

Summary of requested information and additional information

Request for information

No	Date	Notes
1	November 24, 2023 - request for information	Starting on page 2
2	January 30, 2024 - request for information	Starting on page 7

Additional information

No	Date	Notes
1	December 4, 2023 - response to November 24, 2023, request	Starting on page 3
2	April 3, 2024 – response to November 24, 2023, request	Starting on page 5
3	August 1, 2024 – response to January 24, 2024, request	Starting on page 8
4	August 9, 2024 – response to discussion from May 22, 2024	Starting on page 13
5	October 2, 2024 – response to discussion from October 2, 2024	Starting on page 20

From: Mak, Jay
Sent: Friday, November 24, 2023 9:14 AM
To: Kirk, Kyla <Kyla.Kirk@jacobs.com>
Cc: Freihammer, Till <Till.Freihammer@jacobs.com>
Subject: City of Brandon - File No. 6180.00

Hello Kyla,

We received ten Technical Advisory Committee (TAC) comments and no public comment on this proposal. I have attached the comments in a separate attachment and the information would be available on the public registry soon at <https://www.gov.mb.ca/sd/eal/registries/6180/index.html>. I have the following questions regarding this proposal:

1. Could you provide the certificate of title 4446 showing the owner(s) and legal description of the land upon which the development would be constructed?
2. Could you provide the expected chloride (mg/L), total calcium (mg/L), total magnesium (mg/L), and total sodium (mg/L) concentrations in the effluent stream?

TAC members identified a few additional requirements and please contact the respective departments if you need further clarifications. The environmental assessment and licensing process is ongoing and we may have additional questions on this project.

Please let me know if you have any questions.

Thanks,

Jay Mak, M.Sc., P.Eng.
Senior Environmental Engineer
Land Use, Waste Management, and Energy Section
Environmental Approvals Branch
Department of Environment and Climate Change
Box 35, 14 Fultz Blvd, Winnipeg, MB R3Y 0L6

T: (204) 619-0709 /F: (204) 945-5229/ Email: Jay.Mak@gov.mb.ca

To report an environmental emergency, please call the 24/7 Emergency Response Line at 204-944-4888 or 1-855-944-4888.

Facts are key in the fight against COVID-19, visit [Manitoba.ca/covid-19](https://www.manitoba.ca/covid-19)

residential areas or zoning.
(1) Public highways embraced in the description of the land included in a certificate shall be deemed to be excluded unless the certificate is to the Crown or a municipality.
(m) Any zoning regulation as that expression is defined in the Aeronautics Act (CANADA) made under that act and deposited in the Land Titles Office.

Vol. 10 Fol. 432
Cert. No.

4446



Certificate of Title

UNDER "THE REAL PROPERTY ACT"

THE CITY OF BRANDON

DUPLICATE ORIGINAL OF THIS
TITLE DESTROYED BY S.L.T.O.
SEE DEPOSIT CA-14672

is now seized of an estate in fee simple ~~in possession~~ subject to such encumbrances, liens and interests as are notified by memorandum underwritten (or endorsed hereon) in all that piece or parcel of land known and described as follows,

Lots One to Ten both inclusive in Blocks One hundred and four and One hundred and five in the City of Brandon and Province of Manitoba as shewn upon a plan of subdivision of part of Section Twenty-two in Township Ten and Range Nineteen West of the Principal Meridian in said Province now of record in the Brandon Land Titles Office as Plan No. 15.

The District Registrar hereby certifies that this is a true copy of a record maintained in the Property Registry of Manitoba

LAND TITLES OFFICE
JAN 05 2017
BRANDON, MAN.

IN WITNESS WHEREOF I have hereunto signed my name and affixed my Seal of office this Eleventh day of August One thousand nine hundred and two.
Signed in the presence of

"H. Wilson Todd"

"F. G. A. Henderson"

SEAL

District Registrar
for BRANDON

REGISTERED			
Mortgage for	The	day of	No.
\$	at	19	
			TO
			Deputy District Registrar
			No.
Mortgage for	The	day of	No.
\$	at	19	
			TO
			Deputy District Registrar
			No.
Mortgage for	The	day of	No.
\$	at	19	
			TO
			Deputy District Registrar
			No.

Deputy District Registrar

From: Freihammer, Till <Till.Freihammer@jacobs.com>
Sent: Wednesday, April 3, 2024 8:27 AM
To: Mak, Jay <Jay.Mak@gov.mb.ca>
Cc: Beaty, Jeff <Jeff.Beaty@jacobs.com>; A.Stangherlin <A.Stangherlin@brandon.ca>; Alan Howe <a.howe@brandon.ca>; Williamson, Barry <Barry.Williamson@jacobs.com>; Kirk, Kyla <Kyla.Kirk@jacobs.com>
Subject: RE: City of Brandon - File No. 6180.00_new effluent streams

Good Morning Jay,

This message should give you an answer to the questions 2 (see below highlighted) you asked in your email dated November 24, 2023. Question 1 was answered on December 4, 2023 (certificate of title 4446).

We compiled the expected chloride (mg/L), total calcium (mg/L), total magnesium (mg/L), and total sodium (mg/L) concentrations in the effluent stream. We assume you mean the future effluent stream. We apologize this took so long.

The tabled expected concentrations are estimates based on our current mass balances and available Membrane Pilot plant data from 2021/2022. In our EAP submission we explained that we intend to use the City of Brandon’s WTFacilities’ existing residuals treatment infrastructure to treat Backwash effluent from the future Ultrafiltration stage. In the future there will be two new effluent streams from the WTFacility. (Filter backwash effluent and filtrate from the dewatering (belt filter press) are existing).

1. Nanofiltration concentrate : Discharge to River
2. Modified Gravity thickener supernatant: This effluent stream will be discharged to the River and include the treated Ultrafiltration Backwash water combined with treated SCU blowdown effluent.

