SAMSON
ARCHITECTURE | ENGINEERING

Samson Engineering Inc.
162 – 10th Street,
Brandon, Manitoba R7A 4E6
Phone: (204) 727-0747
Fax: (204) 725-9870
info@samsonengineering.com

MUNICIPALITY OF GLENBORO-SOUTH CYPRESS
618 RAILWAY AVENUE, PO BOX 219
GLENBORO, MANITOBA
R0K 0X0

ENVIRONMENTAL ACT PROPOSAL
VILLAGE OF GLENBORO WASTEWATER TREATMENT LAGOON UPGRADE
MUNICIPALITY OF GLENBORO-SOUTH CYPRESS

SUBMITTED BY:

SAMSON ENGINEERING INC.
162 – 10TH STREET
BRANDON, MB
R7A 4E6
PH: 204–727–0747
FAX: 204–725–9870

November 29, 2019

Executive Summary

Samson Engineering Inc. (Samson) was retained by the Municipality of Glenboro-South Cypress (Municipality) to submit an Environmental Act Proposal (EAP) on behalf of the Municipality for the Village of Glenboro Wastewater Treatment Lagoon Upgrade. The Glenboro lagoon site is located approximately 360m west of Glenboro, Manitoba, southeast of the intersection of Provincial Trunk Highway (PTH) 2 and Mile Road 81 W.

The Glenboro lagoon originally operated as a single exfiltration cell in 1956. The current facultative lagoon system was constructed in 1982 and consists of a primary treatment cell and a secondary exfiltration cell that allows effluent to filter through naturally occurring sands on-site into the Assiniboine Delta Aquifer. The current system operates under the Clean Environment Commission Order No. 1023VC which allows exfiltration on-site as long as nitrate and nitrite as N concentrations are below 10 mg/ml.

Manitoba Sustainable Development (MSD) issued a letter to the Municipality dated May 27, 2015 requiring that the wastewater treatment system be upgraded stating the "The lagoon does not meet current environmental standards, in particular with respect to containment in the secondary cell". The residences within the area of the lagoon obtain potable water from shallow sand points 4 to 17 feet below grade. Manitoba Sustainable Development has indicated that they do not approve of exfiltrating effluent into a potable water aquifer unless the effluent meets drinking water criteria.

In addition to the issues of exfiltrating effluent into the drinking water aquifer, the current facultative lagoon does not have sufficient hydraulic storage capacity, the berms require maintenance and the primary cell inlet requires sealing and relocation.

A feasibility study was conducted by J R Cousin Consultants Ltd. (JRCC) entitled "Feasibility Study for the Glenboro Lagoon Expansion" dated September, 2017. JRCC recommended the following options:

- Option 1: Construct a New Aerated Lagoon within the Existing Lagoon Footprint and Discharge to the Assiniboine River with an estimated capital cost of $8, 844, 900 and a 20 year life cycle cost of $11,061,200.
- Option 2: Constructing a New Lagoon in the RM of Argyle with an estimated capital cost of $9,101,300 and a 20 year life cycle cost of $10,114,300.
- Option 3: Expansion and Use of the Spruce Woods Provincial Park Lagoon with an estimated capital cost of $8,833,700 and since the Municipality would be responsible for the increase in operating costs of the expanded Spruce Woods lagoon, the 20 year life cycle cost was estimated at $10,181,000.

Given that the Municipality's current population is 656 people and the projected 20 year population is 740 people (which includes school children that are bussed to the Glenboro school), these options were unattainable for the Village of Glenboro. As such, the Council asked Samson for an alternative option for upgrading the Village of Glenboro Wastewater Treatment Lagoon System. Samson's alternative option included:

- Option 4: Aerating the Current Primary Lagoon Cell and Constructing Two Submerged Attached Growth Reactors (SAGR). This option included building up the existing primary cell berms, moving the inlet to the southeast corner of the primary cell, dividing the primary cell into two partial mix aerated cells and a settling cell, constructing two SAGR

cells north of the existing primary cell, and installing a pre-fabricated building for the blowers and for alum mixing.

This option uses the current primary cell liner without modification. The liner does not specifically meet Manitoba Sustainable Development's Design Objectives for Wastewater Treatment Lagoons dated September, 2014 which indicate that soil liners are to be at least 1m thick and have a hydraulic conductivity 1 x 10^{-7} cm/s or less. The reasoning for using the current liner, without modification, includes:

- KGS conducted a geotechnical assessment of the lagoon and advanced two test holes through the edge of the primary cell liner. Two hydraulic conductivity tests were completed on the bentonite modified clay liner. The two test locations were found to have hydraulic conductivity's of 2.3 x 10^{-8} cm/s and 3.2 x 10^{-8} cm/s. The clay liner was observed to be 11 inches (0.3m) thick with 11 inches (0.3m) of clay over the clay liner as well as clay below the liner between 0.6m and the end of the borehole at 1.5m below surface.
- According to as built drawings, the bentonite amended layer is 8 inches (0.20m) thick with a 6 inch (0.15m) clay over the liner, less than the thickness observed by KGS.
- Based on the hydraulic conductivities a liner constructed to Manitoba's Design Objectives equate to 31.7 years for water to seep through a 1m thick liner with a hydraulic conductivity of 1 x 10^{-7} cm/s as compared to the sites current liner that ranges between 20.1 years (using as built liner thickness and lowest conductivity measured) to 38.5 years (using the clay thickness measured by the geotechnical investigation and the highest hydraulic conductivity); however, the current liner also has additional compacted clay over and under the liner to protect and add additional resistance to seepage that has not been included within the seepage calculation.
- The current liner meets the construction requirements of the Saskatchewan Ministry of Environment Water Security Agency (WSA) which requires that "lagoon cells should be relatively impermeable in accordance with the needs for functional treatment and protection of surrounding land and ground water"; "seepage from a lagoon facility should be limited to 15 cm per year"; "For in-situ materials or soil liners an on-site permeability of 10 times the laboratory value should be used to calculate seepage losses." Based on the hydraulic conductivity of 2.3 to 3.2 x 10^{-8} cm/s the rate of losses from the Glenboro's primary lagoon cell would be 0.725 to 1.009 cm/year. After applying the 10 times safety factor, the seepage is estimated to be 7.3 to 10.1 cm/year, less than the Saskatchewan Ministry of Environment WSA recommendation of 15 cm/year. Again, this calculation was conducted without considering the extra protection of the clay located above and below the liner.
- There is no evidence that the primary lagoon liner is failing. Monitoring wells located within the vicinity of the primary lagoon have been tested since 2015 and no fecal coliforms or E. coli were identified in any of the samples collected adjacent or down gradient from the primary lagoon. If the primary lagoon was not functioning as designed, elevated fecal coliforms and E. coli would be expected in the monitoring wells located adjacent and down gradient to the primary cell.
- If the liner is upgraded to meet the 1 m thickness currently recommended by Manitoba Sustainable Development's objectives, the wastewater would need to be diverted for approximately two months, the primary cell would be pumped out and allowed to dry and the current liner would be excavated and replaced or a synthetic liner installed. During construction of the liner, an estimated 269m^3/day of untreated sewage would be discharged directly into the environment. If the liner upgrade takes two months to complete, approximately 16,000 m^3 of raw sewage would be discharged as well as an estimated 17,000m^3 of sewage pumped from the primary cell for a total estimated volume of 33,000m^3 (33,000,000L) of untreated waste entering the environment.

- The cost of increasing the thickness of the liner is estimated at 2 million dollars because of having to divert sewage prior to liner construction.

Given that the primary liner is not failing, adding 33,000m^3 of untreated sewage to the environment and costing the Municipality an additional $2 million to upgrade a liner that is functioning as designed, is not reasonable and is not affordable for a community with a current population of 656 people. Alternatively, we suggest that modifications be made to the inlet to ensure that seepage does not occur along the inlet pipe, that modifications are made to build up the berms but that no modifications be made to the primary cell liner. Monitoring wells are sampled regularly and if leakage occurs in the future, the primary liner can be upgraded at that time with only modest increases in costs as compared to upgrading the liner at this time.

Three discharge options were considered for Option 4 and include:

1. Exfiltrating through the secondary cell;
2. Discharging to the wetland located approximately 4.7km south of the lagoon and decommissioning the secondary cell; and
3. Discharging to the Assiniboine River located approximately 6km north to northwest of the lagoon and decommissioning the secondary cell.

Based on discussions with Manitoba Sustainable Development and the Municipality, it was decided to proceed with discharging the treated effluent to the Assiniboine River. The estimated construction cost of this option is approximately 4.5 million dollars, 5.5 million with the Glenboro sewer repair included.

As part of this EAP, the potential environmental effects of the proposed Village of Glenboro Wastewater Treatment Lagoon Upgrade were reviewed and specific best practices and mitigation measures were identified to reduce or eliminate any negative environmental effects. The proposed development is not expected to result in any significant adverse environmental effects.

Construction activities will be monitored by Samson to ensure that the project proceeds as planned and that mitigation measures are being followed. Once commissioned, a level 2 operator will be responsible for insuring that the lagoon is operating within the provisions of the Environment Act License.

Based on the design of the proposed project and the implementation of mitigation measures, no significant negative environmental impacts are anticipated.

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1. INTRODUCTION

Samson Engineering Inc. (Samson) was retained by the Municipality of Glenboro-South Cypress (Municipality) to submit an Environmental Act Proposal (EAP) on behalf of the Municipality for the Village of Glenboro Wastewater Treatment Lagoon Upgrade. The Glenboro lagoon site is located approximately 360m west of Glenboro, Manitoba, southeast of the intersection of Provincial Trunk Highway (PTH) 2 and Mile Road 81W. The site currently consists of a facultative lagoon system which consists of a primary treatment cell and a secondary exfiltration cell that operates under Clean Environment Commission Order 1023 VC dated August 25, 1986.

The Site Plan is located in Appendix A. The Clean Environment Commission Order is provided in Appendix B.

1.1 Proponent

The proponent is the Municipality of Glenboro-South Cypress. The contact information for the Municipality is as follows:

Darren Myers
CAO
Municipality of Glenboro-South Cypress
618 Railway Avenue
Glenboro, MB R0K 0X0
PO Box 219
caormsc@mts.net
204-827-2123

Samson was retained by the Municipality to complete the EAP as well as to design and manage the lagoon upgrade. The contact information for Samson is as follows:

Joanne Lanoie, M.Sc., B.Sc.
Senior Project Manager - Environmental
Samson Engineering Inc.
162 10th Street
Brandon, MB R7A 4E6
Mobile: 204-981-9861
JLanoie@SamsonEngineering.com

Phil Dorn, P. Eng.
President
Samson Engineering Inc.
162 - 10th Street
Brandon, MB R7A 4E6
Office: 204-727-0747
PDorn@SamsonEngineering.com

1.2 Project Need

The Glenboro lagoon originally operated as a single exfiltration cell in 1956. The current facultative lagoon system was constructed in 1982 and consists of a primary treatment cell and a secondary exfiltration cell that allows effluent to filter through naturally

occurring sands on-site into the Assiniboine Delta Aquifer. The current system operates under the Clean Environment Commission Order No. 1023VC which allows exfiltration on-site as long as nitrate and nitrite as N concentrations are below 10 mg/ml.

Manitoba Sustainable Development (MSD) issued a letter to the Municipality dated May 27, 2015 requiring that the wastewater treatment system be upgraded stating the "The lagoon does not meet current environmental standards, in particular with respect to containment in the secondary cell"(Appendix B). The residences within the area of the lagoon obtain potable water from shallow sand points 4 to 17 feet below grade. Manitoba Sustainable Development has indicated that they do not approve of exfiltrating effluent into a potable water aquifer unless the effluent meets drinking water criteria.

A feasibility study was conducted by J R Cousin Consultants Ltd. (JRCC) entitled "Feasibility Study for the Glenboro Lagoon Expansion" dated September 2017. JRCC determined that the total projected 20 year organic loading from the serviced population is expected to be 56.2 kg BOD5/day and that the primary cell capacity is 76.2 kg BOD5/day, sufficient for the projected organic loadings. Based on the per capita hydraulic loading rate of 394L person/day, the projected 20 year hydraulic load is approximately 300m^3 /day. A facultative lagoon requires a 230 day hydraulic storage capacity and so the 20 year capacity requirement would be 67,059m^3. The existing lagoon has a total hydraulic storage capacity of approximately 22,192m^3 which is not sufficient for the projected loadings.

In addition to the issues of exfiltrating effluent into the drinking water aquifer and insufficient hydraulic storage capacity, other components of the lagoon system that require upgrading including building up berms and sealing/moving the primary cell inlet.

