you may undertake, to update our database with the most current knowledge of the area.

If you have any questions or require further information please contact me directly at (204) 945-7747.

Chris Friesen
Coordinator
Manitoba Conservation Data Centre
204-945-7747
chris.friesen@gov.mb.ca
http://www.manitoba.ca/conservation/cdc/

-----Original Message-----
From:
Sent: May-31-17 1:48 PM
To: Friesen, Chris (SD)
Subject: WWW Form Submission

1

Below is the result of your feedback form. It was submitted by WWW Information Request () on Wednesday, May 31, 2017 at 13:47:56

DocumentID: Manitoba_Conservation

Project Title: Great Falls WTP Uprade

Date Needed: 2017/06/14

Name: Paul Macaraeg

Company/Organization: Manitoba Water Services Board

Address: 2010-Currie Blvd

City: Brandon

Province/State: MB

Phone: 204-726-6766

Email: paul.macaraeg@gov.mb.ca

Project Description: The RM of Alexander requested the Manitoba Water Services Board (MWSB) to prepare an Environment Act Proposal for a Class 2 Development License under the Manitoba Environment Act for an Upgrade of the Water Treatment Plant (WTP) in the community of Great Falls.

An Environmental Act Proposal (EAP) is currently being drafted for submission. This EAP includes components of the proposed WTP upgrade, raw water supply pipeline, and reject water disposal.

Information Requested: As part of the EAP, potential environmental effects have to be addressed. We are collecting information about the project area with regard to the environment.

Please submit an inclusive set of information available from you so we may identify environmental effects that our project may cause to the environment and come up with mitigation measures and follow-up activities. So we can include this in our proposal.

e.g. fish habitat, species at risk, wildlife habitat, vegetation, traditional, ecological and archaeological sites, and any other sensitive environmental factors

Format Requested: As applicable. If shapefile also available, please include.

Can send by email. Paul.Macaraeg@gov.mb.ca

Location: Proposed location of water treatment plant is not yet finalized, but it will be within the community of Great Falls in the RM of Alexander. It is being proposed to be close in proximity to the existing Great Falls generating station. A wetwell is being proposed to be installed in the vicinity of the dyke 400 m south of the Hydro service buildings. The water treatment plant will likely be immediately northwest of those service buildings (where we think there is about 4 m to 5 m of overburden available).

Please feel free to contact us if clarifications or further information is required.