1. Nanofiltration Concentrate _ Future ESTIMATE

Parameter	Minimum	Average	Maximum
Chloride (mg/L)	38	119	254
Total Calcium (mg/L)	120	405	632
Total Magnesium (mg/L)	53	161	296
Total Sodium (mg/L)	85	288	680

2. Modified Gravity Thickener Supernatant_future ESTIMATE

Parameter	Minimum	Average	Maximum
Chloride (mg/L)	15	26	51
Total Calcium (mg/L)	50	74	100
Total Magnesium (mg/L)	14	34	53
Total Sodium (mg/L)	14	62	126

Mass balance Assumptions:

- The Nanofiltration Concentrate data is based directly on the Dual Membrane pilot data 2021/2022
- The Chloride and Sodium concentrations for the Modified Gravity Thickener Supernatant are based on the raw water data from the Dual Membrane pilot data 2021/2022. This assumes that there is no removal of either parameter through the plant, so the concentrations in the waste residuals are the same as the concentrations in the raw water
- For the gravity thickener supernatant, the assumption is, that the ratio of solids in the effluent matches that in the influent, and that the Ca and Mg in the UF backwash is the same as the raw water (no removal), and that the Ca and Mg in the filter backwash are that of the filter effluent (no removal).
- For the gravity thickener influent, we assumed that there is essentially no “removal” of the Ca and Mg from the UF backwash and the filter backwash and that 99.5% of the Ca and Mg in the SCU waste is removed by the thickener.

The above tables are estimates and values could be different based on future operating process and operating conditions. We suggest to review the operating data with you, when the membrane plant will be commissioned. Alternatively we could develop a **specific** algorithmic-based mass balance to provide further detail.

I would like to take this opportunity to ask if you think a meeting would be helpful (teams or in person) to discuss the EAP in general, project update, the proposed residuals treatment configuration and the information we provided in this message.

Please don't hesitate to contact myself or Kyla.

Best Regards

Hanns Till Freihammer, P.Eng.

Jacobs

Senior Project Manager

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till.freihammer@jacobs.com

Unit 700 – One Research Road | Winnipeg, R3T 6E3 | Canada

From: Mak, Jay

Sent: Tuesday, January 30, 2024 2:30 PM

To: A.Stangherlin <A.Stangherlin@brandon.ca>; Kirk, Kyla <Kyla.Kirk@jacobs.com>

Cc: Dey, Asit <Asit.Dey@gov.mb.ca>; Fagan, Paul <Paul.Fagan@gov.mb.ca>; a.howe@brandon.ca

Subject: City of Brandon File No. 6180.00, 4262.00, 3996.00

Hello Alexia and Kyla,

For your consideration

- Would you prefer to consolidate the following water supply and treatment licences/proposal or have separate licences for each component?

There is an opportunity to rescind the previous two licences for the City of Brandon and have a new licence cover the following three components. If consolidated, the new licence can include the notice of alteration for the existing Environment Act License No. 2279 (details shown below).

- File No. 4262.00 (Licence No. 2279) - Water Treatment Plant Waste Management
- File No. 3996.00 (Licence No. 2081) - Groundwater Supply System For Municipal Purposes
- File No. 6180.00 (Active proposal) - Brandon Water Treatment Facility Upgrades

Request for information

- Could you provide an estimate of greenhouse gases generated by the proposed development?

Please let me know if you would like to discuss further or have any questions.

Thanks,

Jay Mak, P.Eng.

Senior Environmental Engineer

Environmental Approvals Branch

T: (204) 619-0709 / Email: Jay.Mak@gov.mb.ca

Brandon Water Treatment Facility Upgrade Project GHG Emission Estimates

1 Project Information

1.1 Project Scope and Construction Schedule:

Table 1 - Project Scope and Construction Schedule

Component	Project Phase (as per June 2024)				
	Project Definition	Design	Construction	Commissioning	Operation
Chemical Building*	Dec. 2017 to August 2018	August 2018 to April 2019	September 2019 to August 2022	August to December 2022	December 2022
New RWI and reservoir	Dec. 2017 to June 2022	Fall 2023 to January 2025	June 2025 to July 2026	July to October 2026	October 2026
Membrane Plant	Dec. 2017 to June 2020	July 2020 to October 2022	October 2024 to October 2027	October 2027 to October 2028	December 2028
Existing Facility Upgrades					
Filter Upgrades	Dec. 2017 to August 2021	Summer 2023 to August 2024	December 2024 to February 2027	May 2025 to February 2027	July 2025
Remaining Upgrades	Dec. 2017 to August 2021	November 2025 to May 2026	August 2026 to December 2027	December 2027 to March 2028	March 2028

Note: *. Only additions to the Chemical Building post-2024 are included.

The updated overall construction period: **October 2024 to December 2027**
3 years **2 months**

1.2 Assumptions:

Construction months in a year: **12 months per year**
 Average construction days in a month: **23 day/month**
 Construction hours per day: **12 hour/day**

Construction and commissioning will be sequenced so that process areas (or portions of a process area) will move to the operation phase in a staged manner.

1.3 Calculation of total Construction Hours

Calculated total construction months: **38 months**
 Calculated total construction days: **874 days**

Calculated total construction hours = Total construction days x 12 hours/day
 = 874 days x 12 hours/day
 = **10,488** hours/construction period

2 Reference Data:

2.1 Reference Document

At the time of preparing the GHG emission estimate, information on construction equipment/vehicles, onsite fuel usage and electricity consumption related to the construction activities were not available. Therefore, a high level preliminary GHG estimate was conducted using information from the report "Buffalo Pound Water Treatment Plant (BPWTP) Renewal Greenhouse Gas (GHG) Mitigation Assessment" (February 18, 2021) prepared by KGS Group for Jacobs. This study was conducted to support the plant renewal that had the goal of integrating increased production capacity (from 205 million liters per day (ML/d) to a firm capacity of 220 ML/d) with technologies recommended by the project team to meet regional needs for treated water along with regulatory requirements in the upgraded facility. This report provided construction GHG estimates based on estimated onsite fuel usage and electricity consumptions during the construction period. Onsite fuel usage during construction usually includes diesel/gasoline, natural gas and propane. The report incorporated the onsite propane, natural gas as indicator to represent the fuel usage during construction as the construction information from the contractor were not available at the time. KGS's consent to using the data as reference was confirmed.

The daily fuel usage rate for the construction period were derived from the GHG emissions, emission factors and construction duration (see below for details). The daily electricity consumption rate was assumed 500 kW per hour, 12 hours per day, 7 days per week for the duration of the construction period in the BPWTP report.