1.3 Previous Reports

The following is a list of previous reports that have been issued for the Glenboro Lagoon and are listed from oldest to newest:

- Hydrogeology in the Vicinity of the Village of Glenboro Sewage Lagoon System, prepared by the Province of Manitoba Department of Natural Resources Water Resources Branch, dated January 1985.
- Clean Environment Commission Order 1023 VC, prepared by the Clean Environment Commission Under the Clean Environment Act, dated August 25, 1986 (Appendix B)
- "Village of Glenboro Subdivision Feasibility Study, Final Report", prepared by Genivar, dated December 2011.
- "Feasibility Study for the Glenboro Lagoon Expansion" prepared by J R Cousin Consultants Ltd. (JRCC) prepared for the Municipality of Glenboro South Cypress, dated September 2017.
- Letter titled "File No. 178.20 Environment Act Licence No. 1023 VC" prepared by Manitoba Sustainable Development, to the Municipality of Glenboro South Cypress, dated May 29, 2019 (Appendix B).
- Topographic Survey of Part of NW1/4 SEC. 10-7-14 WPM being Parcel 2 Plan No. 1136 (C. Div.) and Lot Plan No. 53101, Municipality of Glenboro-South Cypress, Manitoba" prepared by Prairie Benchmark Land Surreys, For Samson Inc., dated 2019.

- Nexom Proposal for Design, Supply and Installation of OPTAERTM Wastewater Treatment System, prepared by Nexom for Samson Engineering Inc., dated July 17, 2019.
- "Preliminary Design of Lagoon Upgrades, Glenboro, Manitoba, Geotechnical Investigation and Assessment – Final" prepared by KGS Group Consulting Engineers (KGS), For Samson Engineering Inc., dated August 16, 2019.
- Groundwater Quality Assessment, Municipality of Glenboro-South Cypress Lagoon, prepared by Samson Engineering Inc. for the Municipality of Glenboro-South Cypress, dated September 17, 2019.
- "Village of Glenboro Wastewater Lagoon Feasibility Study Addendum" prepared by Samson Engineering Inc. for the Municipality of Glenboro-South Cypress, dated September 19, 2019.

1.4 Alternatives Assessed

The JRCC Feasibility Study presented three options for upgrading the lagoon including:

- **Option 1: Construct a New Aerated Lagoon within the Existing Lagoon Footprint and Discharge to the Assiniboine River.** This option would require excavating 2.1m of soil from the secondary storage cell and constructing 2 aerated cells in its footprint. Two SAGR units would be constructed beside the aerated cells and a disinfection ultraviolet unit would be installed. This option requires a sewage treatment building, a discharge pumping system and a 5.8 km discharge pipeline to the Assiniboine River. Once operational, the existing primary storage cell would be decommissioned. The estimated capital cost was $8,844,900 with a 20 year life cycle cost of $11,061,200.

- **Option 2: Constructing a New Lagoon in the RM of Argyle.** This option would require obtaining approval from the RM of Argyle to construct a facultative lagoon in their RM and installing a 5.3 km forcemain from the existing Glenboro lift station to the new lagoon. The new facultative lagoon would require constructing a new primary and secondary cell, and excavating a 500m ditch that would discharge effluent from the new secondary cell to a nearby wetland. Once operational, the existing lagoon cells would be decommissioned. The estimated capital cost was $9,101,300 with a 20 year life cycle cost of $10,114,300.

- **Option 3: Expansion and Use of the Spruce Woods Provincial Park Lagoon.** This option would require obtaining an agreement with Spruce Woods Provincial Park (Spruce Woods) to permit effluent treatment which would include constructing a 16.7km forcemain from the existing Glenboro lift station to Spruce Woods, upgrading the existing Spruce Woods primary cell with aeration and constructing a new secondary cell at Spruce Woods. Once operational, the existing lagoon cells would be decommissioned. The estimated capital cost was $8,833,700 and since the Municipality would be responsible for the increase in operating costs of the expanded Spruce Woods Lagoon, the 20 year life cycle cost was estimated at $10,181,000.

Given that the Municipality's projected 20 year population of approximately 740 people, these options seemed unattainable for the Village of Glenboro. As such, the Council asked

Samson for an alternative option for upgrading the Village of Glenboro Wastewater Treatment Lagoon System. Samson's alternative option included:

- **Option 4: Aerating the Current Primary Lagoon Cell and Constructing Two Submerged Attached Growth Reactors (SAGR).** This option included building up the existing primary cell berms, moving the inlet to the southeast corner of the primary cell, dividing the primary cell into two partial mix aerated cells and a settling cell, constructing two SAGR cells north of the existing primary cell, and installing a pre-fabricated building for the blowers and for alum mixing.

Three effluent discharge options were considered, including:

1. Exfiltrating through the secondary cell;
2. Discharging to the wetland located approximately 4.7 km south of the lagoon and decommissioning the secondary cell; and,
3. Discharging to the Assiniboine River located approximately 5.8 km north to northwest of the lagoon and decommissioning the secondary cell.

Based on preliminary discussions with Manitoba Sustainable Development and the Municipality, it was decided to proceed with discharging the treated effluent to the intermediately flowing water body at Glenboro Marsh. Although this option was more expensive than discharging on-site, the decision would ensure that treated effluent would not be discharged to the potable water aquifer. Additionally, discharging to the marsh would align with the recommendations made in The Central Assiniboine and Lower Souris River Intergraded Watershed Management Plan which recommends reducing nutrient discharges to the Assiniboine River from municipal wastewater treatment systems by utilizing wetlands to reduce nutrient loads to the Assiniboine River. The estimated cost of this option was approximately 4.5 million dollars, 5.5 million with the addition of sewer pipe repair in the Village of Glenboro.

The Municipality agreed to proceed with Option 4, including discharging treated effluent to the Glenboro Marsh. The Municipality passed resolution #2019-155 dated August 14, 2019 that resolved that the Glenboro Lagoon Upgrade be submitted for funding through the Investing in Canada Infrastructure Program – Green Infrastructure Stream and Environmental Quality Sub-stream (GIS-EQ-27466702) and that the Council committed to provide its share of $5.5 million towards the project if federal and provincial funding is confirmed.

Prior to the issuing of the EAP, Manitoba Sustainable Development contacted Samson and requested that Samson hold off issuing the EAP and participate in a conference call, during which, they requested that the discharge point be a continuously flowing water body based on a concern of winter flooding. Manitoba Infrastructure's Water Management Planning and Standards Department (which is responsible for assessing the potential for flooding) had no concerns regarding the Glenboro Marsh discharge point in regards to flooding; however, changing the discharge point from the Glenboro Marsh to the Assiniboine River did not significantly change the cost of construction and as such, the Municipality agreed to change the discharge location to the Assiniboine River.

2. PROPOSED DEVELOPMENT

The proposed development consists of upgrading the current lagoon by turning the current facultative lagoon system into an aerated primary cell with two Submerged Attached Growth Reactors (SAGRs). The existing primary cell berms will be built up, the inlet will be moved to

the southeast corner of the primary cell, and the primary cell will be divided into two partial mix aerated cells and a settling cell. Two SAGR cells will be constructed north of the existing primary cell and a pre-fabricated building will be brought to the site to for the blowers and alum mixing. A force main will be constructed from the site where it will cross PTH 2 and continue along Mile Road 81 West (also known as Golf Course Drive) along SE16-7-14W, NE16-7-14W, SE21-7-14W, NE21-7-14W, SE28-7-14W and NE28-7-14W. The force main will then turn west and continue along an unused right of way north of NE28-7-14W and NW28-7-14W to the Assiniboine River ending at approximately 49°36'22.79"N Latitude and 99°18'58.53"W Longitude. Once operational, the secondary cell will be decommissioned.

Drawings showing the proposed site plan are provided in Appendix A

2.1 Title of Land

The legal address for the property is Lot 4 Plan 53101 MLTO in NW-10-07-14-W.

The property is described as follows:
In the Town site of Glenboro, in the Province of Manitoba, and being all that portion of the NW-10-07-14-W as follows:

1. The most easterly 130 feet in lineal length of Parcel No 1 (lift station)
2. The whole of Parcel 2. (lagoon site)
3. A right-of-way or easement over Parcel 1 aforesaid with the exception of that portion described in Paragraph 1 above mentioned for the purpose of laying down, construction of, operation, maintenance, inspection, alteration, removal, replacement, reconstruction or repair of one or more sewerage pipes, lift drains and generally all work of the Village of Glenboro necessary for its sewerage installation under-taking together with the right of ingress and egress to and from the said right-of-way, which said Parcels are shown on a Plan registered in the Carman Land Titles Office as No. 1136.

A Status of Title dated June 27, 2019 and the Certificate of Title is provided in Appendix C.

2.2 Mineral Rights

Mineral rights are with the Crown and will remain with the Crown.

2.3 Current Site and Adjacent Land Use

Photos and descriptions of the current site are provided in the table below.

Table 1: Photos of the Current Lagoon Site

Primary cell, looking northeast.

Primary cell to the left and exfiltration cell on the right, looking east.

East side of primary cell looking north. Location of inlet pipe is marked with wooden sticks.

Northwest corner of the exfiltration cell, looking southeast.

Ease side of exfiltration cell looking south. Manhole is located on the left side of the photo.

The description and photos of properties adjacent to the lagoon site are provided in the table below.

Table 2: Adjacent Land Uses of the Lagoon Site	
North: Two monitoring wells (sand points) are located approximately 80m north and down-gradient of the primary cell on municipal property which is outside of the site fencing (GP-6 on the west side, GP-5 on the east side). North of the municipal property is PTH 2 followed by a Manitoba Hydro Substation and agricultural crop land. The Hydro Buildings are located approximately 275m from the primary cell and 560m down-gradient from the exfiltration cell. Photo taken adjacent GP-6 looking north.	
Northeast: PTH 2 followed by agricultural crop land. A residential dwelling is located approximately 600m northeast of the primary cell and is expected to have a shallow sand point for potable water.	
East: Agricultural crop land followed by residential dwellings located within the village of Glenboro. The closest residential houses are approximately 418m east and cross-gradient from the primary cell and approximately 400m east and cross-gradient from the exfiltration cell. The residences obtain potable water from shallow sand points. Two groundwater monitoring wells (sand points) are located east of and cross-gradient from the lagoon, one approximately 380m east of the exfiltration cell (GP-3) and one approximately 460m east of the primary cell (GP-4). Photo taken from east of the lagoon, looking east.	

South and Southeast: Fair Grounds are located approximately 40m south and up-gradient from the exfiltration cell. A dump station is located approximately 120m south and up-gradient from the exfiltration cell and connects to a septic tank that has been reported to empty into the exfiltration cell. A barn is located approximately 150m southeast and up to cross-gradient from the exfiltration cell. Groundwater monitoring well/sand point (GP-2), used for livestock watering, is located approximately 195m southeast and up to cross-gradient from the exfiltration cell. Groundwater monitoring well/sand point (GP-1) is located approximately 125m south and up to cross-gradient from the exfiltration cell. Photo taken from Mile Road 81N looking southeast. Fair grounds are located both north and south of the tree line.	
Southwest: A farm house is located southwest of the exfiltration cell at NE 9-7-14 with a sand point in the basement, located approximately 330m southwest of the exfiltration cell. A new sand point was being installed adjacent the north elevation of the house. The septic field was reported to be south of the house, an estimated 15m up-gradient from the active water well. A water sample was collected from this residence. A questionnaire/survey was conducted with the homeowner regarding the lagoon.	
West: Mile Road 81W followed by agricultural crop land.	

Northwest: A farm house is located northwest of the lagoon at SE 16-7-14W with a sand point in the basement, approximately 270m northwest of the primary cell and 450m northwest and down to cross-gradient from the primary cell. A water sample was collected from this residence. A questionnaire/survey was conducted with the homeowner regarding the lagoon.	

Three possible discharge locations were assessed for the proposed upgrades. The current discharge location into the Assiniboine River was agreed upon in November of 2019, and as such, snow cover limited visual assessment of ground surfaces. The description and photos of properties adjacent to the force main are provided in the table below and are a combination of photos obtained from Google Earth™ dated June 2014, copyright 2018 and 2019 (non-snow covered) and Samson in November 2019 (snow covered).

Table 3: Adjacent Land Uses of The Force Main And Outfall

	
The majority of land uses adjacent the force main include agricultural crop land. Photo looking north along Mile Road 81 West at SE16-7-14W.	Signage identified the crop as being InVigor L159 Hybrid Canola, view looking west from Mile Road 81 West.

 G lenboro Golf and Country Club in SE21-7-14W.	 View of SW22-7-W.
 View of Mile Road 81W by the Glenboro Golf and Country Club in SE21-7-14W.	 View of where Mile Road 81W ends and the force main will turn west towards the Assiniboine River between NE28-7-14W and SE33-7-14W.
 Farm located in SE33-7-14W. The owner has land that surrounds the undeveloped municipal right of ways that lead to the Assiniboine River, both to the west and to the north from this point. The owner preferred that the force main run west towards the River.	 View of right of way looking west towards the Assiniboine River. Agricultural land to the left (south) and residential farm to the right (north).

View of the treed right of way that leads to the Assiniboine River. View looking north. The foreground and background is adjacent agricultural farm land.

Another view of the treed right of way that leads to the Assiniboine River, closer to the river. View looking north. The foreground and background is adjacent agricultural farm land.

Photo of trees near the Assiniboine River.

Photo of the Assiniboine River bank near the proposed outfall location.

