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December 22, 2021

Director, Environmental Approvals Branch
Manitoba Conservation and Climate
1007 Century Street
Winnipeg, MB R3H 0W4

Reference: File No: 5890.00
EAP Notice of Alteration
Meadowbrook Village, RM of Cornwallis, MB

Dear Director,

Burns Maendel Consulting Engineers Ltd. is pleased to submit this revision to the Environment Act Proposal for the proposed Domestic Wastewater Lagoon in the Municipality of Cornwallis on behalf of Meadowbrook Village and the RM of Cornwallis. This Domestic Wastewater Lagoon will be constructed in two phases to accommodate the growing needs of Meadowbrook Village as well as the population of Chater. The final lagoon will be sized to treat wastewater from a design population of 1023 people.

BMCE requests item 24 (f) of the Environmental Act License be changed to allow effluent to be discharged between the 1st day of May and the 1st day of November. As well as item 27 changed to allow spray irrigation to occur between the 1st day of May and the 15th day of October. We understand that the discharge dates are set due to fish spawning but the discharge from the Meadowbrook Lagoon will not be discharged into spawning waterways and BMCE does not foresee this being an issue.

All of the information relating to the Environmental Act Proposal has been compiled in the [redacted]) electronic copy of this revision has been issued. If you have [redacted], please don't hesitate to contact the undersigned.

[redacted]

[redacted]

Cc: Don Sawatsky, Sawatsky Group
Donna Anderson, RM of Cornwallis
/enclosed

Director, Environmental Approvals Branch
Manitoba Conservation and Water Stewardship
Suite 160, 123 Main Street
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Environmental Act Proposal – NOA

Domestic Wastewater Lagoon
Meadowbrook Village, MB

Submitted by:

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On behalf of:

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Executive Summary

Meadowbrook Village (formerly known as Campbell's Mobile Home Park) is planning to expand the mobile home park in a phased manner in the Rural Municipality of Cornwallis, approximately 6 km east of Brandon, Manitoba. All proposed phases of expansion will be on property owned by Meadowbrook Village. The mobile home park is located in the southeast quarter of 33-10-18 WPM. Surrounding Meadowbrook Village is currently cultivated farm land to the north, Glen Lea Golf Course to the west and south, and privately owned residences to the east. Meadowbrook Village has retained Burns Maendel Consulting Engineers Ltd. (BMCE) for engineering services regarding the expansion and necessary upgrades required to accommodate the increased population.

The original park was constructed in the 1970's along with the existing wastewater treatment lagoon located on the northeast quarter of 33-10-18 WPM. Since its construction, the park has grown in size and overloaded the existing lagoon. Meadowbrook Village will require a new wastewater treatment facility to manage their current wastewater effluent, as well as additional effluent produced from the proposed expansions. After discussion with the RM of Cornwallis and Meadowbrook Village the lagoon will also have the capacity to hold the wastewater effluent of the neighbouring community of Chater after future sewer network development. Due to the site conditions as well as the isolation of the site, BMCE is proposing a new domestic wastewater lagoon be built adjacent to the existing lagoon. BMCE is responsible for the design of the wastewater treatment lagoon, as well as the generation of this corresponding EAP. BMCE is proposing a new three-cell remoulded clay-lined lagoon be constructed north of the existing lagoon on NE 33-10-18 WPM. The primary cell will have a volume of 17,269 m^3 and the secondary cells will have a volume of 51,035 m^3 and 15,003 m^3. The first secondary cell has been sized to accommodate the existing mobile home park and the future population of Chater as well as phase 1 and 2 of the four proposed expansion phases. The second secondary cell will be constructed prior to the development of phase 3 of the expansion which is anticipated to occur within the next eight years. Once all three cells have been completed, the combined total active storage will be 74,673 m^3.