2.2 Daily fuel usage estimates from BPWTP GHG reference document:

a. Calculation of total construction days

Scope 2 Electricity Consumption Emissions (tonnes): **2,036 tonnes CO_{2e}**
 Saskatchewan 2020 Electricity intensity EF ^(a): **620 g CO_{2e}/kWh consumed**

^(a): Table A13-9 Electricity Generation and GHG Emission Details for Saskatchewan, NATIONAL INVENTORY REPORT 1990 –2020: GREENHOUSE GAS SOURCES AND SINKS IN CANADA, Part 3. Note: Saskatchewan uses mainly coal and natural gas for power generation.

Total electricity usage (kWh): **3,284,323**
 Total hours (hr), based on 500 kW/h: **6,569**
 Total days of construction (day): **547**

b. Calculation of daily fuel usage:

Propane combustion emissions:	378.75 tonnes CO ₂
Emission factor:	1515 g CO ₂ e/L fuel usage
Propane usage during construction:	250,000 L
Propane usage per day:	457 L/day

3 Fuel Usage and Electricity Consumption Used in Brandon Facility Construction GHG Emission Estimates

3.1 Scaling Factor:

The regional Buffalo Pound Water Treatment Plant provides the cities of Regina and Moose Jaw with safe and reliable drinking water. The BPWTP renewal project is intended to provide a firm capacity of 220 ML/d. The renewal has a large construction site with several construction areas with multiple buildings and conversions plus waste ponds.

The City of Brandon Water Treatment Facility supplies water to residents in the City. This project scope specifically focuses on a new Membrane Building and filter upgrades in the existing Facility (i.e. no large construction areas or buildings). The Membrane Plant will be constructed to meet the ultimate 2048 buildout expansion flow of 30 ML/d.

Due to the significant difference in construction scope between the BPWTP renewal project and this portion of the Brandon Water Treatment Facility upgrade project, a conservative scaling factor of 1/3 is applied to obtain the fuel consumption and electricity usage during construction at the Brandon Facility.

3.2 Fuel Consumption and Electricity Usage during Construction:

Table 2 - Summary of Fuel & Electricity Usage

	BPWTP	Scaling Factor	Brandon Facility
Propane Usage (L/day)	457	1/3	152.33
Electricity Usage (kW)	500	1/3	166.67

Sample calculation:

$$\begin{aligned} \text{Electricity Usage at Brandon Facility} &= [\text{Electricity usage rate from BPWTP}] \times [\text{Scaling Factor}] \\ &= 500 \text{ (kW)} \times 1/3 \\ &= 167 \text{ (kW)} \end{aligned}$$

4 Construction GHG Emission Estimate:

4.1 Scope 1: Direct GHG Emissions from Onsite Fuel Combustion:

$$\begin{aligned} \text{Total fuel usage (L)} &= \text{Construction days (day)} \times \text{Fuel usage (L/day)} \\ &= 874 \text{ (day)} \times 152 \text{ (L/day)} \\ &= 133,139 \text{ (L) during construction period} \end{aligned}$$

$$\begin{aligned} \text{Sample calculation of CH}_4 \text{ emissions} &= \text{Fuel usage (L)} \times \text{CH}_4 \text{ Emission Factor (g/L fuel)} \\ &= 133,139 \text{ (L)} \times 0.64 \text{ (g/L)} \times 1 \text{ (tonne)/1,000,000 (g)} \\ &= 0.09 \text{ (tonne)} \end{aligned}$$

$$\begin{aligned} \text{Convert CH}_4 \text{ emissions to CO}_2\text{e emissions} &= \text{CH}_4 \text{ emissions (tonne)} \times \text{CH}_4 \text{ Global Warming Potential (28)} \\ &= 0.09 \text{ (tonne)} \times 28 \\ &= 2.39 \text{ (tonne CO}_2\text{e)} \end{aligned}$$

Table 3 - Scope 1 GHG Emissions - Construction

	CO ₂	CH ₄	N ₂ O	CO ₂ e
Global Warming Potential	1	28	265	
Off-road Propane Emission Factor (g/L fuel) ^(b)	1515	0.64	0.087	
GHG Emissions (tonne)	202	0.09	0.012	207.16
CO ₂ equivalent Emissions (tonnes CO ₂ e)	202	2.39	3.07	207.16

^(b): National Inventory Report 1990–2022: Greenhouse Gas Sources and Sinks in Canada, Part 2, 2024. Annex 6, Table A6.1-14.

4.2 Scope 2: Indirect GHG Emissions from Electricity Purchasing:

$$\begin{aligned} \text{Total electricity consumption} &= \text{Construction hours (hour)} \times \text{electricity usage rate (kW)} \\ &= 10,488 \text{ (hr)} \times 167 \text{ (kW)} \\ &= 1,748,000 \text{ kWh} \end{aligned}$$

$$\begin{aligned} \text{CO}_2\text{e emissions} &= \text{Electricity usage (kWh)} \times \text{Manitoba electricity consumption GHG Intensity (g CO}_2\text{e/kWh)} \\ &= 1,748,000 \text{ (kWh)} \times 1.4 \text{ (g CO}_2\text{e/kWh)} \times 1 \text{ (tonne)/1,000,000 (g)} \\ &= 2.45 \text{ (tonne)} \end{aligned}$$

Table 4 - Scope 2 GHG Emissions - Construction

	CO ₂	CH ₄	N ₂ O	CO ₂ e
Global Warming Potential	1	28	265	
Manitoba 2022 Electricity Consumption Intensity (g CO ₂ e/kWh consumed) ^(c)	n/a	n/a	n/a	1.4
GHG emissions (tonne)				2.45

^(c): National Inventory Report 1990–2022: Greenhouse Gas Sources and Sinks in Canada, Part 3, 2024, Table A13-8, 2022 value. Note: Manitoba has 98% hydroelectricity and wind power generation. https://www.gov.mb.ca/sd/environment_and_biodiversity/energy/initiatives/hydro.html

4.3 Total CO_{2e} Emissions from Construction:

$$\begin{aligned} \text{Total CO}_{2e} \text{ Emissions from Construction} &= \text{Scope 1 Emissions} + \text{Scope 2 Emissions} \\ &= 207.16 \text{ tonnes} + 2.45 \text{ tonnes} \\ &= \mathbf{209.61 \text{ tonnes}} \end{aligned}$$

4.4 Comparison of Construction GHG Emissions with 2022 Manitoba and Federal GHG emissions:

The construction emissions will occur over a three to four year construction period. Conservatively the total emissions were compared to 2022 Manitoba and Federal GHG emissions.