2.4 Organic and Hydraulic Storage Capacity

JRCC determined that the total projected 20 year organic loading from the serviced population is expected to be 56.2 kg BOD5/day and that the primary cell capacity is 76.2 kg BOD5/day, sufficient for the projected organic loadings. Based on the per capita hydraulic loading rate of 394L person/day, the projected 20 year hydraulic load is approximately 300m^3/ day. A facultative lagoon requires a 230 day hydraulic storage capacity and so the 20 year capacity requirement would be 67,059m^3. The existing lagoon has a total hydraulic storage capacity of approximately 22,192m^3 which is not sufficient for the projected loadings.

2.5 Design Criteria

Manitoba Sustainable Development's Information Bulletin – Design Objectives for Wastewater Treatment Lagoons indicates that effluent quality requirements for wastewater treatment lagoons discharging to surface water must meet the following requirements:

- Five-day carbonaceous biochemical oxygen demand (CBOD5) – not to exceed 25 milligrams per litre.
- Total suspended solids (TSS) – not to exceed 25 milligrams per litre unless caused by algae.
- Fecal coliform content or E. Coli content as indicted by the MPN index – not to exceed 200 per 100 millilitres.
- Un-ionized ammonia content expressed as nitrogen (N), at 15°C ±1°C – not to exceed 1.25 milligrams per litre for intermittently discharging facilities.
- Total phosphorus – not to exceed 1 mg/L; or a demonstrated nutrient reduction strategy for facilities discharging less than 820 kg/year of total phosphorus (a population equivalent of under 2000 people.) For facilities proposing a nutrient reduction strategy, strategies will be evaluated on a site specific basis, and strategies which do not offer a reasonable likelihood of attaining a total phosphorus content of 1 mg/L at a significant downstream waterway will not be approved.

The design criteria for the lagoon upgrade is based on information obtained from the JRCC Feasibility Report, KGS Geotechnical Investigation, a topographic survey, Samson Water Assessment, Nexom Proposal and the Samson Feasibility Study Addendum. The proposed lagoon upgrade is designed for a 20 year life cycle. The 20 year population, including students bussed in for school, is 740 people. The volume of truck hauled loading was determined to be insignificant. A summary of the preliminary design parameters prepared by Nexom is provided in the table below. Note that the final design will be prepared once funding and regulatory approval is confirmed.

Table 4: Design Parameters

Parameter	Units	Influent	Effluent
Design Flow (20 Year)	M3/day	292	
$cBOD_5$	mg/L	203	< 25
$cBOD_5$	Kg/day	59	
TSS	mg/L	200	< 25
TSS	Kg/day	58	
TKN	Kg/day	11.7	
Total Ammonia	mg/L		<1 in summer 5 in winter
Unionized Ammonia	mg/L		<0.2
Total P	mg/L	6	<1

2.6 Preliminary Design Modifications

The information provided within this EAP is based on the current preliminary design and are subject to change. Final project design will be completed after funding and regulatory approvals are received. Nexom has provided preliminary design details for the proposed lagoon upgrade. Diagrams of the proposed lagoon system are provided in Appendix A.

2.7 Glenboro Sewer Pipes

The Village of Glenboro's aging sewers leak, causing sewage to enter into the environment and groundwater to enter into the sewage system. The Municipality will repair/relining approximately 4,430m of sewer mains by installing insitupipe within the existing sewer line to reduce sewage leakage and to reduce infiltration of groundwater into the lagoon. This work is separate from the Proposed Village of Glenboro Wastewater Treatment Lagoon Upgrade; however, it has been included here for informational purposes as the work directly affects the functioning of the lagoon.

2.8 Primary Cell Sludge

The primary cell was de-sludged in 2007 and the biosolids were injected into agricultural land at NE 9-7-14 WPM as approved by Environment Act License 2739. An assessment of the sludge present within the primary cell was conducted on June 26, 2019 and included 10 sample points distributed across the primary cell. Sludge was present in thickness ranging from 4 to 6 inches with the greatest depth being near the inlet. The sludge in facultative lagoon consists of a high organic content and the volume of sludge is less than 10% of the total volume of effluent within the cell and as such, according to Nexom, aeration equipment can be placed directly onto the sludge without the need for sludge removal.

2.9 Secondary Cell Sludge

The secondary cell has not been previously de-sludged. An assessment of the sludge present within the primary cell was conducted on June 26, 2019 and included 10 sample points distributed across the secondary cell with a sludge drudge. The sludge was observed to be a black material suspended in a layer of water near the bottom of the secondary cell. The suspended solids were seen as being 1 to 3 inches thick with the greatest depth being near the inlet. An attempt was made at collecting a composite sample of the sludge for laboratory analyses. The 10 sample points did not yield the required volume so additional sludge was collected near the shallow portions of the secondary cell with a stainless steel trowel and laboratory bottles to collect the black sediment filled water/sludge mixture. Approximately four liters of sludge was collected and submitted to ALS for laboratory analyses. The laboratory contacted Samson indicating that there were insufficient solids in the sample to analyze. Based on the sampling conducted, it does not appear that there are significant quantities of sludge in the secondary cell.

2.10 Primary Cell Liner

Manitoba Sustainable Development's Design Objectives for Wastewater Treatment Lagoons dated September 2014 allows wastewater treatment lagoons to use either soil or synthetic liners. Soil liners are to be at least 1m thick and have a hydraulic conductivity 1 x 10^{-7} cm/s or less. It would take water approximately 31.7 years for water to flow through a 1 m thick liner with a hydraulic conductivity of 1 x 10^{-7} cm/s. KGS conducted a geotechnical assessment of the lagoon and advanced two test holes through the primary cell liner. Two hydraulic conductivity tests were completed on the bentonite modified clay liner. The two test locations were found to have hydraulic conductivity's of 2.3 x 10^{-8} cm/s and 3.2 x 10^{-8} cm/s. According to as built drawings, the

bentonite amended layer is 8 inches (0.20m) thick with a 6 inch (0.15m) clay over the liner; however, the geotechnical borehole logs identify that the bentonite modified layer was observed to be 11 inches (0.3m) with 11 inches (0.3m) of clay over the clay liner as well as clay below the liner between 0.6 m and the end of the borehole at 1.5m below surface.

The hydraulic conductivity, liner thickness and the number of years required for water to flow through the bentonite modified liner already in place verses a liner built to Manitoba Sustainable Development's design objectives is summarized in the table below.

Table 5: Estimated Number of Years for Seepage to Penetrate Liner

PRIMARY CELL HYDRAULIC CONDUCTVITY TEST RESULTS		
TH19-03	3.20E-08 *CM/S*	
TH19-04	2.30E-08 *CM/S*	
MODIFIED BENTONITE LAYER THICKNESS		
	INCHES	**CM**
AS BUILT DRAWINGS	8	20.32
BOREHOLE LOGS	11	27.94
ESTIMATED YEARS TO PENETRATE LINER		
THICK \ HY COND	***2.30E-08 CM/S***	***3.20E-08 CM/S***
8" THICK (drawings)	28.0 years	20.1 years
11" THICK (measured)	38.5 years	27.7 years
ESTIMATED YEARS TO PENETRATE 1 M THICK LINER WITH HYDRAULIC CONDUCTIVITY OF 1X10-7 (MANITOBA SUSTANABLE DEVELOPMENT DESIGN OBJECTIVES)		
THICK \ HY COND	***1.00E-07***	
1000 MM	31.7 Years	

It would take 31.7 years for water to seep through a liner constructed to Manitoba's Design (1m thick with a hydraulic conductivity of 1 x 10^{-7} cm/s) as compared to the sites current liner that ranges between 20.1 years (using as built liner thickness and lowest conductivity measured) to 38.5 years (using the clay thickness measured by the geotechnical investigation and the highest hydraulic conductivity); however, the current liner also has additional 6 to 11 inches of compacted clay over the liner protects the liner from damage and adds additional resistance to seepage that has not been included within the seepage calculation. Additionally, the clay under the liner would also add to the number of years that water would take to seep into the soils beneath the primary

cell; however, as this layer may not be homogeneous, the additional protection from this layer has not been calculated.

Although Manitoba's Design Objectives are based on thickness and hydraulic conductivity and not on the number of years for water to seep through the liner, other jurisdictions have requirements that the Glenboro primary liner would conform to. For comparison purposes, the construction requirements of the Saskatchewan Ministry of Environment Water Security Agency (WSA) requires that "lagoon cells should be relatively impermeable in accordance with the needs for functional treatment and protection of surrounding land and ground water" "seepage from a lagoon facility should be limited to 15 cm per year" "For in-situ materials or soil liners an on-site permeability of 10 times the laboratory value should be used to calculate seepage losses." Based on the hydraulic conductivity of 2.3 to 3.2 x 10-8 cm/s the rate of losses from the Glenboro's primary lagoon cell would be 0.725 to 1.009 cm/year. After applying the 10 times safety factor, the seepage is estimated to be 7.3 to 10.1 cm/year, less than the Saskatchewan Ministry of Environment WSA recommendation of 15 cm/year.

There is no evidence that the primary lagoon liner is failing. Water sampling within the vicinity of the primary lagoon had no fecal coliforms or E. coli in any of the samples collected adjacent or down gradient from the primary lagoon. If the primary lagoon was not functioning as designed, elevated fecal coliforms and E. coli would be present in the adjacent monitoring wells (Groundwater Quality Assessment, Village of Glenboro Wastewater Lagoon, dated September 17, 2019).

If the liner is upgraded to meet the 1m thickness currently recommended by Manitoba Sustainable Development's objectives, the wastewater would need to be diverted for approximately two months, the primary cell would be pumped out and allowed to dry and the current liner would be excavated and replaced or a synthetic liner installed. During construction of the liner, an estimated 269m³/day of untreated sewage would be discharged directly into the environment. If the liner upgrade takes two months to complete, approximately 16,000m³ of raw sewage would be discharged as well as an estimated 17,000m³ of sewage pumped from the primary cell for a total estimated volume of 33,000m³ (33,000,000L) of untreated waste entering the environment. The cost of increasing the thickness of the liner is estimated at $2 million because of having to divert sewage prior to liner construction. Given that the primary liner is not failing, adding 33,000m³ of untreated sewage to the environment and costing the Municipality an additional $2 million to upgrade facilities that are not failing is not reasonable and is not affordable for a community of 656 people. The proposed development assumes that no modifications will be made to the primary cell liner. Monitoring wells are sampled regularly and if leakage occurs in the future, the primary liner can be upgraded at that time with only modest increases in costs as compared to upgrading the liner at this time (increased costs due to removing and then replacing aeration equipment in the primary cell).

Historically, sewage was exfiltrated directly into the ground. The current facultative lagoon was constructed in 1982 and exfiltrates partly treated effluent into the ground. Regular testing has occurred since 2015 and all historical data showed nitrate and nitrite as N concentrations below the Canadian Drinking Water Guideline for the nitrate nitrogen limit of 10 mg/L and the nitrite nitrogen limit of 1 mg/L. None of the groundwater monitoring wells adjacent or downgradient from the primary cell have

been impacted with E. coli or fecal coliforms since sampling started in 2015. The proposed upgrade will improve groundwater quality by fully treating wastewater and discharging the effluent to the Assiniboine River. Once the inlet pipe is moved and sealed, the current liner is expected to continue to function as designed for the proposed life cycle of 20 years and beyond.

2.11 Conversion of the Facultative Primary Cell to an Aerated Partial Mix Cell

The proposed upgrades to the current primary cell will include the following:

- Build up the perimeter of the primary cell berm: lagoon cells are required to have a minimum of 1m freeboard around the entire perimeter.
- Install a new inlet: the existing inlet discharges wastewater to the center of the lagoon cell. A new inlet structure will be installed at the southeast corner. The current inlet pipe will be decommissioned and sealed.
- Impermeable flow diversion baffles will be installed to separate the existing primary cell into 3 different treatment cells. Cells 1 and 2 are designated as partial mix cells. Alum is added to Cell 1 to cause flocculation/coagulation. The partial mix cells are aerated and provide oxygen, residence, and contact time to natural bacteria. The diffuser density in the partial mix cells is based upon the oxygen demand. The aeration in the cells controls odors and provides internal sludge digestion resulting in minimal organic bottom sludge accumulation. Cell 3 will be for settling and will be located on the north side of the primary cell. The following design parameters were provided by Nexom.

Table 6: Design Parameters

Cell	Reactor Type	Water Depth (m)	Retention Time (days)	Water Volume (m^3)
1a	Partial Mix	1.5	37.3	10,866
2b	Partial Mix	1.5	36.0	10,500
1c	Settling	1.5	5.8	1,678
	SAGR	1.95		
	Total		**79.1**	**23,044**

Additional design parameters for the aeration and SAGR design parameters are identified in the Nexom proposal provided separately. The chemical dosing of alum will occur in a pre-fabricated blower building. A side stream of lagoon water will be pumped into the building and dosed prior to a static mixer for rapid mixing and chemical dispersion before returning to the front of cell 1. The dosing pumps will be designed to deliver 500 ml/min of alum. The pumps will have the ability for 1000:1 turn down during initial operation. The aeration will provide slow mixing to facilitate flocculation. Alum floc will settle in the lagoon. Alum will be stored on-site in drums. A 3300 gallon clean water tank will be used for periodic flushing of the dosing pumps, manifold and feed piping.