2

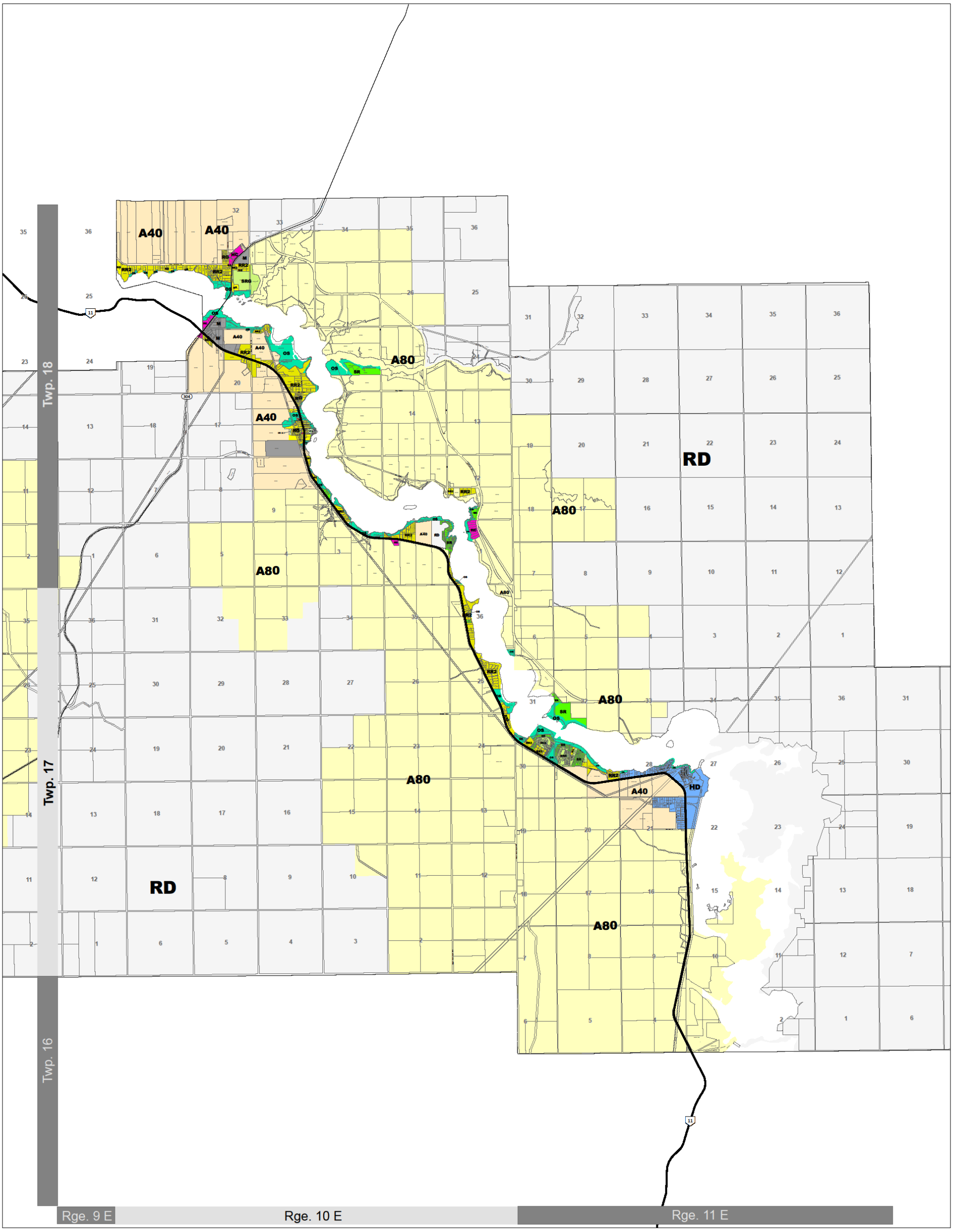
Thank-you.