Table 5 - Comparison of GHG emissions from Project Construction with the Provincial and Federal GHG Emissions

	Project Construction GHG Emissions	2022 Manitoba GHG Emissions ^(d)	2022 Federal GHG Emissions ^(d)
GHG Emissions (Mt CO _{2e})	0.00021	22	708
Percentage of Project Emissions over Provincial and Federal Emissions (%)	-	0.0010%	0.00003%

^(d): 2024 National Inventory Report 1990–2022: Greenhouse Gas Sources and Sinks in Canada, Part 1, Table 2-2.

5 Operational GHG Emission Estimates for the Proposed Upgrades Project:

5.1 Scope 1: Annual Direct GHG Emissions from On-site Fuel Combustion:

5.1.1 Natural Gas Unit Heaters

- 1) Data: The Membrane Building will utilize 6 natural gas unit heaters.
 Unit Heater (UH) Model: UH-M801 – M806 specified Modine HD75
 Fuel type: Natural gas
 Power rating: 120 V, 1p
 Heat input: 75,000 BTU/h per unit

2) Estimates of Operating Hours

The UHs would likely be operating intermittently during the shoulder season (April and October) below 10 C°, then continuously during winter months.

Shoulder seasons:	2 months	350 hours/month
Winter season:	6 months	730 hours/month

$$\begin{aligned} \text{Calculated Annual Operation Hours} &= [\text{shoulder season operation hours}] + [\text{winter seasons operation hour}] \\ &= [2 \text{ months} \times 350 \text{ hours/month}] + [6 \text{ months} \times 730 \text{ hours/month}] \\ &= 700 \text{ hours} + 4,380 \text{ hours} \\ &= 5,080 \text{ hours} \end{aligned}$$

3) Calculation of Fuel Consumption

$$\begin{aligned} \text{Total heat input of 6 UH units} &= 6 \text{ units} \times 75,000 \text{ BTU/h per unit} \\ &= 450,000 \text{ BTU/h} \\ \text{Total annual MMBTU of 6 UH units} &= 450,000 \text{ BTU/h} \times \frac{\text{MMBTU}}{1,000,000 \text{ BTU}} \times 5,080 \text{ hours} \\ &= 2,286 \text{ MMBTU} \\ \text{Natural Gas energy content}^{(e)} &= 39 \text{ TJ/GL} = 0.037 \text{ MMBTU/m}^3 \end{aligned}$$

^(e): 2024 National Inventory Report 1990–2022: Greenhouse Gas Sources and Sinks in Canada, Part 2, Table A4-2.

$$\begin{aligned} \text{Natural gas consumption} &= \frac{\text{Total annual MMBTU}}{\text{NG Energy Content}} \\ &= \frac{2,286 \text{ MMBTU}}{0.037 \text{ MMBTU/m}^3} \\ \text{Natural gas consumption:} &= 62,081 \text{ m}^3 \end{aligned}$$

4) Calculation of GHG Emissions

$$\text{GHG Emissions (tonnes)} = \text{Natural Gas Combustion Emission Factor (g/m}^3\text{)} \times \text{Natural Gas Consumption (m}^3\text{)} / 1,000,000 \text{ (g/tonne)}$$

Table 6 - Unit Heater Annual GHG Emissions

	CO ₂	CH ₄	N ₂ O	CO _{2e}
Global Warming Potential	1	28	265	
Natural Gas combustion Emission Factor ^(f) (g/m ³)	1915	0.037	0.033	
GHG Emissions (tonne)	118.89	0.0023	0.0020	119.49
CO ₂ equivalent Emissions (tonnes CO _{2e})	118.89	0.06	0.54	119.49

^(f): 2024 National Inventory Report 1990–2022: Greenhouse Gas Sources and Sinks in Canada, Part 2, Table A6.1-1, And Table A6.1-3.

5.1.2 Natural Gas Water Heaters

1) Data: There will be 5 natural gas fired hot water tanks to support the Member Building.

Table 7 - List of Proposed Natural gas Water Heaters

Tag Number	Heating Capacity		Operating Hours (hour)		Model
	kW/hr	BTU/hr	Daily	Annual	
WH-C871	117	399,221	4	1460	Bradford White EF-100T-399E
WH-C872	117	399,221	4	1460	Bradford White EF-100T-399E
WH-C873	117	399,221	4	1460	Bradford White EF-100T-399E
WH-C874	117	399,221	4	1460	Bradford White EF-100T-399E
WH-C875	117	399,221	4	1460	Bradford White EF-100T-399E
Total	585	1,996,103			

2) Calculation of Fuel Consumption

$$\begin{aligned}
 \text{Total annual MMBTU of 5 WH Tanks} &= 1,996,103 \text{ BTU/h} \times \frac{\text{MMBTU}}{1,000,000 \text{ BTU}} \times 1,460 \text{ hours} \\
 &= 2,914 \text{ MMBTU} \\
 \text{Natural Gas (NG) energy content}^{(e)} &= 39 \text{ TJ/GL} = 0.037 \text{ MMBTU/m}^3 \\
 \text{Natural gas consumption} &= \frac{\text{Total annual MMBTU}}{\text{NG Energy Content}} \\
 &= \frac{2,914 \text{ MMBTU}}{0.037} = 79,144 \text{ m}^3
 \end{aligned}$$

3) Calculation of GHG Emissions

$$\text{GHG Emissions (tonnes)} = \text{Natural Gas Combustion Emission Factor (g/m}^3) \times \text{Natural Gas Consumption (m}^3) / 1,000,000 \text{ (g/tonne)}$$

Table 8 - Unit Heater Annual GHG Emissions

	CO ₂	CH ₄	N ₂ O	CO _{2e}
Global Warming Potential	1	28	265	
Natural Gas combustion Emission Factor ^(f) (g/m ³)	1915	0.037	0.033	
GHG Emissions (tonne)	151.56	0.0029	0.0026	152.34
CO ₂ equivalent Emissions (tonnes CO _{2e})	151.56	0.08	0.69	152.34

5.1.3 Standby Diesel Generators

1. Data: There will be 2 standby diesel generators added as part of the project upgrades. The generators will be operating during power outage and in routine maintenance testing.