Diffusers are suspended near the bottom which creates convection cells in the water. Air bubbles rise, mixing the water. The solids settle through the downward motion of the water between diffusers. Additional oxygen is provided through diffusers near the bottom to provide oxygen for additional biodegradation resulting in minimal sludge

accumulation. Information on the diffusers and the construction of the cells can be found in the Nexom proposal in provided separately.

Outlet piping on the northwest corner of the primary cell will be installed to discharge the wastewater into the SAGR cells where the wastewater will be further treated.

2.12 Construction Of Two SAGR Units

The Nexom Submerged Attached Growth Reactor (SAGR) System provides nitrification (ammonia removal) in cold weather climates, further reduces BOD and TSS, and provides significant reductions in fecal and total coliform concentrations.

The SAGR units are sized to meet the discharge criteria from the Government of Canada and will handle the 20 year wastewater demand. The proposed development requires the installation of two 25m x 16m aerated SAGR cells along the north side of the existing primary lagoon cell on land currently owned by the Municipality. A 4.57m by 9.1m prefabricated blower building will be installed on a concrete slab west of the primary cell to provide the primary cell and the SAGR cells with aeration. Electrical lines will be extended to the building.

The SAGR system also provides an element of disinfection. According to Nexom, results of coliform data from sites where there was no additional disinfection being used following the SAGR cells were almost always passing the allowable limit. Bienfait, Saskatchewan and Melita, Manitoba, recently installed SAGR systems without additional disinfection. The system will be designed so that if additional disinfection is required, it can be added in the future if necessary.

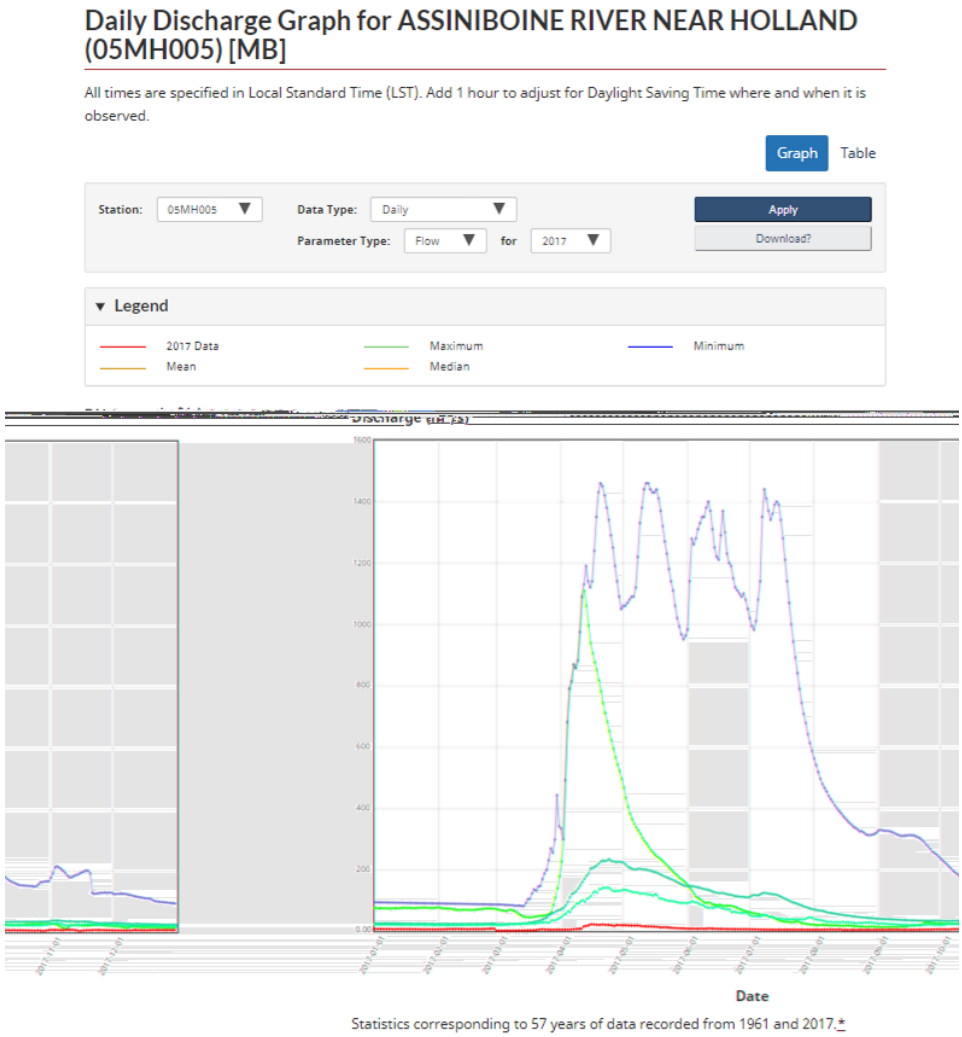
2.13 Construction of a Pumping Station, Force Main and Outfall

A pumping station will be constructed and treated effluent, that meets discharge criteria, will be discharged into the Assiniboine River through a buried 10 cm diameter HDPE force main that is approximately 6 km long. The force main route will start at the lagoon site where it will cross PTH 2 and continue along Mile Road 81W (also known as Golf Course Drive) along SE16-7-14W, NE16-7-14W, SE21-7-14W, NE21-7-14W, SE28-7-14W and NE28-7-14W. The force main will then turn west and continue along an unused right of way north of NE28-7-14W and NW28-7-14W to the Assiniboine River ending at approximately 49°36'22.79"N Latitude and 99°18'58.53"W Longitude (See Site Drawing in Appendix A). A maintenance pad will be constructed back from the river's bank and the outfall will be directionally drilled into the river to avoid disturbance of the river bank. The force main will discharge treated effluent continuously year round.

2.14 Flow into the Assiniboine River

The closest monitoring readings of the Assiniboine river is station 05MH005 (Assiniboine River near Holland) which is approximately 31 km northeast of the outfall, an estimated 80 km downgradient following the flow of the river. Monitoring station 05MH001 (Assiniboine River at Brandon) is located approximately 55 km northwest of the outfall, an estimated 100 km up-gradient following the flow of the River. Flow measurements are available from 1961 to 2017 for station 05MH005. A graph from The Government of Canada Water Office showing the maximum, minimum, mean and median daily

discharges for the Holland station, with the 2017 data added in red for comparison, is shown below.



Source: The Government of Canada Water Office

The following table has the maximum and minimum daily values recorded from 1961 to 2017 for the Assiniboine River at the Holland monitoring station 05MH005.

Table 7: Annual Maximum and Minimum Daily Flow Value For the Assiniboine River at Holland, Station 05MH005 From 1961 to 1917

Maximum Daily Discharge				Minimum Daily Discharge			
Date	**Value (m3/s)**	**Date**	**Value (m3/s)**	**Date**	**Value (m3/s)**	**Date**	**Value (m3/s)**
4/10/1961	57.2 B	**4/16/1990**	146 B	1961		1/30/1990	6.82 B
4/20/1962	184 B	**4/11/1991**	106	1962		2/27/1991	10.0 B
4/8/1963	107 B	**4/7/1992**	239	1963		11/15/1992	10.2 B
4/20/1964	144 E	**4/16/1993**	40.3	1964		3/24/1993	6.42 B
4/14/1965	379 B	**4/14/1994**	80.8	1965		2/21/1994	18.6 B
5/9/1966	224	**4/29/1995**	780	1966		2/21/1995	16.1 B
4/22/1967	219 B	**4/18/1996**	581 B	1967		11/13/1996	17.6 B

4/13/1968	105	**4/18/1997**	552 B	12/31/1968	6.74 B	11/15/1997	16.7 A
4/24/1969	694 A	**4/6/1998**	364 A	1/30/1969	5.38 B	3/15/1998	12.8 B
4/28/1970	501	**5/25/1999**	542	3/2/1970	14.7 B	2/28/1999	16.4 B
4/18/1971	193	**7/18/2000**	109	11/8/1971	10.8 B	11/14/2000	18.0 B
4/21/1972	314	**5/9/2001**	482	9/17/1972	13.3	11/28/2001	13.2
4/1/1973	56.4 B	**4/24/2002**	52.2	8/28/1973	10.6	3/10/2002	10.5 B
4/22/1974	909	**4/22/2003**	194	1/27/1974	13.5 B	12/8/2003	5.64 B
5/1/1975	498 E	**4/3/2004**	161	2/18/1975	24.6 B	1/1/2004	7.05 B
4/20/1976	1,460	**4/6/2005**	618	11/30/1976	12.7 B	2005	
7/13/1977	42.2	**4/12/2006**	366	11/22/1977	10.4 B	12/22/2006	7.46 B
4/10/1978	154 B	**2007**		10/23/1978	10.9	11/25/2007	16.6 B
4/24/1979	546 A	**4/20/2008**	109	10/6/1979	10.2	2008	
4/17/1980	97.5	**4/13/2009**	621 B	12/21/1980	9.21 B	1/5/2009	14.3 B
3/22/1981	41.8 B	**2010**		8/22/1981	6.20	1/29/2010	18.2 B
4/16/1982	239 A	**5/12/2011**	1,460	3/23/1982	10.8 B	2011	
4/11/1983	334 A	**7/14/2012**	280	12/19/1983	13.8 B	3/22/2012	10.7 B
4/6/1984	56.1 B	**5/1/2013**	518 B	8/27/1984	6.94	1/3/2013	20.3 B
3/28/1985	247 B	**7/8/2014**	1,440	2/1/1985	9.73 B	3/27/2014	27.5 B
4/5/1986	264	**4/10/2015**	397	9/19/1986	12.1	11/28/2015	25.9 B
4/7/1987	333 B	**11/4/2016**	215	11/21/1987	8.57	12/10/2016	25.7 B
5/19/1988	84.6	**4/12/2017**	1,110	11/15/1988	4.00 B	11/8/2017	12.4 B
4/7/1989	173 B			8/11/1989	4.87		

A = Partial Day

D = Dry

R = Revised within the last two years

B = Ice Conditions

E = Estimated

Source: The Government of Canada Water Office

The minimum daily flow recorded at the Holland station was 5.38m^3/second on January 1 in 1969. This equates to 464,832m^3/day. The estimated 20 year discharge expected from the Glenboro Lagoon is approximately 300m^3/day which is 0.06 percent of the volume on the lowest daily flow ever recorded. The average minimum daily flow was calculated to be 13.47 m^3/second which is 1,163,808m^3/day. The estimated 20 year discharge expected would be approximately 0.026% of the average minimum daily flow from 1968 to 2017. This shows that the volume of effluent from the Glenboro Lagoon is negligible, even compared to the lowest daily flow ever recorded. The greatest daily discharge recorded was 1,460 m3/second in both 1976 and 1911. The Glenboro Discharge would be 0.0002% of the daily flow and therefore would be an insignificant addition with regards to flooding.

2.15 Decommission Existing Secondary Cell

After the force main is complete and the upgraded system is operational, the existing secondary cell will be decommissioned. Decommissioning activities include the following:

- Effluent will no longer be discharged to the exfiltration cell.
- The secondary cell will empty via exfiltration.
- Effluent piping will be removed.

- Based on sludge testing conducted, there is minimal sludge present within the exfiltration cell and thus the sludge can be remediated on-site by mixing and aerating the sludge with earth moving equipment.
- Upon completion, soil samples will be collected and analyzed by a certified laboratory and a remedial report will be issued to Manitoba Sustainable Development.
- After the exfiltration cell is remediated, the dikes will be leveled.
- Topsoil and seeding will be installed.
- This area will remain within the lagoon fencing and will be available for SAGR gravel cleaning and future expansion (beyond the 20 year lagoon life cycle) if required.

2.16 Operation and Maintenance

The new lagoon system will require a level 2 operator. The current operator is a level 1 and will require additional training to obtain a level 2 operator status. The operator will require an estimated half hour per day to inspect the systems blowers, temperature, pressure, flows, effluent parameters, chemical levels and to record data. In addition to the daily requirements, the operator will need to conduct regular effluent sampling and submit sample results to Manitoba Sustainable Development as per license requirements, order replacement chemicals as needed and maintain the building and property.

2.17 Health and Safety

The overall health and safety concern regarding the Glenboro Lagoon is the current practice of exfiltrating partly treated water into the drinking water aquifer. Manitoba Sustainable Development is concerned that the exfiltration could, in the future, cause a potential health issue. The proposed lagoon upgrade minimizes the potential for impacting the local drinking water by treating the wastewater and discharging the treated water into the Assiniboine River.

During the construction phase, the perimeter fence will be expanded to the north so that SAGR cells are located within the fenced lagoon site. The fence has a lockable gate on the west side of the site. Prior to construction activity, site specific health and safety protocols will be developed. site construction activities will proceed with industry best practices. Tailgate health and safety meetings will occur daily and will include inspecting equipment daily for leaks and maintenance. On-site storage of gasoline is not expected during the construction or operation of the lagoon. Alum will be stored in a drum within the blower building.