The proposed discharge location for the lagoon is into a natural drainage ditch south of the lagoon which discharges to irrigation reservoirs in Glen Lea Golf Course. The golf course currently uses discharge from the existing lagoon for irrigation purposes. Meadowbrook Village and Glen Lea Golf Course hold a caveat to discharge the lagoon to this location, which is in the process of being updated. No significant adverse impact on human health or the environment is anticipated to result from the proposed construction, operation of the lagoon, or wastewater irrigation, as will be elaborated on within the Environmental Act Proposal.

The construction of the licensed facility is currently under construction therefore we request immediate review of the NOA to expand the facility to include loading from Chater.

Standard Limitations

This report was prepared by Burns Maendel Consulting Engineers Ltd. (BMCE) for the account of Meadowbrook Village (the Client). The disclosure of any information contained in this report is the sole responsibility of the Client. The material in this report reflects BMCE's best judgment in light of the information available to it at the time of preparation. Should this report be used by a third party, any reliance or decisions made based on this report are the responsibility of such third party. BMCE accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this report. BMCE makes no representation concerning the legal significance of the findings or the information contained within this report.

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1. Introduction and Background

Meadowbrook Village, formerly known as Campbell's Mobile Home Park, is located in the southeast quarter of 33-10-18 WPM in the Rural Municipality of Cornwallis, just east of the City of Brandon. The original park was constructed in the 1970's along with the existing wastewater treatment lagoon which is located in the northeast quarter of 33-10-18 WPM.

In 2000, a four phase expansion to the park was conceptualized and a lagoon expansion was undertaken. An updated Environmental Act License No. 2441 was issued at this time. Complications during construction of the lagoon lead to the abandonment of the expansion which has sat partially complete to this day. Phase 1 of the proposed expansion was constructed in 2017. Currently 26 of the proposed 49 homes have been located to the site. Not all are occupied at this time.

The village of Chater in the RM of Cornwallis includes 49 homes and a proposed 27 more to be developed. The current properties use sewage holding tanks and septic fields. Due to a high ground water table and the extensive costs associated with pumping out septic tanks the RM of Cornwallis has requested a partnership with Meadowbrook Village. Additional capacity added to the design to allow for the future development of Chater's sewer system.

BMCE has been retained to complete the design and environmental approvals associated with the expansion of the existing wastewater lagoon to accommodate Chater in the near future.

1.1. Existing Lagoon

Domestic wastewater from Meadowbrook Village residents is currently treated by the existing two cell lagoon located approximately 185 meters north of the nearest residence. Wastewater is collected by a gravity sewer system which flows to a lift station located directly south of the primary cell along Spruce Street in Meadowbrook Village where wastewater is then pumped to the lagoon via a force main.

Currently, there is no operational procedure in place for the existing lagoon. The lagoon has become overloaded since its construction in the 1970's and has been poorly maintained. The lagoon berms have become covered with vegetation due to the poor maintenance procedures.

Once construction of the new facility is complete, the existing lagoon facility will be decommissioned. Decommissioning will involve the removal of biosolids materials for the purpose of land application, which will include the submission of an Environment Act Proposal (EAP). The required EAP will be prepared and submitted separately from this report at a later date.

1.1.1. Lagoon Survey

There is no as-built information available to determine the original construction specifications for the existing lagoon; however, BMCE conducted a survey of the lagoon on August 26, 2016 and January 13, 2017 to determine the approximate size, berm dimensions and slopes, water and sludge depth, outlet valve location, and overall condition of the existing structure.

At the time of the inspection, January 13, 2017, the wastewater in the primary cell was on average approximately 1.5m deep, and the wastewater in the secondary cell was on average approximately 1.0m deep. This is an approximation, as the bottom elevation varied throughout. The sludge depths in both cells varied throughout but generally ranged between 0.20m and 0.30m depth.

Also noted during the survey was the fact that the surface water elevations varied between the primary and secondary cells. This indicates that the equalization pipe between the two cells is plugged or not working. This also suggests that currently the lagoon is overtopping the common berm between the primary and secondary as a means of liquid flow between the cells. According to the survey it is suspected the water is overflowing on the northern portion of the common berm as this is the lowest portion.