Number of Generator Units: 2
 Power Rating: 1.5 MW each
 Operating hours: 20 hours/year each

2) Calculation of Fuel Consumption

Estimated fuel consumption-1.5 MW diesel generator^(g): 403.2 L/hr

^(g): EverPower, Generator Fuel Consumption, <https://eventpower.ca/learning-2/generator-fuel-consumption/>, assessed on July 30, 2024.

$$\begin{aligned}
 \text{Annual fuel consumption per unit} &= \text{Fuel consumption rate (L/hr)} \times \text{Operating hours (hr/an)} \\
 &= 403.2 \text{ L/hr} \times 20 \text{ hr/an} \\
 &= 8,064 \text{ L/an per unit} \\
 \text{Total annual fuel consumption for 2 generators} &= 8,064 \text{ L/an per unit} \times 2 \text{ units} \\
 &= 16,128 \text{ L/an}
 \end{aligned}$$

3) Calculation of GHG Emissions

$$\text{GHG Emissions (tonnes)} = \text{Diesel Combustion Emission Factor (g/L)} \times \text{Diesel Consumption (L)} / 1,000,000 \text{ (g/tonne)}$$

Table 9 - Diesel Generator Annual GHG Emissions

	CO ₂	CH ₄	N ₂ O	CO _{2e}
Global Warming Potential	1	28	265	
Diesel Combustion GHG Emission factor ^(g) (g/L)	2,681	0.078	0.022	
GHG Emissions (tonne)	43.24	0.0013	0.00035	43.37
CO ₂ equivalent Emissions (tonnes CO _{2e})	43.24	0.035	0.094	43.37

^(g): 2024 National Inventory Report 1990–2022: Greenhouse Gas Sources and Sinks in Canada, Part 2, Table A6.1-6.

5.1.4 Summary of Annual Scope 1 Direct GHG Emissions from Operation of the Proposed Upgrades

Table 10 - Annual Scope 1 GHG Emissions - Operation

	CO ₂	CH ₄	N ₂ O	CO _{2e}
Natural Gas Unit Heaters (tonnes/yr)	118.89	0.0023	0.0020	119.49
Natural Gas Hot Water Tanks (tonnes/yr)	151.56	0.0029	0.0026	152
Standby Diesel Generators (tonnes/yr)	43.24	0.0013	0.0004	43.37
Total Scope 1 GHG Emissions (tonnes/yr)	313.69	0.0065	0.0050	315.20

5.2 Scope 2 - Annual GHG Emissions from Grid Electricity Consumption:

1) *Data:* Estimated Average Daily Electrical Loads of the Membrane Building:
 Process: (mainly pumps, mixers): 15,370 kWh/day
 Mechanical (air Handling, make up air): 2,737 kWh/day
 Total: 18,107 kWh/day

2) *Estimates of Annual Electricity Consumption:*

Annual electricity consumption = [Average daily load (kWh/day)] x [operation days per year (day/year)]
 = 18,107 kWh/day x 365 days/year
 = 6,609,055 kWh/year

3) *Estimates of Indirect GHG emissions:*

Annual indirect CO_{2e} emissions = Electricity usage (kWh) x Electricity consumption GHG Intensity (g CO_{2e}/kWh)
 = 6,609,055 (kWh) x 1.4 (g CO_{2e}/kWh) x 1 (tonne)/1,000,000 (g)
 = 9.25 (tonne)

Table 11 - Annual Scope 2 GHG Emissions - Operation

	CO ₂	CH ₄	N ₂ O	CO _{2e}
Global Warming Potential:	1	28	265	
Manitoba 2022 Electricity consumption intensity (g CO _{2e} /kWh consumed) ^(c) :	n/a	n/a	n/a	1.4
GHG emissions (tonne):				9.25

5.3 Annual CO_{2e} Emissions during Operation:

Annual CO_{2e} Emissions during Operation = Scope 1 Emissions + Scope 2 Emissions
 = 315.20 tonnes + 9.25 tonne
 = **324.45 tonnes**

5.4 Comparison of Annual operation GHG Emissions with 2022 Manitoba and Federal GHG emissions:

Table 12 - Comparison of GHG emissions from Project Operation with the Provincial and Federal GHG Emissions

	Project Construction GHG emissions	2022 Manitoba GHG Emissions ^(d)	2022 Federal GHG emissions ^(d)
GHG Emissions (Mt CO _{2e})	0.00032	22	708
Percentage of Project Emissions over Provincial and Federal Emissions (%)	-	0.00147%	0.000046%

6 **GHG Emission Summary**

The GHG emission estimates for construction of the proposed upgrades project were conducted based on the available information at this stage. The total GHG emissions from construction of the proposed upgrades will be approximately 210 tonnes of carbon dioxide equivalent. This equates to 0.001% of the 2022 Manitoba GHG emissions and 0.00003% of 2022 Federal GHG emissions (ECCC, 2024a).

Construction GHG emissions are short-term emissions during the construction period. Since the construction may last for 3 to 4 years, the annual GHG emissions from construction will be lower than the above estimated total emission value, which were considered high level preliminary estimates due to lack of detailed construction information. Refinement could be made when the construction information from the contractors becomes available.

The annual GHG emissions from the proposed upgrades during operation were estimated based on the equipment and operation data from the design engineer. The annual GHG emissions from operation of the proposed upgrades, mainly the membrane building, will be approximately 324 tonnes of carbon dioxide equivalent. This equates to 0.0015% of the 2022 Manitoba GHG emissions and 0.00005% of 2022 federal GHG emissions (ECCC, 2024a). The operation GHG emissions will be included in the Brandon WTP annual GHG emission inventory under the Government of Canada's Greenhouse Gas Reporting Program (GHGRP).