2.18 Schedule

The final design of the Village of Glenboro Wastewater Treatment Lagoon Upgrade is expected to be complete within two months from approval with tendering expected to be completed within another one to two months. Construction on the lagoon site is expected to begin in spring. Construction of the force main and outfall will occur later in the construction season (after June) to avoid disturbance of wildlife mating and spawning periods. The new lagoon is expected to be commissioned and operational within a year of receiving funding and regulatory approval. Depending on funding, this may occur in 2020 or in 2021.

Decommissioning of the exfiltration cell will is expected to occur within a year of the new upgraded wastewater treatment system becoming operational. The sludge in the exfiltration cell was observed to be 1-3 inches of black material suspended in a layer of water near the bottom of the secondary cell and 4 liters of this material did not yield enough solids for the laboratory to conduct sludge sampling and therefore the amount of sludge present within the exfiltration cell is considered minimal. The effluent in the exfiltration cell will be left to exfiltrate into the ground. Once the base of the cell is dry, the exfiltration cell will be mixed on-site and the soil will be tested for standard parameters. If required, the soil will be mixed and the degradation of sludge will be monitored. The length of time for the remediation is not known at this time. The area of the former exfiltration cell will remain within the fenced lagoon area and will be available for future lagoon expansion if required. Remediation updates will be provided to Manitoba Sustainable Development quarterly. Soil testing and a remedial report will be provided to Manitoba Sustainable Development to review and approve before backfilling and seeding occurs.

The proposed lagoon upgrade has a 20 year design life. Nexom anticipates that biomass buildup in the SAGR system will occur when the system exceeds its design life; however, the rock may be excavated from the SAGR cells, washed and re-used, extending the life of the system for another 20 years and beyond as the components of the system are expected to last well over 40 years. After the 20 year design life, sludge removal may be required in cell 3 of the primary cell. These end-of-life maintenance activities as well as general on-going maintenance will ensure that the wastewater treatment system continues to function well after the 20 year design life. If additional treatment capacity is required beyond the 20 year design life, an additional SAGR unit can be added to the proposed system at a modest cost as no additional land is required. Given the ability to extend the life of the proposed system well past the 20 year design life, decommissioning of the proposed upgrade is not included within this EAP.

The proposed upgrade cannot proceed without significant external funding and if funding is not provided, the project will not be completed until sufficient external funding is secured.

2.19 Funding

Funding is being requested through the Investing in Canada Infrastructure Program. If approved, up to 40% of the project would be federally funded, up to 33.3% of the project would be provincially funded, and the remaining 27% would be the responsibility of the Municipality. Funding has not yet been secured.

2.20 Approvals, Licenses, Permits, Authorizations

The following approvals will be required for the proposed developments:

- **Manitoba Sustainable Development:** This Environmental Act Proposal is required to obtain approval from MSD and to obtain a new license for the operation of the Village of Glenboro Wastewater Treatment System.
- **Funding:** Funding has been requested through the Investing In Canada Infrastructure Program (ICIP). If funding approval is not received, the project will not be able to proceed as planned until sufficient funding is in place.

- **Manitoba Infrastructure:** Permits and agreements will be required by MIT to cross PTH 2.
- **Building Permits:** Building permits will be applied for after final design has been completed.

2.21 Public Consultation

The Village of Glenboro Treatment Lagoon Upgrade is managed by the Municipality of Glenboro-South Cypress Council. All of the discussions and decisions regarding the lagoon upgrade over the years havev been documented in the Council minutes. The Council minutes are published on the municipal website: http://www.glenboro.com/town-hall/ (2017 to current). The website has a contact form for comments.

The Council minutes are also reported in "The Baldur-Glenboro Gazette" which is a free newspaper published weekly which services the communities of Glenboro, Baldur, Wawanesa, Treesbank, Cypress River, Ninette, Belmont, and Glenora. The Baldur-Glenboro Gazette is also available on-line at http://www.baldur-glenborogazette.ca/. The website includes archived papers that are searchable by key words or dates.

Four examples of The Baldur-Glenboro Gazette included the following headlines:

- "Plans for Wastewater Lagoon Sent to Manitoba Conservation" dated February 19, 2016
- "Glenboro South Cypress Council Doing Study on Municipal Lagoon" dated August 19, 2016
- "Glenboro South Cypress Council Hire Engineer for New Lagoon" dated July 11, 2019
- "Glenboro South Cypress Support Federal Grant Applications" dated September 19, 2019

Several Lagoon upgrade options have been considered for this project and interested parties were contacted regarding these options. Several property owners were contacted regarding selling their land for the purpose of building a new lagoon and all refused. Manitoba Sustainable Development was able to confirm that provincially owned land within the area was protected as wildlife preserves and would not be available for lagoon development. The RM of Argyle approved the discharge of treated effluent into the Glenboro Marsh located within the RM of Argyle; however, Manitoba Sustainable Development requested that the effluent be discharged into a continuously flowing water body. The owner of the properties located adjacent the undeveloped right of ways near the proposed Assiniboine River outfall locations was contacted regarding the lagoon upgrades. It was explained that the force main could run through the undeveloped right of ways either to the west or to the north to the Assiniboine River. The owner specifically preferred that the force main run west towards the river to prevent disturbance of a hunting cabin located close to the northern route. This was incorporated into the development plan so that the outfall is located near 49°36'22.79"N Latitude and 99°18'58.53"W Longitude.

As part of a groundwater assessment completed by Samson, six residential sand points were tested and the home owners were asked to participate is a short survey. The survey included the two residences located adjacent the lagoon (NE 9-7-14 and SE 16-7-14 W), one in the center of Glenboro (200 Duncan), one at the eastern edge of

Glenboro (407 Cochrane), one southeast of Glenboro (SE 10-7-14), and one northeast of Glenboro (SW 14-7-14). The survey included asking if the residents had heard about the proposed lagoon upgrades. All surveyed had known about the lagoon requiring upgrades. Respondents were asked if they had any concerns about either the current or the proposed lagoon upgrades and none of the respondents had voiced any concerns.

An open house was conducted to determine if the public supported the construction of a new arena and how much financial support the public was willing to provide. The event had nothing to do with the lagoon upgrades; however, 17 respondents commented in writing, that the lagoon upgrades/sewer repairs were more important than a new arena.

3. EXISTING ENVIRONMENT

3.1 Prevailing Climate and Meteorological Conditions

Average monthly precipitation ranges from 81mm (3.2 inches) in June to 18mm (0.7 inches) in February. Rainfall during the growing season is usually not more than 330 mm (13 inches) with total annual precipitation averaging 460mm (18 inches). The mean effective growing season is approximately 155 days, with an average frost free period of approximately 124 days (Watershed Management Plan).

3.2 Geology, Hydrogeology and Topography of the Site

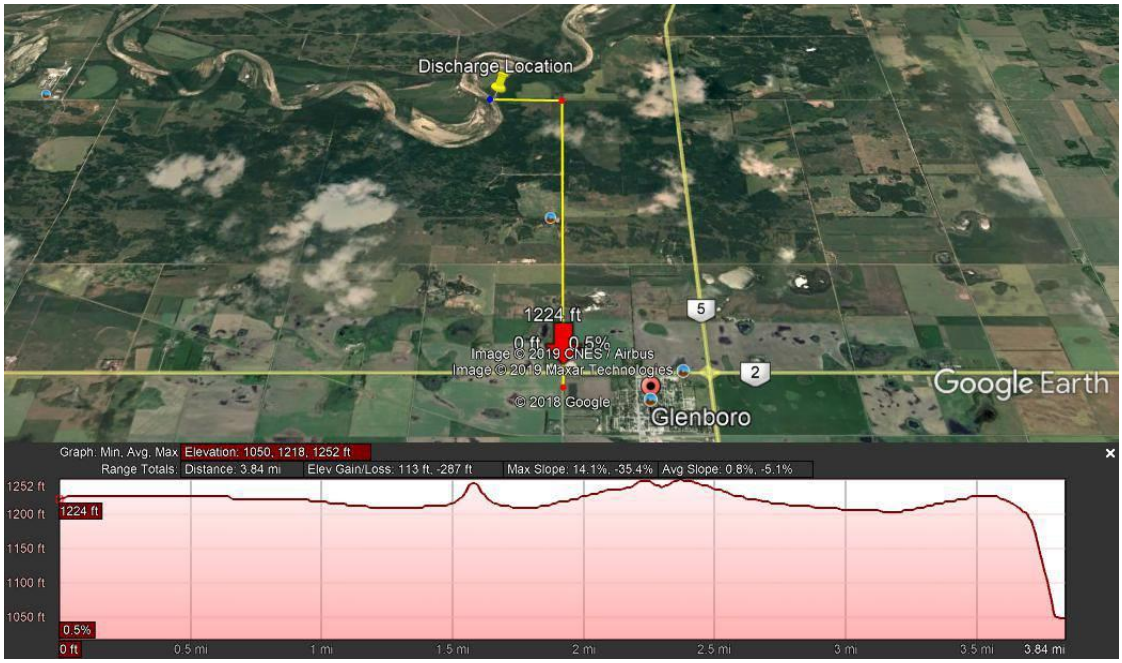
The Glenboro soils are developed on loam to clay loam lacustrine sediments. Glenboro soils consist of loamy sediments underlain by sand at depths below 0.7m. Agriculture capability is class 2M. Potential for environmental impact in the area of the lagoon is moderate. The areas north and east of Glenboro have a high potential for environmental impact.

Surficial geology in the area of the site includes proximal glaciofluvial sediments (Surficial Geology Compliation Map Series NTS 62G). Bedrock consists of a low permeability, soft clayey shale, approximately 300 m thick overlain by 5 to 10m of glacial till. Regional groundwater flow adjacent the lagoon is northerly towards the Assiniboine River (1985 Lagoon Hydrogeology Report).

The Central Assiniboine and Lower Souris River Integrated Watershed comprises of seven subwatersheds. The Glenboro Lagoon is located in the Epinette Creek sub-watershed. The Epinette Creek sub-watershed is located over the Assiniboine Delta Aquifer and has sandy soils. There are minimal waterway networks as most precipitation infiltrates. The Assiniboine Delta structure is the result of a very large glacial river depositing sediments into a large bay in Lake Agassiz. The aquifer body comprises mostly of sand and gravel. The saturated zone of the Assiniboine Delta Aquifer is approximately 21m in the Glenboro area. Arsenic and barium have been found above drinking water quality standards in some wells, particularly in deeper parts of the aquifer. Hardness, iron and manganese are common aesthetic water quality problems (The Central Assiniboine and Lower Souris River Intergraded Watershed Management Plan). Based on a 2019 survey conducted by Samson, residence in the area of the site obtain potable water from shallow sand points generally 4.5 to 17 feet below grade.

The Assiniboine River is a major tributary of the Lake Winnipeg Basin and has been listed as a vulnerable water body under the Nutrient Management Regulations under the Water Protection Act. The Assiniboine River is located approximately 4 km northwest of the lagoon site and will receive the treated effluent at approximately 49°36'22.79"N Latitude and 99°18'58.53"W Longitude. The river generally flows from west to east with several meanders. The lowest minimum daily flow recorded at the monitoring station closest to the outfall location (the Holland station) was 5.38m3/second on January 1 in 1969 and the greatest was 1,460m³/second in both 1976 and 1911. The yearly high and low daily flows recorded at the Holland station are summarized in Table 7.

According to Google Earth Pro, the elevation along the force main ranges from a low of 1204ft to a high of 1252 ft. The elevation at Mile Road 81W where the force main turns towards the river is approximately 1204ft, rising to 1227 at the edge of the agricultural crop land then decreasing towards the river. The elevation of the bank of the river is approximately 1215ft and the base of the Assiniboine River is at an elevation of 1050ft. The approximate elevations can be seen in the Google Earth image below.



3.3 Flora and Fauna

The Village of Glenboro is within the Stockton Ecodistrict, which is part of the Aspen Parkland Ecoregion. The Aspen Parkland Ecoregion is dominated by grasslands in dry areas, trembling aspen and shrubs in moist areas as well as areas with marshes and shallow open water. Wildlife found within the Aspen Parkland Ecoregion include white-tailed deer, snowshoe hare, cottontail rabbit, coyote, red fox, northern pocket gopher, ground squirrel and waterfowl.

Vegetation of the lagoon site is grass that is trimmed and maintained regularly. Adjacent land is agricultural crop land. Vegetation along the majority of the proposed force main is cut/harvested regularly. Oak trees are located along approximately 600m of the proposed force main as it approaches the Assiniboine River. Treed areas are located along the Assiniboine River.