action: Submit

3

Appendix H

Land Use and Zoning Maps



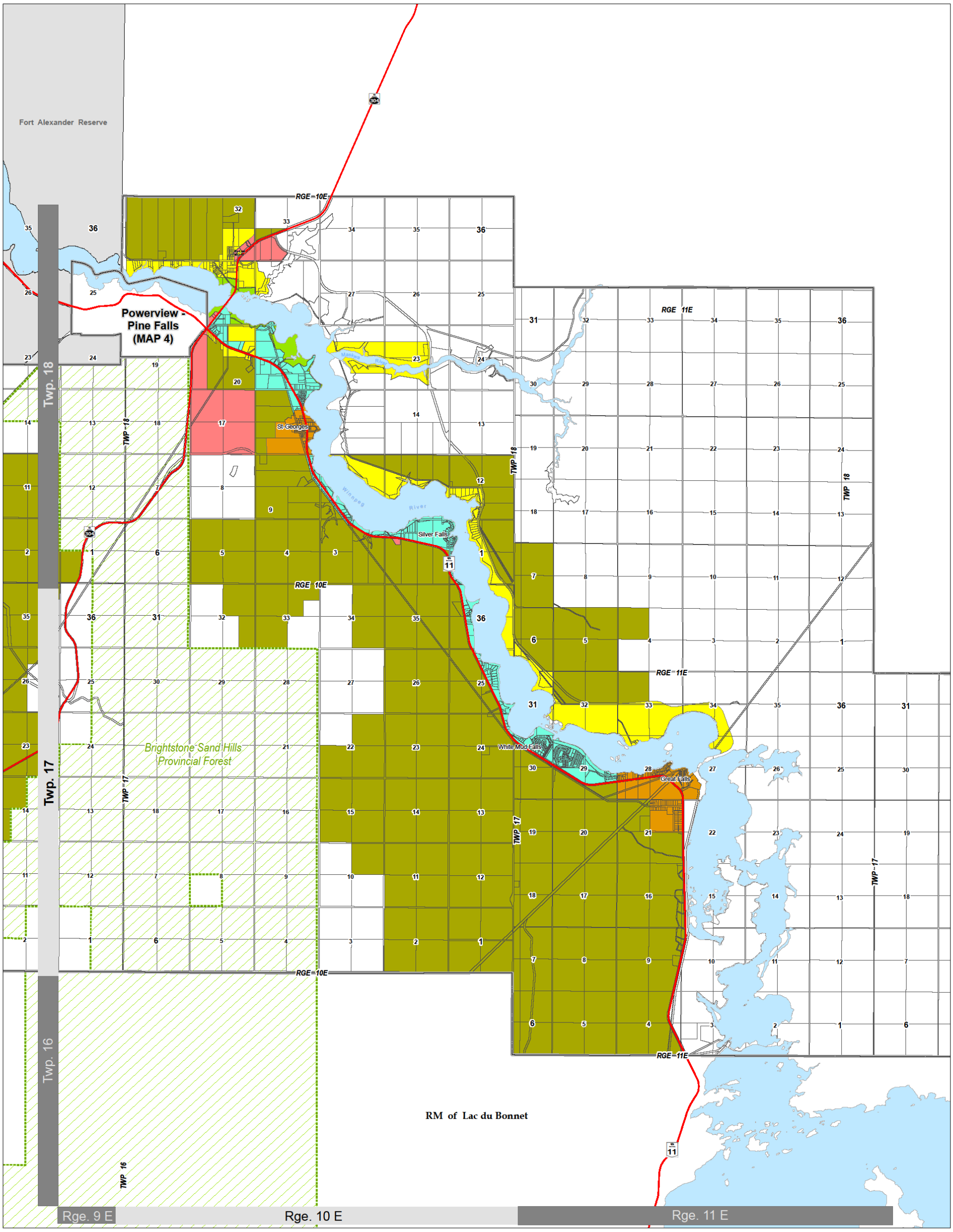
RM of Alexander
Zoning By-Law
Office Consolidation
Up to and including By-Law 06-16

MAP 2

Legend

RD	Resource Development Zone	RR2	Rural Residential Zone	M	Industrial Zone
A80	General Agricultural Zone	RR5	Rural Residential Zone	OR & I	Open Space Recreational and Institutional Zone
A40	Limited Agricultural Zone	CG	General Commercial Zone	OS	Shoreland Open Space Zone
A40-S	Special Limited Agricultural Zone	HC	Highway Commercial Zone	SR	Seasonal Residential Zone
RG	General Residential Zone	HD	Hamlet Development Zone	SRG	General Seasonal Recreational Zone

1:36,000
Miles 1 0.5 0 1
Kilometres 2 1 0 2
Manitoba MUNICIPAL GOVERNMENT
Date: Jan 31, 2017


Fort Alexander Reserve
Powerview - Pine Falls (MAP 4)
St-Georges
Silver Falls
White Mud Falls
Great Falls
Brightstone Sand Hills Provincial Forest
RM of Lac du Bonnet
RGE 10E
RGE 11E
TWP 18
TWP 17
TWP 16
Twp. 18
Twp. 17
Twp. 16
Rge. 9 E
Rge. 10 E
Rge. 11 E
Winnipeg River PD
RM of Alexander
Development Plan By-law 68-10
MAP 2
Legend
RURAL AREA
RESIDENTIAL AREA
RURAL COMMERCIAL AREA
NATURAL RESOURCE AREA
COMMUNITY AREA
PARKS/OPEN SPACE/INSTITUTIONAL AREA
WINNIPEG RIVER CORRIDOR AREAS
WMA
Forests
Waterbody
Parks/Reserves
Miles
Kilometres
Manitoba
MUNICIPAL GOVERNMENT
Date: March 10, 2016