Through discussions with the Client on the operation of the lagoon it was identified that it has not be operated in accordance with typical discharge procedures. It is likely that the secondary cell of the lagoon is overflowing as well in the southwest corner where the berm is at its lowest point. This would suggest the lagoon is operating in a continuous discharge configuration by overtopping the secondary cell berm.

Drawings obtained from Manitoba Sustainable Development for the previously submitted EAP and NoA in 1999 and 2000 by Glen Newton, P.Eng. indicated the following information:

- Interior Side Slopes: 3:1
- Freeboard: 0.30m
- Dead Space Provided: 0.00m
- Active Storage Depth: 1.20m
- Total Berm Height: 1.50m

The information provided by the previous submission is the best available information for the configuration of the existing lagoon and was utilized by BMCE in the determination of the existing lagoon capacities. It can be noted however that survey collected by BMCE would suggest that the information contained within the report is not accurate. For the purposes of the review of the existing lagoon the assumptions from G.D. Newton & Associates will be utilized.

Currently, the existing lagoon provides wastewater treatment to approximately 365 people; refer to the population calculations in Section 1.2 for more information. Utilizing typical loading and treatment rates found in Section 2.3 of this report, the existing organic loading rate was found to be 28 kg BOD_5/day while the hydraulic loading was found to be 113.3 m^3/day. The available treatment area at the average water depth (0.6 m from bottom) in the primary cell was determined to be 3,254 m^2 which can provide treatment to a corresponding organic load of 18.2 kg BOD_5/day. The volume of the existing primary cell was estimated at 3,910 m^3, while the secondary cell was estimated at 6,820 m^3. This provides a total hydraulic capacity of 8,770 m^3 or 38.1 m^3/day when utilizing a 230 day detention period.

Based on these observed and measured site conditions, the existing lagoon is organically over-loaded by approximately 154% and hydraulically over-loaded by approximately 297% with the current day population.

1.1.2. Discharge

The existing lagoon discharges through a natural drainage ditch, approximately 320 meters long, on to the south neighboring property of Glen Lea Golf Course and into their irrigation reservoir which is used for irrigation; see Section 2.5 for more information on the discharge route. There is currently a caveat between the owners of the lagoon and Glen Lea Golf Course to discharge the lagoon to this location, see Appendix A.

1.1.3. Condition

A condition assessment of the existing facility was not completed. The condition of the lagoon facility is largely unknown at this time. Plant overgrowth was observed along the berm throughout the side slopes. This issue was also identified by Manitoba Sustainable Development in a previous site inspection of the lagoon.

1.2. Population and Loading Projections

1.2.1. Current and Future Populations Served

Currently, Meadowbrook Village consists of 146 modular and mobile homes, or a population of approximately 365 people. In the ~40 years since the lagoon's construction, the mobile home park has expanded and is planning to continue with the development of four future phases in which 172 remaining residences are proposed, or an approximate 430 additional people. Refer to Table 1 for further details:

Table 1: Current and Future Populations Serviced by the Lagoon

Phase of Construction	Assumed Construction Completion	Mobile Homes	Assumed People per Residence	Cumulative Population
MB Current	-	146	2.5	365
MB Phase 1	2018	195	2.5	488
MB Phase 2	2025	244	2.5	610
MB Phase 3	2030	293	2.5	733
MB Phase 4	2035	318	2.5	795

Sewage infrastructure for the mobile home park and proposed future phases consists of a gravity flow sewer network which services the residences throughout the park. It should be noted that no industrial or commercial waste will be generated in the mobile home park or proposed future phases. The gravity flow sewers from the mobile home park and proposed future phases are connected to separate lift stations, which will pump the wastewater to the lagoon. The mobile home park and the proposed future phases (as constructed) are expected to immediately connect to the lagoon once the lagoon expansion is complete. Phase 1 was given permission to be constructed so long as only 11 homes would be serviced and waste generated by the serviced homes was pumped from the new lift station to a tank and hauled, until the expansion to the lagoon was complete.