The following fish species are known to inhabit the Assiniboine River:

Table 8: Assiniboine River Fish Species				
Bigmouth Buffalo	Carp	Golden Redhorse	Northern Pike	Spotfin Shiner
Bimouth Shiner	Central Mudminnow	Golden Shiner	Pearl Dace	Spottail Shiner
Black Bullhead	Channel Catfish	Goldeye	Quillback	Stonecat
Black Crappie	Chestnut Lamprey	Iowa Darter	River Darter	Tadpole Madtom
Blackchin Shiner	Common Shiner	Johnny Darter	River Shiner	Walleye
Blacknose Dace	Creek Chub	Lake Sturgeon	Rock Bass	White Sucker
Blacknose Shiner	Emerals Shiner	Logperch	Sand Shiner	Yellow Perch
Blacksided Darter	Fathead Minnow	Longnose Dace	Sauger	
Brook Stickleback	Finescale Dace	Mimic Shiner	Shorthead Redhorse	
Brown bullhead	Flathead Chub	Mooneye	Silver Chub	
Burbot	Freshwater Drum	Ninespine Stickleback	Silver Redhorse	

Fish spawning periods for fish in the Assiniboine River are from April 1 to June 15 for spring spawning fish such as Northern Pike, Walleye, Sauger, Yellow Perch, and Suckers and May 1 to June 30 for summer spawning fish such as Channel Catfish, Lake Sturgeon, Goldeye, Mooneye, and Freshwater Drum (Fisheries and Oceans Canada (DFO) Restricted Activity Timing Windows).

Spruce Woods Provincial Park is located approximately 7 km northeast of the outfall location and 11 km northeast of the lagoon site.

3.4 Rare, Threatened and Endangered Species

A search of Manitoba Conservation Data Centre's (CDC) rare species database was requested and a response was received on November 15, 2019 (included in Appendix B). The search included a 100m radius buffer of the lagoon site and force main as well as a 2 km radius buffer. The CDC provided an excel spreadsheet which included scientific and common names, provincial (SRank) ranks, Manitoba Endangered Species and Ecosystem Act (ESEA) designations, the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designations and Species at Risk Act (SARA) designations. The following occurrences were identified within 100m of the site:

3.4.1 Western Tiger Salamander

Reported Location: Within NW-007-14W1
Category: Vertebrate Animal
Scientific Name: Ambystoma mavortium
Common Name: Western Tiger Salamander
S Rank: S4S5
ESEA: NA
SARA: Special Concern
COSEQIC: Special Concern

Photo from *The Manitoba Herps Atlas*

The Barred Tiger Salamander (Ambystoma mavortium, is 33 cm in length, gray to ark olive green with darker stripes, bars or blotches with a lighter belly colour. Its habitat includes moist grasslands or woodlands near wetlands. They burrow below the frost line or use animal burrows to overwinter and may remain active throughout winter. They mate in early spring and the eggs are attached to submerged vegetation that hatch by late July. Larvae grow and develop for several years before they move to a terrestrial habit as adults. Some stay in larval form. The Western Tiger Salamander is threatened from habitat loss, fragmentation, fish stocking, emerging diseases, disruption of migration routes, morality through roadkill and deterioration and loss of breeding and upland habitat.

3.4.2 Plains Hognose Snake

Reported Location: Within 100 m of NE-16-007-14W1, SE-21-007-14W1
Category: Vertebrate Animal
Scientific Name: Heterodon nasicus
Common Name: Plains Hognose Snake
S Rank: S1S2
ESEA: Threatened
SARA: NA
COSEQIC: NA

Photo from *The Manitoba Herps Atlas*

A stout-bodied snake, generally less than 80 cm long. The body is light gray, brown or olive green with dark brown blotches or spots along the sides. The belly is mostly black. The rostrum, or "nose", is upturned like a pig's, giving this species its common name. They occupy grasslands or open woodlands in areas with loose, sandy soils. They overwinter below the frost line. Mating takes place in May and hatchlings emerge in late August or September. They can often be found along trails or roadways in early to mid morning or under logs, boards or other debris (The Manitoba Herps Atlas).

3.4.3 Red-headed Woodpecker

Reported Location: Within 100 m of SE-21-007-14W1
Category: Vertebrate Animal
Scientific Name: Melanerpes erythrocephalus
Common Name: Red-headed Woodpecker
S Rank: S3B
ESEA: Threatened
SARA: Threatened
COSEQIC: Threatened

Photo from All About Birds

The Red-headed Woodpecker is medium-sized with fairly large, rounded heads, short, stiff tails, and powerful, spike-like bills. Adults have bright-red heads, white underparts, and black backs with large white patches in the wings, making the lower back appear all white when perched. Immatures have gray-brown heads, and the white wing patches show rows of black spots near the trailing edge. Male and female have similar coloring. They live in pine savannahs and other open forests with clear understories. Open pine plantations, tree rows in agricultural areas, and standing timber in beaver swamps and wetlands attract Red-headed Woodpeckers (All About Birds).

3.4.4 Hairy Prairie-clover

Reported Location: Within 100 m SE-21-007-14W1
Category: Vascular Plant
Scientific Name: Dalea villosa
Common Name: Hairy Prairie-clover
S Rank: S2S3
ESEA: Threatened
SARA: Special Concern
COSEQIC: Special Concern

Photo from *Species at Risk Public Registry, Credit Guillermo Perez*

Hairy Prairie-clover is a member of the Fabaceae (pea) family. It is a perennial with a woody taproot, stem base and is a nitrogen-fixing legume that grows on sand dunes. In the United States, the species has been developed as a horticultural species. The greatest threats are dune stabilization, grazing and the spread of invasive species such as Leafy Spurge, Smooth Brome and Crested Wheatgrass and others introduced through hay for deer feed. All-terrain vehicles and hiking can crushed plants. Sand removal by humans results in a complete loss of habitat and presumably the seed bank (Species at Risk Public Registry).

Sand dune stabilization is not expected to occur during this project as the force main being installed in areas that contain sand dunes will be installed within previously developed right of ways and therefore the project is not expected to impact the Hairy Prairie-clover.

3.4.5 Green Milkweed

Reported Location: Within 100 m of SE-21-007-14W1
Category: Vascular Plant
Scientific Name: Asclepias viridiflora
Common Name: green milkweed, green comet milkweed and green-flower milkweed
S Rank: S3
ESEA: NA
SARA: NA
COSEQIC: NA

Photo from *Wildflower Org*

Green Comet Milkweed is a perennial with foot tall stems. Leaves are up to four inches long and are long and narrow leaves in dry sites and round in moist sites. Clusters of 20-80 pale green flowers occur in the upper leaf axils. The pods are pointed at both ends and are approximately four inches long. They grow in sunny, dry soil. They cause skin irritation in humans and are toxic to both humans and animals. They are important to bees (wildflower.org).

3.4.6 Northern Prairie Skink

Reported Location: Within 100 m of SE-21-007-14W1, SE-28-007-14W1
Category: Vertebrate Animal
Scientific Name: *Plestiodon septentrionalis*
Common Name: Northern Prairie Skink
S Rank: S1
ESEA: Endangered
SARA: Endangered
COSEQIC: Special Concern

Photo from *The Manitoba Herps Atlas*

The Northern Prairie Skink is a small, slender lizard, olive-brown or grayish in colour with alternating light and dark stripes running the length of its body. The belly is light grey. Adult skinks can grow to a length of about 20 cm. Juvenile skinks have bright blue tails. The blue colour fades as they reach adult size. During the breeding season adult males develop orange colouration on their heads and throats. Their habitat is sparse grasslands in areas of very sandy soils. They overwinter in burrows below the frost line in sandy soils. They mate in May or June with eggs usually hatching in early August. They can be found on south facing slopes in grassy habitats under cover (The Manitoba Herps Atlas).

3.4.7 Louisiana Broom-rape

Reported Location: Within 100m of SE-21-007-14W1
Category: Vascular Plant
Scientific Name: Orobanche ludoviciana
Common Name: Louisiana Broom-rape
S Rank: S2
ESEA: NA
SARA: NA
COSEQIC: NA

Photo from *Wildflower Org*

Louisiana Broom-rape is a thick single-stemmed, reddish-brown plant that is parasitic on the roots of other plants. typically species of Artemesia campestris. Leaves are 1 cm and ovate. Flowers are white-pink with purple tips and tubular shape. They grow in sandy grassland areas (Saskwildflower.ca).

3.4.8 American Bugseed

Reported Location: Within 100 m of SE-28-007-14W1
Category: Vascular Plant
Scientific Name: Corispermum americanum var. americanum
Common Name: American Bugseed
S Rank: S3
ESEA: NA
SARA: NA
COSEQIC: NA

Photo from *Lady Bird Johnson Wildflower Center*

The most common natural area containing Bugseed is sand dunes and lacustrine beaches. The most common anthropogenic modified habitat for bugseed was roadsides that cut into a stabilized sand dune.

3.4.9 Sharp-tailed Grouse

Reported Location: Within 100 m of NE-28-007-14W1
Category: Vertebrate Animal
Scientific Name: Tympanuchus phasianellus
Common Name: Sharp-tailed Grouse
S Rank: S5
ESEA: NA
SARA: NA
COSEQIC: NA

Left female, right male
Photos from All About Birds

The Sharp-tailed Grouse forage in grasslands, open fields, bogs, and forest or woodland (All About Birds).

3.5 Socioeconomic

The closest community to the site is the Village of Glenboro located approximately 365m west of the site. Other communities near the site include Stockton located 11 km northwest of the site and Cypress River located 15 km east of the site. The project's primary benefit is protecting Assiniboine Delta Aquifer which supplies drinking water to all of the residents in the area. Additional benefits include increased employment from temporary construction jobs and increased profitability of local businesses through the purchase of materials, supplies and services within the community.

The negative socioeconomic impact of the lagoon upgrade is the financial burden of the project on a very small community. The current lagoon is not causing off-site impacts (no E. coli or fecal coliforms have been identified in off-site monitoring wells) and yet the lagoon needs to be upgraded to protect the drinking water aquifer from potential future impact. The original cost estimates for construction ranged from 8.8 to 9.1 million dollars with the Water Services Board funding half. This left the Municipality paying for over 4.4 million dollars in construction costs as well as an estimated 2 million in operational costs. The current population of the Village of Glenboro is 656 people. The lagoon upgrade would cost a family of four approximately $42,700 on top of their current tax requirements. Looking for alternatives, the Municipality requested options from Samson. The current lagoon upgrade proposal re-uses the primary cell, including the bentonite modified liner. The bentonite modified liner does not meet the Manitoba Sustainable Development objectives for thickness but has a penetration rate of an estimated 20.1 to 38.5 years as compared to a liner meeting Manitoba's design objectives having an estimated penetration rate of 31.7 years. By using the primary cell's current liner, the proposed upgrade costs are reduced by approximately 2 million dollars on this one component alone and an estimated volume of 33,000m^3 of untreated sewage is prevented from entering the environment during construction. The current proposed upgrade has a cost estimate of 4.5 million dollars (5.5 million including services not included in the JRCC estimates such as sewer repair). The Water Services Board is unable to fund the project because they had retained a company to complete the work and could not provide funding for a project proposed by a company other than the one they retained. The Water Services Board suggested that the contract be broken and that the Municipality apply for funding with ICIP. Funding has been requested by ICIP and, if approved, would result in just over 4 million dollars of construction costs being funded by ICIP and 1.6 million dollars of construction costs being the responsibility of the Municipality. The Municipality will still have to pay for increases in operational costs and therefore the proposed upgrade is still a significant tax burden to the community, averaging nearly $22,000 for a family of four. Actual details regarding how the cost of the project will be distributed between the tax payers has not been determined and as such, the estimates used here are overly simplified (rounded construction and operational costs / population x 4) and do not represent actual tax amounts as they have not included interest charges, property assessments, school taxes/fees or other factors influencing tax rates and are provided for comparison purposes only.

3.6 Natural Resources

The majority of the site is surrounded by agricultural crop land.

The property at SE 33-7-14W has a conservation agreement with Manitoba Sustainable Development. This property is located adjacent and north of the proposed force main. The owner of this property was contacted about the proposed development and the force main route to the Assiniboine River which could turn west or continue north along the property located at SE 33-7-14W. The owner indicated that he preferred that the force main run west towards the river as the area to the north was used for hunting.

Tourism and recreation within the area of the site includes several opportunities within the Village of Glenboro. The Glenboro Golf and Country Club is located along the force main in SE21-7-14W. Spruce Woods Provincial Park is located approximately 7 km northeast of the outfall location and 11 km northeast of the lagoon site.

There is no forestry, mining, hydroelectric production or oil and gas developments in the area of the site.

3.7 Protected Areas

The property at SE 33-7-14W has a conservation agreement with Manitoba Sustainable Development. This property is located adjacent and north of the proposed force main. The owner of this property was contacted about the proposed development and the force main route to the Assiniboine River which could turn west or continue north along the property located at SE 33-7-14W. The owner indicated that he preferred that the force main run west towards the river as the area to the north was used for hunting.

A protected Wildlife Management Area is located at the crown land located at SE29-7-14W which is approximately 1.2 km southwest of the outfall and approximately 3 km northwest of the lagoon site.

Spruce Woods Provincial Park is located approximately 7 km northeast of the outfall location and 11 km northeast of the lagoon site.