From: Freihammer, Till <Till.Freihammer@jacobs.com>
Sent: Friday, August 9, 2024 9:27 AM
To: Mak, Jay <Jay.Mak@gov.mb.ca>
Cc: A.Stangherlin <A.Stangherlin@brandon.ca>; Kirk, Kyla <Kyla.Kirk@jacobs.com>; Williamson, Barry <Barry.Williamson@jacobs.com>; Beaty, Jeff <Jeff.Beaty@jacobs.com>; Alan Howe <a.howe@brandon.ca>; Griffiths, Kelly <Kelly.Griffiths@jacobs.com>
Subject: City of Brandon - Water Treatment Facility Upgrades - Environmental AP - EAB File No. 6180.00_Commissioning Flows

Good Morning Jay,

As promised here is the description regarding the commissioning treated water flows we're intending to discharge towards the Assiniboine during commissioning of the Membrane Building for the City of Brandon. This was the following action item from our meeting at the Jacobs office on May 22, 2024. See below snapshot

124.4.1	<u>Commissioning membrane trains:</u> During the commissioning phase of the membrane plant individual membrane trains will be tested with water . During this phase flows of up to about 7.5 MLD (about 87 l/s) of membrane (UF and NF) filtered unchlorinated water may be discharged to the land drainage system and subsequently to the Assiniboine river. Jacobs will follow up with a short description	Jacobs
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The attached document is principally an extract of the commissioning plan we intend to submit with the tender documents for the project. It outlines the intended commissioning and testing steps for the Membrane plant.

Please get back to me for further clarification if needed. I will follow up with a call shortly.

Regards

Hanns Till Freihammer, P.Eng.

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To:	Environmental Approvals Branch – Government of Manitoba	Date:	August 7, 2024
Subject:	Commissioning Sequence of the Membrane Building Process Systems	Project Name:	Brandon Water Treatment Facility Upgrade
Project No.:	699358CH		
Attention	Jay Mak, P.Eng., Senior Environmental Engineer T: (204) 619-0709 Email: Jay.Mak@gov.mb.ca	From:	Till Freihammer, P.Eng. (Jacobs)

Introduction

Note: The following description relates to action item 124.4.1 from the meeting “ Project meeting No 124_ Environmental AP - EAB File No. 6180.00_review Residual licenses” held at Jacobs offices on May24, 2024. Minutes have been circulated.

After the construction of the new Membrane Building, the membrane plant will be commissioned in several stages. After a period of functional tests, it is required to operate the process units (e.g. flocculation tanks, membrane trains, overflows) with water. Some of the test flows are significant and must occur continuously. The project will use the low lift pumps 9 and 10 to provide testing flows. During commissioning the discharge of these flows after testing will be directed via overflow piping to the land drainage system (overland) which drains towards the Assiniboine River.

The detailed planning (responsibilities, timelines, flows, safety precautions, etc.) of the following commissioning stages and will be submitted during construction of the new Membrane Building after consultation with the key stakeholders (i.e. City of Brandon, contractor, membrane systems supplier, contract administrator and regulator).

The membrane process systems will be commissioned gradually in steps, including offline testing with plant effluent directed to the Assiniboine River and later online testing, with treated (disinfected) water pumped to the City's distribution.

The present information is part of a larger commissioning plan for the Membrane Building which is included in the tender documents.

An outline of the commissioning steps for the Membrane Building is provided below:

- Start-up and testing of Raw Water Pumping with Flocculation (Offline; flows directed to Assiniboine)
- Start-up and testing of Coagulation with UF System (Offline; flows directed to Assiniboine)
- Start-up of testing of Nanofiltration (NF) System (Offline; flows directed to Assiniboine)
- Full testing of Membrane Plant (Offline; flows directed to Assiniboine)
- Disinfection of Rectangular Clearwell (Offline; flows directed to Assiniboine with dechlorination)
- Operation and testing of Membrane Plant and blending with Existing Facility's Plant 1 Filtered Water (Online)
- Completion of Treated Water Tie-in Work
- Disinfection of Clearwell 3B, Circular Clearwell, High Lift Pump Well, and Associated Piping (Offline)
- Operation and testing of Membrane Plant and blending with Existing Facility in Final Configuration (Online)
- Monitoring Test Period for Membrane Plant (Online)

More detail for each step which includes a discharge to the Assiniboine is provided in the sections that follow.

Step 1: Start-up and Testing of Raw Water Pumping with Flocculation (Offline)

In Step 1, the raw water pumping system will be started up, which includes low-lift pumps 9 and 10 located in the existing Water Treatment Facility (WTF). The low-lift pumps will pump raw water from the wetwell to the flocculation tank in the new membrane building through the 600 mm raw water line that is routed around the north-side of the Existing WTF. The raw water will flow through the flocculation tanks to the flocculated water channel and then overflow from the channel to a 600 mm O/F line that ties into the 750 mm storm drain that drains to the site overland drainage system (i.e. swale) located in the northwest corner of the site, which drains to the Assiniboine River (Figure 1).

Coagulant will not be added to the raw water until Step 2. Sulphuric acid for pH adjustment of the raw water will be tested during Step 1.

Flows will be about 15 MLD with a short-term peak of 30 MLD.