3.8 Heritage Resources

A search of historic sites of Manitoba was conducted on the Manitoba Historical Society web page. A search with the key word “Glenboro” identified 56 results. The location of each result was identified. Historic sites located near the proposed project include the Glenboro Water Tower, the Burrough of the Gleann Museum, Glenboro School, Glenboro War Memorial, Sara the Camel, St. Stepen’s Anglican and Glenboro United Church which are located within the Village of Glenboro approximately 0.8 to 1.1 km east of the proposed project. The Glenboro Cemetery is located approximately 2.8km southwest of the site in NW 33-6-14W in the RM of Argyle.

No nationally designated sites were identified near the proposed project. Only one provincially designated site was located near the site, the Glenboro Water Tower, located approximately 0.9 km southeast of the lagoon site.

The proposed project is not expected to impact heritage sites or resources and therefore a heritage resource impact assessment is not required. If potential historic or heritage resources are discovered in the course of excavation, excavation activities will temporarily stop and the Manitoba Historic Resources Branch will be contacted for advice.

3.9 Identification of Indigenous Communities

There are no identified indigenous communities in the vicinity of the proposed development. The closest indigenous communities are the Swan Lake Indian Reserve No 7A located approximately 19 km north of the site and the Swan Lake Indian Reserve No. 7 located approximately 32 km southeast of the site.

The proposed project is not expected to impact Indigenous Communities.

4. ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATION

The assessment of potential environmental impacts considers the interactions between the proposed development and the environment and includes the site as well as components of the environment in the area of the site that may be affected or influenced by the proposed project during planning, construction and operation of the project. A time period of 20 years has been considered for the operation of the proposed development. Potential impacts to air, land, vegetation, wildlife, surface water, groundwater, fisheries, noise, and invasive species have been identified and the potential impacts have been assessed considering the likelihood of the impact, the nature of the effect, the magnitude of the effect, the duration of the effect, the frequency of occurrence, geographical extent and reversibility. Adverse environmental impacts are to be avoided or minimized through project design and utilizing good construction practices. Mitigation measures will include, at minimum, complying with license requirements, applicable health and safety rules and regulations, and following industry pest practices. The following sections describe the potential environmental impacts of the project and specific mitigation measures to reduce or eliminate environmental impacts.

4.1 Air

Potential environmental impacts to air from the proposed development include the following:

- Dust from moving vehicles and earthworks during construction and operation may occur in dry conditions in high wind events for short durations. Mitigation measures include:
    - Cover stockpiles or spray with water to prevent airborne dust.
    - Temporarily suspended earthworks or spray the area with water during high wind events if dust is observed to be an issue.
    - Revegetate exposed soil that is at a high risk for erosion, such as the primary cell berms

After mitigation, adverse effects on air quality from dust are expected to be insignificant.

- Noise from equipment operation and material handling is expected during construction. Sound levels associated with heavy construction equipment range

from 79 to 90 dB(A) within 5 m of the source. The contribution of construction noise will be a short-term impact and will be limited to regular working hours. Mitigation measures include:

- Inspections of vehicles and equipment will be conducted at the beginning of each day and periodically throughout the day to ensure they are in good working condition
- Unnecessarily idling will be avoided.

After mitigation, adverse effects on air quality from noise are expected to be insignificant.

- Odours associated with sewage can be unpleasant. Any odours produced as part of the construction phase are expected to be minor in magnitude and of short duration. Odours from the operation of a lagoon are typically caused by anaerobic conditions. The proposed project design includes the addition of aeration to the primary cell which will decrease odours produced by the lagoon operation as compared to current lagoon operations. Mitigation measures to reduce odours further include:
  - Adjusting the oxygen levels in the primary cell as required to ensure that the lagoon has sufficient oxygen for aerobic decomposition.
  - Maintain set back distances with regards to new developments in the area of the lagoon.

After mitigation, odours are expected to decrease and as such the residual effects are considered to be positive in nature.

- Greenhouse gases, particulates, and chemicals from vehicle and equipment exhaust are expected in the construction and operation phases; however, the concentrations are minor and the duration is short term. Mitigation will include:
  - Equipment will be fitted with standard air emission control devices.
  - vehicle inspections will be conducted at the beginning of each day and periodically throughout the day to ensure vehicles and equipment are in good working condition.
  - Avoid unnecessarily idling.

After mitigation, the adverse effects on air quality are expected to be minor and insignificant.

- The lagoon services a small population and is not a significant source of greenhouse gas emissions. Greenhouse gases from the new lagoon are expected to be similar in nature and magnitude as what has occurred in the past and is not changing significantly.

Construction and operations of the new lagoon will be conducted within limits set by Workplace Health and Safety regulations. The overall negative effects of the project on air quality are considered to be minor.

4.2 Land

Potential environmental impacts to land from the proposed development include the following:

- Disturbed areas are subject to erosion during the construction phase of the project. Mitigation measures include:
    - Use of natural or existing clearings for vehicles and equipment when possible.
    - Encourage natural regeneration of disturbed sites by reusing original topsoil with intact roots and seed bed or re-vegetate with seed or sod.
    - Install force main via plow method or directional drilling to reduce impacts.

After mitigation, the potential adverse effects of erosion are considered minor.

- Disturbed areas are subject to invasive species such as Leafy spurge. Mitigation measures include:
    - Cleaning and inspection of equipment prior to bringing it to site to reduce the likelihood of seed transfer to disturbed areas.
    - Use of natural or existing clearings for vehicles and equipment when possible.
    - Encourage natural regeneration of disturbed sites by reusing original topsoil with intact roots and seed bed or re-vegetate with seed or sod.
    - Install force main via plow method or directional drilling to reduce soil disturbance as compared to excavating.

After mitigation, the potential adverse effect of invasive species is considered minor.

- Petroleum hydrocarbons leaks from equipment failure or accidents may occur during construction and operation phases of the project. No on-site petroleum hydrocarbon storage is expected, and as such, any leaks or accidents would be small in magnitude. Mitigation measures will include:
    - Equipment will be inspected daily to ensure proper maintenance to prevent leaks and spills of fuels, lubricants, hydraulic fluids or coolants.
    - Drip-trays will be used where appropriate.
    - At least one personnel on-site will be trained in leak/spill prevention and clean up including the use of spill response management forms.
    - A spill kit will be located on-site and will include sorbent material and an empty barrel for spill collection and disposal.
    - If a leak or spill occurs, provincial guidelines will be followed for clean-up and reporting.
    - On-site storage of hazardous materials is not expected; however if required, the materials will be stored in approved containers away from sensitive areas.

After mitigation, the potential adverse effect of petroleum hydrocarbon leaks or spills is considered minor.

- Compaction of soils can occur during construction, particularly soils being harvested by farmers along the force main. Mitigation measures will include:
    - Using temporary access areas to avoid unnecessary compaction of soils.
    - Avoid driving and parking in adjacent agricultural fields.

After mitigation, the potential adverse effects of soil compaction is considered minor.

- The primary cell has minimal sludge buildup and does not appear to require removal. If removal is required, land application will comply with the requirements of Manitoba Regulation 62/2008 respecting nutrient management.

No adverse long-term effects regarding land use are anticipated as a result of the project.

4.3 Vegetation

The force main will be installed primarily along municipal right of ways, the majority of which are previously disturbed land that is regularly harvested by farmers. A length of approximately 600 m of force main will be installed in an undeveloped right of way that contains trees (mostly oak) along the edges of the right of way. This portion of the right of way has agricultural crop land on either side of the right of way. A length of approximately 200 m of force main will be installed in a treed area that leads to the river bank. A maintenance pad will be constructed back from the river bank and the pipe will be directionally drilled to the river. Potential environmental effects to vegetation from the proposed development include the following:

- Damaging and removing vegetation with vehicles and equipment during construction activities is expected. Mitigation measures will include:
  - Use of natural or existing clearings for vehicles and equipment when possible
  - Avoid driving and parking in adjacent agricultural fields.
  - Preserve excavated overburden in stockpiles for use in site remediation.
  - Encourage natural regeneration of disturbed sites by reusing original topsoil with intact roots and seed bed or re-vegetate with seed or sod.
  - Install force main via plow method or directional drilling to reduce impacts.
  - Some oak trees and/or branches may need to be removed for equipment access and force main installation. The path of the force main will be selected based on minimizing the need for tree and branch removal.

After mitigation, the potential adverse effects of the project on vegetation is considered minor.

- There is a very low possibility of fire during construction and operation which could destroy vegetation. Mitigation measures will include:
  - Ensure appropriate firefighting equipment is on-site and is serviceable.

After mitigation, the risk of fire effecting vegetation is considered unlikely.

- Petroleum hydrocarbons leaks from equipment failure or accidents may occurs during construction and operation phases of the project. No on-site petroleum hydrocarbon storage is expected, and as such, any leaks or accidents would be small in magnitude. Mitigation measures will include:
  - Equipment will be inspected daily to ensure proper maintenance to prevent leaks and spills of fuels, lubricants, hydraulic fluids or coolants.
  - Drip-trays will be used where appropriate.
  - At least one personnel on-site will be trained in leak/spill prevention and clean up including the use of spill response management forms.
  - A spill kit will be located on-site and will include sorbent material and an empty barrel for spill collection and disposal.

- If a leak or spill occurs, provincial guidelines will be followed for clean-up and reporting.
- On-site storage of hazardous materials is not expected; however if required, the materials will be stored in approved containers away from sensitive areas.

After mitigation, the potential adverse effect of petroleum hydrocarbon leaks or spills is considered minor.

No adverse long-term effects to vegetation are anticipated as a result of the project.

4.4 Wildlife

The main lagoon site is located within a fence area that is not expected to contain wildlife with the possible exception of birds. The installation of the 10 cm diameter HDPE force main within right of ways will cause disturbances that may affect wildlife by vehicles, tilling soil, noise or directional drilling. According to the "Recommended Development Setback Distances from Birds" issued by Manitoba conservation Data Centre dated June 24, 2015, the disturbance caused by pipeline construction of less than 1 foot in diameter is considered a medium disturbance. Construction of a small maintenance pad that is 5 to 6m^2 in size (final design has not been completed) would be considered to be medium to high disturbance for a short period of time. Given that the majority of the force main will be installed along developed right of ways that are being harvested, the impact to wildlife in these areas is expected to be similar to normal seasonal disturbance caused by farming. The only area where the risk of adverse effects are greater than normal is the treed area near the Assiniboine River which consist of approximately 200m of force main and a small maintenance pad. The Potential environmental effects are as follows:

- Noise and vibration can disturb animals, particularly breading animals and birds. Earth works can destroy habitat. Potential mitigation measures are as follows:
  - When possible, schedule project activities outside of the breeding season. Based on the rare and/or engendered species identified in the area of the site, the force main should not be installed between April 1 and June 30.
  - The work area will be scouted for signs of rare species prior to land disturbance. If signs of rare species are observed, work will stop until the appropriate mitigation is determined which may include avoidance, relocation or habitat compensation.

After mitigation, no adverse long-term effects to wildlife are anticipated as a result of the project.

4.5 Surface and Groundwater

The driving force for the proposed lagoon upgrade is to protect the Assiniboine Delta Aquifer from potential future impacts. The project has been designed to treat effluent to meet discharge standards and to deposit the effluent into the Assiniboine River instead of exfiltrating the effluent into the ground. Potential environmental effects to surface and groundwater from the proposed development include the following:

- Nutrient Reduction into the Assiniboine Delta Aquifer – Partly treated effluent will no longer be exfiltrated into the Assiniboine Delta Aquifer which is potable water used by the Municipality. This will prevent E. coli, fecal coliform, BOD, TSS,

phosphorus, ammonium and other nutrients from entering the aquifer on site. This is a positive affect and does not require mitigation.

- Nutrient deposits into the Assiniboine River – Treated effluent, that meets discharge criteria that is protective of aquatic life, will be discharged into the Assiniboine River which will result in low concentrations of nutrients that, by themselves are not expected to harm aquatic life but that can contribute to a higher concentration of nutrients in the river due to the cumulative affects with other projects. The Assiniboine River has been listed as a vulnerable water body under the Nutrient Management Regulations under the Water Protection Act. The Central Assiniboine and Lower Souris River Intergraded Watershed Management Plan recommends reducing nutrient discharges to the Assiniboine River from municipal wastewater treatment systems by utilizing wetlands to reduce nutrient loads to the Assiniboine River; however, Manitoba Sustainable Development has requested that the effluent be discharged to a continuously flowing water body, the closest being the Assiniboine River. Given the circumstances, discharging to the Assiniboine River is the only cost effective option available. The volume of treated effluent entering the Assiniboine River from the proposed development is small (less than 300m³/day) and therefore, the cumulative effect of nutrient accumulation in the Assiniboine River is considered minor and acceptable.
- Flooding – Manitoba Sustainable Development was concerned about potential flooding if effluent was discharged to the Glenboro Marsh and as such mitigation measures included changing the discharge location to the Assiniboine River. The 20 year expected discharge from the lagoon would be 0.0002% of the greatest daily flow ever recorded and therefore would be an insignificant addition with regards to flooding. No mitigation measures are required.
- Changing the flow patterns of the Assiniboine River during low flow events - The minimum daily flow recorded at the monitoring station closest to the outfall location (Holland station) was 5.38 m³/second on January 1 in 1969. This equates to 464,832 m³/day. The estimated 20 year discharge expected from the Glenboro Lagoon is approximately 300 m³/day which is 0.06% of the volume of the lowest daily flow ever recorded therefore the contribution is insignificant to the flow of the Assiniboine River. Potential changes in flow patterns due to erosion and sedimentation are discussed below. The potential adverse effect is considered minor.
- Slope destabilization, slope erosion and sedimentation of the Assiniboine River – Earth works such as the installation of the force main can lead to erosion, slope destabilization and sedimentation of the river. Mitigation measures include:
    - The use of directional drilling to minimize earth works close to the river.
    - Placing the outfall in the river such that erosion is minimized – exact location and design will be determined during the final design of the outfall.
    - Sediment fencing to be used for work proceeding near the river.
    - Avoiding any unnecessary work near the river.

After mitigation, the potential adverse effect is considered minor.

- Petroleum hydrocarbons leaks from equipment failure or accidents may occurs during construction and operation phases of the project. No on-site petroleum hydrocarbon storage is expected, and as such, any leaks or accidents would be small in magnitude. Mitigation measures will include:
    - Equipment will be inspected daily to ensure proper maintenance to prevent leaks and spills of fuels, lubricants, hydraulic fluids or coolants.

- Drip-trays will be used where appropriate.
- At least one personnel on-site will be trained in leak/spill prevention and clean up including the use of spill response management forms.
- A spill kit will be located on-site and will include sorbent material and an empty barrel for spill collection and disposal.
- If a leak or spill occurs, provincial guidelines will be followed for clean-up and reporting.
- On-site storage of hazardous materials is not expected; however if required, the materials will be stored in approved containers on the lagoon site, away from the river and sensitive areas.

After mitigation, the potential adverse effect is considered minor.

The net long-term effects of the project on water resources are anticipated to be positive as effluent will no longer be exfiltrated into the potable water aquifer.

4.6 Fisheries

Fish and fish habitat can be effected by water quality, sedimentation, noise and vibration and as such, the mitigation measures provided for the protection of surface water and noise are applicable to the protection of fish and fish habitat. Additionally, the outfall should not be constructed between April and June to avoid disturbing fish spawning.

The effluent will be compliant with license conditions and the Manitoba Water Quality Standards, Objectives and Guidelines that set limitations on parameters to ensure the health of aquatic ecosystems. The preliminary design takes into consideration that unionized ammonia can be toxic to fish and has a design objective for unionized ammonia of less than 0.2 mg/L and a design objective for total ammonia to be less than 1 mg/L in summer and less than 5 mg/L in winter.

No adverse long-term effects regarding fish and fish habitat are anticipated as a result of the project.

4.7 Noise

Elevated ambient noise levels will occur near the project site during construction. The contribution of construction noise will be a short-term impact and will be limited to regular working hours. Noise can bother people and wildlife. Sound levels associated with heavy construction equipment range from 79 to 90 dB(A) within 5 m of the source. Potential environmental effects due to noise from the proposed development include the following:

- Construction activities will create noise and vibration that can disturb wildlife, including nesting birds. Noise can also be a nuisance to people. Mitigation measures include:
  - The force main will not be installed during mating seasons of rare or endangered species. Based on the species identified in the area of the site, construction of the force main will not occur between April and June.
  - Equipment and vehicles will be inspected daily to ensure that it is in good working order and is properly maintained throughout project.
  - Equipment will be fitted with standard air emission control devices.
  - Unnecessary idling of vehicles and machinery will be avoided.

Noise impacts are anticipated to be minor and temporary. No adverse long-term effects regarding noise is anticipated as a result of the project.

4.8 Invasive Species

Leafy spurge is a long-lived, hardy plant that is a noxious weed in Manitoba. Leafy spurge can be found in pastures, agricultural lands, roadsides, ditches, and riparian areas. In Manitoba, it does best in sandy soils of moderate moisture and takes advantage of disturbed sites (Watershed Management Plan). Mitigation measures against invasive species include:

- Cleaning and inspection of equipment prior to bringing it to site to reduce the likelihood of seed transfer to disturbed areas.
- Use of natural or existing clearings for vehicles and equipment when possible.
- Preserve excavated overburden in stockpiles for use in site remediation.
- Encourage natural regeneration of disturbed sites by reusing original topsoil with intact roots and seed bed or re-vegetate with seed or sod.
- Install the force main via plow method or directional drilling to reduce impacts as compared to other excavation methods.

No adverse long-term effects regarding invasive species are anticipated as a result of the project.

5. HUMAN HEALTH EFFECTS

The perimeter fence will be expanded to the north so that SAGR cells are located within the fenced lagoon site. The lagoon site will be protected from unauthorized persons through the use of the lockable perimeter fence. Prior to construction activity, site specific health and safety protocols will be developed. All people on-site will be trained to conduct their specific tasks and Workplace Health and Safety regulations will be followed.

Site construction activities will proceed with industry best practices. Tailgate health and safety meetings will occur daily and will include inspecting equipment daily for leaks and maintenance. On-site storage of gasoline is not expected during the construction or operation of the lagoon. Alum will be stored in a drum within the blower building.

The proposed lagoon development will operate in accordance to the updated Environmental Act Licence and as such, human impacts related from effluent discharges are not expected. Groundwater monitoring wells located near the lagoon are tested regularly and the results are provided to Manitoba Sustainable Development. The current lagoon has not caused any known off-site fecal contamination and once the new proposed lagoon is operational, effluent will no longer be exfiltrated into the groundwater. Groundwater monitoring wells will continue to be tested regularly as per license requirements.

6. RESIDUAL AND CUMULATIVE EFFECTS

The significance of residual environmental effects are assessed based on the likelihood of the effect happening and the nature, magnitude, duration, geographical extent and reversibility of the effect. Following mitigation measures, the majority of potential negative environmental effects of the proposed development are not likely to occur and if they did occur, the effects would be small in magnitude, duration and geographical extent as well as being reversible.

The overall effect of the proposed Village of Glenboro Lagoon Upgrade is that lagoon effluent will no longer be exfiltrated into the potable groundwater aquifer. Conversely, the treated effluent will be deposited into the Assiniboine River. The treated effluent will meet discharge criteria protective of aquatic life; however, residual concentrations of nutrients that, by themselves are not expected to harm aquatic life, can contribute to a higher concentration of nutrients in the river due to the cumulative affects with other projects. The Assiniboine River has been listed as a vulnerable water body under the Nutrient Management Regulations under the Water Protection Act. The Central Assiniboine and Lower Souris River Intergraded Watershed Management Plan recommends reducing nutrient discharges to the Assiniboine River from municipal wastewater treatment systems by utilizing wetlands to reduce nutrient loads to the Assiniboine River. Discharging effluent to the Glenboro Marsh was assessed as part of this EAP; however, Manitoba Sustainable Development requested that the effluent be discharged to a continuously flowing water body, the closest being the Assiniboine River. Given the circumstances, discharging to the Assiniboine River is the only cost effective option available. The volume of treated effluent entering the Assiniboine River is very small (less than 300 m3/day) and therefore the cumulative effect of nutrient accumulation in the Assiniboine River is considered minor and acceptable.

No other negative long term residual or cumulative effects are expected as a part of the proposed development.

7. MONITORING AND FOLLOW-UP PLANS

Construction activities will be monitored by Samson to ensure that the project proceeds as planned and that mitigation measures are being followed. Once commissioned, a level 2 operator will be responsible for insuring that the lagoon is operating within the provisions of the Environment Act License. The operator will be responsible for inspecting equipment daily, monitoring flows and effluent parameter, sampling effluent and submitting sample reports to Manitoba Sustainable Development. If the effluent does not meet the Environment Act Licence, the additional mitigation measure may be required. As an example, if E. coli concentrations exceed the license requirements, disinfection can be added to the proposed development.

8. CONCLUSIONS

The proposed Village of Glenboro Wastewater Treatment Lagoon Upgrade will treat wastewater effectively through the addition of aeration and the use of two SAGR cells. As requested by Manitoba Sustainable Development, the proposed lagoon will stop exfiltrating effluent into the on-site groundwater and treated effluent will be discharged into a continuous flowing water body, the Assiniboine River. Based on the design of the proposed project and the implementation of mitigation measures, no significant negative environmental impacts are anticipated.

9. REPORT LIMITATIONS

This report is based on the information collected by Samson in good faith with the assumption that the information is correct or to the best of their knowledge. Samson accepts no responsibility for any inaccurate information in this report as a result of omissions or misinterpretations of information that was provided by persons interviewed or contacted. Work was conducted in accordance with generally accepted best practices and principles. The assessment is intended to reduce but not wholly eliminate the uncertainty regarding potential environmental concerns and recognizes reasonable limitations with regards to time, scope of

work and cost. Environmental conditions may change from the date of the report. Unless otherwise noted within the report, Samson renounces any obligations to update this report with information that becomes available after the time during which Samson conducted the assessment.

This report has been prepared exclusively for the Municipality of Glenboro-South Cypress. Should this report be used by a third party, any reliance or decisions made based on this report shall be the responsibility of the third party. Written authorization from Samson will be required should an additional party require reliance upon this report. Samson makes no representation concerning the legal significance of the findings or the information contained within this report.

10. REFERENCES

- Clean Environment Commission Order 1023 VC, prepared by the Clean Environment Commission Under the Clean Environment Act, dated August 25, 1986
- Feasibility Study for the Glenboro Lagoon Expansion prepared by J R Cousin Consultants Ltd. (JRCC) prepared for the Municipality of Glenboro South Cypress, dated September 2017
- Feasibility Study Update prepared by Samson Engineering Inc. for the Municipality of Glenboro-South Cypress, dated November 29, 2019
- Government of Canada, Species at Risk Act (SARA)
- Government of Canada. Canadian Wildlife Species at Risk. Committee on the Status of Endangered Wildlife in Canada (SOSEWIC). Canadian Wildlife Service, environment Canada. http://www.cosewic.gc.ca/eng/sct5/index_e.cfm
- Groundwater Quality Assessment, Village of Glenboro-South Cypress Lagoon, prepared by Samson Engineering Inc. for the Municipality of Glenboro-South Cypress , dated September 17, 2019
- Hydrogeology in the Vicinity of the Village of Glenboro Sewage Lagoon System, prepared by the Province of Manitoba Department of Natural Resources Water Resources Branch, dated January 1985
- Letter titled "File No. 178.20 Environment Act Licence No. 1023 VC" prepared by Manitoba Sustainable development, to the Municipality of Glenboro South Cypress, dated May 29, 2019
- Manitoba Historical Society, Historic Sites of Manitoba, 2019, http://www.mhs.mb.ca/docs/sites/index.shtml
- Manitoba Sustainable Development
- Municipality of Glenboro-South Cypress
- Nexom Proposal for Design, Supply and Installation of OPTAER Wastewater Treatment System prepared by Nexom for Samson Engineering Inc., July 17, 2019
- Preliminary Design of Lagoon Upgrades, Glenboro, Manitoba, Geotechnical Investigation and Assessment - Final prepared by KGS Group Consulting Engineers (KGS), For Samson Engineering Inc., dated August 16, 2019
- Rarity Status Assessments of Bugseeds (Amaranthaceae: Corispermum) in Manitoba by Diana Bizecki Robson 2011, Canadian Field-Naturalist 125(4): 338-352. The Manitoba Museum. file:///C:/Users/Owner/Downloads/1262-5006-2-PB.pdf
- Recommended Development Setback Distances from Birds" issued by Manitoba conservation Data Centre dated June 24, 2015

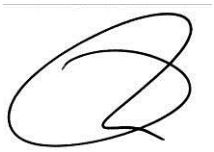
- Resolution #2019-160, prepared by the Municipality of Glenboro South Cypress, dated August 14, 2019
- The Atlas of the Breeding Birds of Manitoba, 2010-2014. Bird Studies Canada. Winnipeg, Manitoba http://www.birdatlas.mb.ca/accounts/speciesaccount.jsp?sp=BCNH&lang=en [25 Sep 2019]
- The Central Assiniboine and Lower Souris River Integrated Watershed Management Plan. https://www.gov.mb.ca/sd/water/watershed/iwmp/central_assiniboine/documentation/central_assiniboine_mngt.pdf
- The Manitoba Herps Atlas, http://www.naturenorth.com/Herps/MHA_Salamanders.html
- Topographic Survey of Part of NW1/4 SEC. 10-7-14 WPM being Parcel 2 Plan No. 1136 (C. Div.) and Lot Plan No. 53101, Municipality of Glenboro-South Cypress, Manitoba" prepared by Prairie Benchmark Land Surreys, For Samson Engineering Inc., dated 2019
- Lady Bird Johnson Wildflower Center, Plant Database, https://www.wildflower.org/plants/result.php?id_plant=COAM8
- Village of Glenboro Subdivision Feasibility Study, Final Report, prepared by Genivar, dated December 2011

11. CLOSURE

We trust that this report meets your requirements. If you have any questions or comments, please feel free to contact our office.

Yours very truly,
Samson Engineering Inc.

Joanne Lanoie, B.Sc., M.Sc.
Senior Project Manager - Environmental



Phil Dorn, P. Eng.
Owner