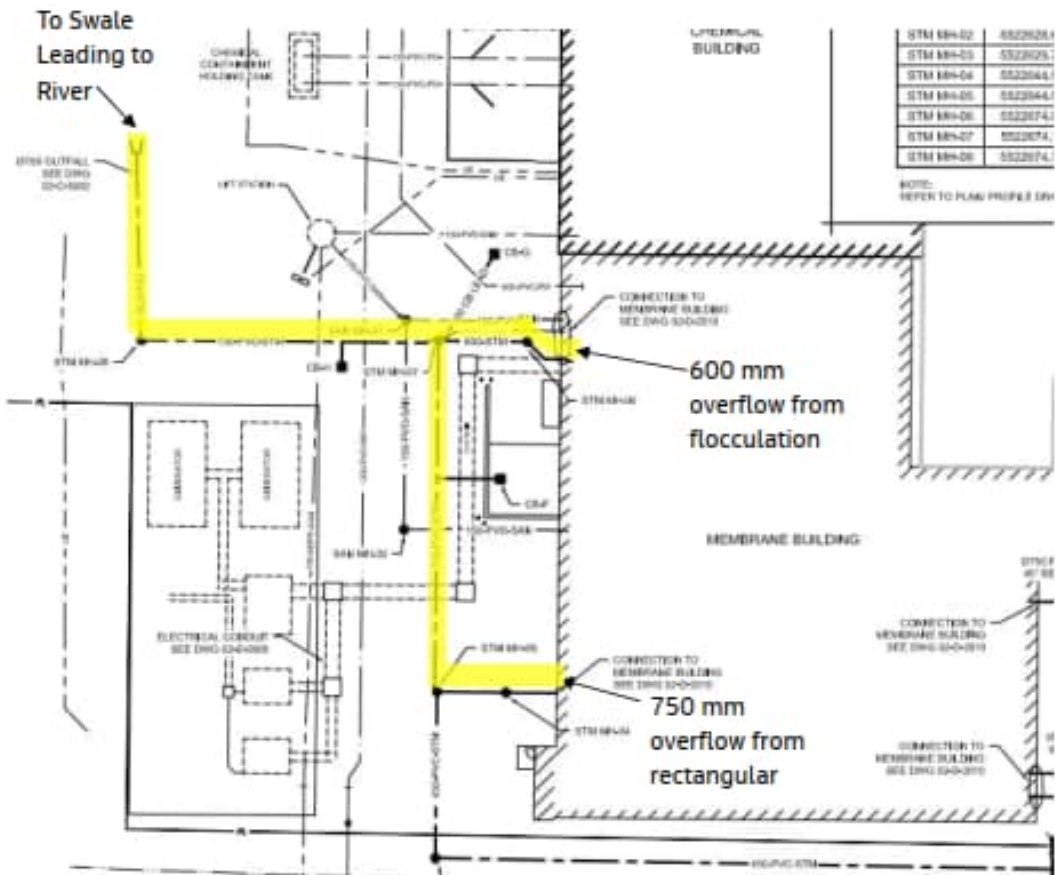


Figure 1. Flow Path for Raw Water to River from Flocculation Channel and Rectangular Clearwell

Figure 1. Flow Path for Raw Water to River from Flocculation Channel and Rectangular Clearwell

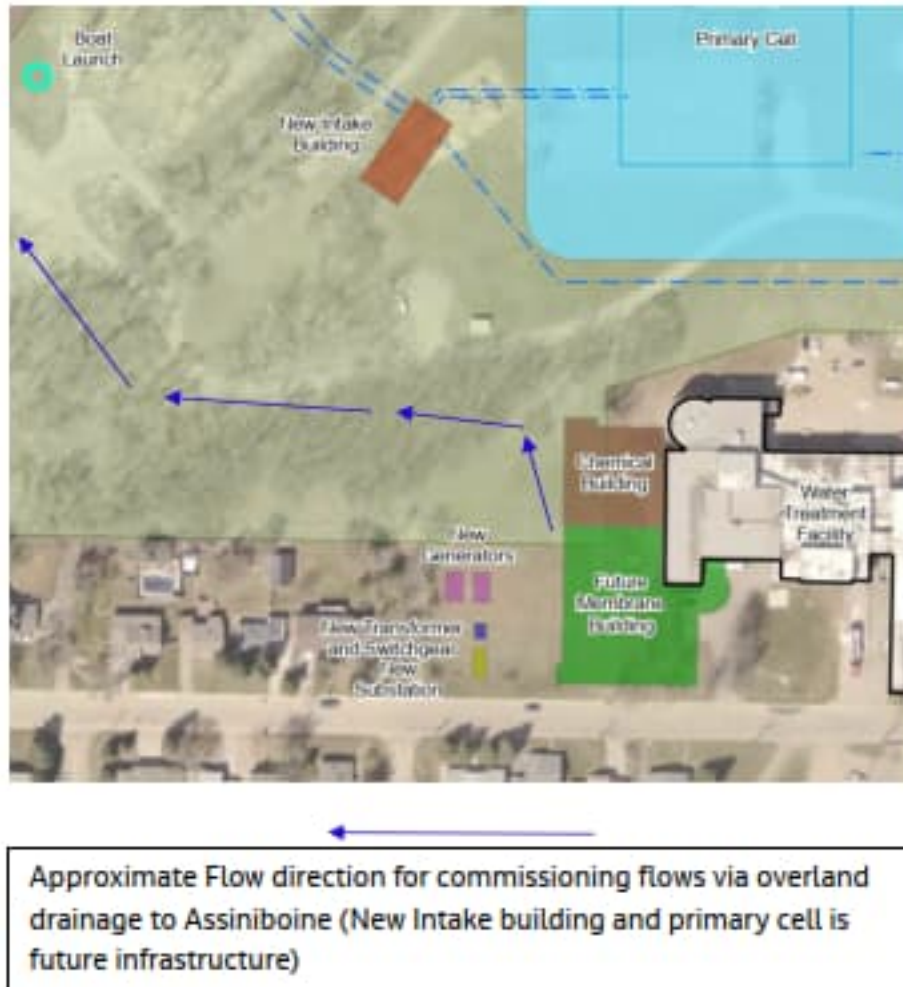


Figure 2. Flow Path Towards River

Step 2: Start-up and Testing of Coagulation with Ultrafiltration System (Offline)

In Step 2, the raw water pumping system and flocculation tanks will continue to operate, and the Ultrafiltration (UF) System will be started up, with one train tested at a time. Coagulation will be established by dosing the coagulant (i.e. ferric sulphate) into the raw water line upstream of the flocculation stage.

Once the UF trains are ready to operate at larger flows, the flow path of the UF filtrate will be configured to allow for the UF filtrate to fill the UF/NF break tank to allow for backpulse water for the UF trains for backwashing. Once the UF/NF break tank is full, the flow path will be configured to make-use of the NF bypass to direct the UF filtration to the rectangular clearwell.

The UF filtrate will flow through the NF bypass and fill the rectangular clearwell. Prior to starting Step 2, plugs will be inserted into the outlet piping for the rectangular clearwell and associated valves will be

closed to ensure that filtered water does not enter the Existing Facility's circular clearwell or transfer pumps suction header. Once the clearwell is full, UF filtrate will overflow from the clearwell to a 750 mm overflow line that ties into the 750 mm storm drain that drains to the site overland drainage system (i.e. swale) located in the northwest corner of the site, which flows to the Assiniboine River (Figure).

The UF trains (4 trains) will be tested one train at a time and testing will include the operation of all associated systems and equipment; including the UF feed pumps and strainers, the UF modules, the UF backpulse system, air scour system, the UF Cleaning in Place (CIP) system, neutralization system, UF/NF break tank, UF waste system, and all associated chemical storage and transfer systems. Testing will include all operating modes including, but not limited to the Production Mode, Backwash mode, Maintenance Clean Mode, Recovery Clean Mode, and the Membrane Integrity Mode. Refer to the Vendor's commissioning plan for more details on the specific testing requirements.

During testing for Step 2, the UF waste will be directed to one of the offline SCU's (not in operation) at the Existing WT Facility and subsequently directed to the Sludge Dewatering Facility for further treatment.

Flow per train will be about 5 MLD with a short-term peak of 7.5 MLD.

Step 3: Start-up of Testing of Nanofiltration System (Offline)

In Step 3, the raw water pumping system, flocculation, and UF system will continue to be operated, while the NF system is started up, with one train tested at a time. The NF system can only be started up after the UF systems have successfully been tested in Step 2. Ferric sulphate (optional) and sulphuric acid will continue to be dosed to the raw water for coagulation and pH adjustment. The addition of sodium hydroxide to the rectangular clearwell will be started up for post-treatment pH adjustment. Disinfection with sodium hypochlorite and the addition of phosphoric acid and fluoride (SFS solution) will not be operated until the water is directed to the distribution system.

Note: pre-chloramination may be tested during this stage; however, the implementation of pre-chloramination will need to be discussed with the regulatory authority.

The NF permeate will fill the rectangular clearwell and overflow to a 750 mm overflow line that ties into the 750 mm storm drain that drains to the site overland drainage system (i.e. swale) located in the northwest corner of the site, which flows to the Assiniboine River.

The NF trains will initially be tested one train at a time and testing will include the operation of all associated systems and equipment; including the NF feed pumps and cartridge filters, the NF pressure vessels, the NF flush system, the NF CIP system, the neutralization system (for NF), NF residual line, and all associated chemical storage and transfer systems. Testing will include all operating modes including, but not limited to the Production Mode, Flush Mode, and CIP Mode. Refer to the vendor's commissioning plan for more details on the specific testing requirements.

During testing for Step 3, the NF reject will be directed to the Assiniboine River via the NF residual piping and the existing 400 mm outfall.

Permeate flow per train will be about 5 MLD with a short-term peak of 6 MLD (translating to a feed flow of approximately 6 MLD with a short team peak of about 7 MLD).

Step 4: Full Testing of Membrane Plant (Offline)

In Step 4, the entire membrane treatment process (e.g. pre-treatment, UF, and NF) will be operated with multiple trains for UF and NF and the permeate will be directed to the Assiniboine River as noted in Step 3. As with Step 3, disinfection with sodium hypochlorite and the addition of phosphoric acid and fluoride (SFS solution) will not be operated.

Permeate Flow will be about 15 MLd with a short-term peak of 23 MLd.

Step 5: Disinfection of Rectangular Clearwell (Offline)

In Step 5, the rectangular clearwell and all associated treated water piping will be disinfected as per AWWA standards.

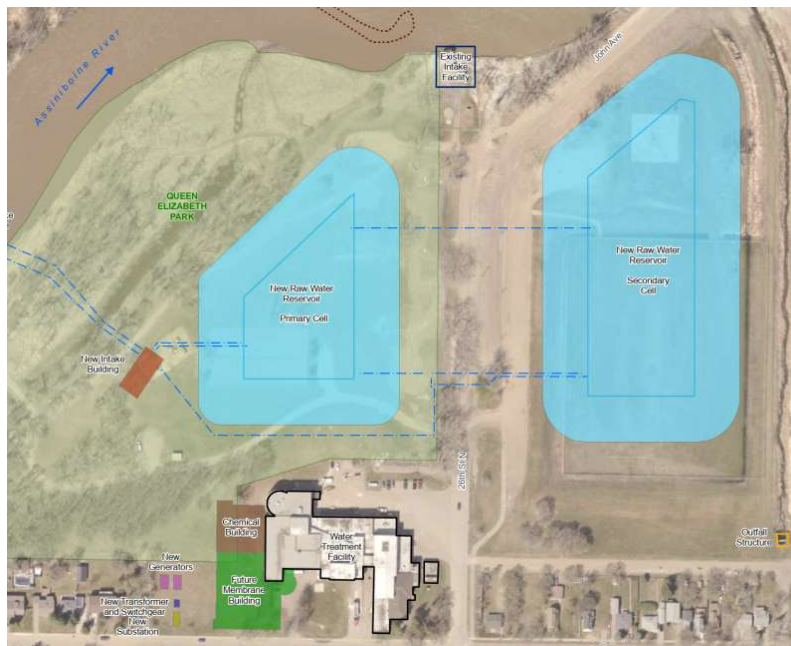
From: Freihammer, Till <Till.Freihammer@jacobs.com>
Sent: Wednesday, October 2, 2024 3:16 PM
To: Mak, Jay <Jay.Mak@gov.mb.ca>
Cc: Kirk, Kyla <Kyla.Kirk@jacobs.com>; A.Stangherlin <A.Stangherlin@brandon.ca>; Alan Howe <a.howe@brandon.ca>
Subject: City of Brandon_WTFacility upgrade_Environmental Assessment plan_raw water cells_File No. 6180.00

Good Afternoon Jay,

During our call today you asked if we could communicate an estimate of the volume of the future primary and secondary cell (Figure 2.1 of the Environment act proposal, see below) .

The purpose of these cells is to store raw water from the new intake location before it enters the plant. As Alexia pointed out we still need to work on the detailed design of these cells (parameters like surface area, depth, slope , process configurations including the intake) , so what we show is preliminary and can change in the course of the work. I had a quick look at the dimensions as shown on a previous sketch and came up with the following approximate volume fill volume for storage at a median water level of 356.46 . The level in the cells can change, it is also dependent on the water level in the river.

Primary cell: fill volume about 24.000 m3 (24 Mld)
Secondary Cell : fill volume about 41.000 m3 (41 Mld)



I hope this helps. Let me know if you need more clarification.

Best regards
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till.freihammer@jacobs.com