In addition to the Meadowbrook Village population loading from the Village of Chater will consists of 49 homes or a population of approximately 147 people. The RM of Cornwallis has further subdivided the area creating 27 more residential lots within Chater creating an estimated future population of 228 people. Refer to Table 2 for further details:

Table 2: Current and Future Populations Serviced by the Lagoon

Phase of Construction	Assumed Construction Completion	Homes	Assumed People per Residence	Cumulative Population
Chater Current	2023	49	3.0	147
Chater Phase 1	2030	27	3.0	228

Sewage infrastructure to connect Chater to the Meadowbrook Lagoon will be future development and occur during the future phases of the project. The infrastructure will include a lift station and a 2.5 km forcemain to support the above population. This infrastructure has not yet been designed and is estimated to be constructed in 2021 - 2022.

1.2.2. Proposed Lagoon Loading Criteria

Using a typical loading rate of 0.077 kg BOD_5/cap/d, the expected future average daily organic loading is provided in Table 3. The average day hydraulic loading is also shown in Table 3 based on the estimated wastewater generation rates for the population as outlined in Section 1.2.

The hydraulic loading attributable to the mobile home park members and residents of Chater were averaged at a value of 270 L/c/d. This is based off quarterly water meter readings from the Municipality of Cornwallis at the Chater Treatment Plant connection from April 2019 up to and including January of 2020. This consumption rate is also representative of typical values used in residential areas. An infiltration rate of 15% of the per capita hydraulic loading was included in the cumulative hydraulic loading.

Table 3: Lagoon Loading Criteria

Phase of Construction	Cumulative Population	Cumulative Organic Loading (kg BOD_5/d)	Cumulative Hydraulic Loading (m^3/d)
Up to MB Phase 2 + Chater Phase 1	838	64.5	260.2
Up to MB Phase 4	1023	78.8	317.6

1.3. Projected Load Growth

The final lagoon expansion will not be designed to service an increased capacity beyond the four proposed future phases and the addition of the Chater municipal wastewater in Section 1.2. No other expansions are planned for the life of the facility. Assumed construction completion timelines for each phase of development have also been provided in Table 1 in Section 1.2.1.

1.4. Lagoon Feasibility Report

As the existing lagoon is currently overloaded both organically and hydraulically, the lagoon will either need to be modified and expanded, or a new facility will need to be constructed. BMCE completed a review of options available to Meadowbrook Village and determined that ultimately there are two options; the construction of a new lagoon facility and decommissioning the existing lagoon, or upgrade and expand the existing lagoon to provide the required capacity.

1.4.1. Modification and Expansion of Existing Lagoon

The existing lagoon consists of a primary and secondary cell. To provide sufficient storage, the two cells would need to be combined to form one larger

cell, which would function as the new primary cell. If these cells were combined it would provide a capacity which could serve a portion of the proposed future phases but was not adequate to service the entire proposed expansion. In order to accommodate the full expansion, expansion of the primary cell would also need to be completed. In addition to the capacity, the existing lagoon would require upgrades to bring the slopes, freeboard, and dead space provided up to current standards. This would involve a significant reconstruction of the existing lagoon. As the condition and construction of the existing lagoon is largely unknown, this presents a significant challenge and largely unknown cost to the project.

Staged secondary cells would be required to be built to the north of the existing lagoon. These secondary cells would need to be built at the same elevation as the existing lagoon which is quite deep into the ground. The cells would require significant earthworks as you move northward due to the natural grade changes in the area. Additionally, the existing depth of the lagoon cell bottom does not provide adequate grade to ensure drainage of the discharge pipe to the golf course property.

This option presents several challenges including expansion and upgrade of the existing lagoon facility, large earthworks quantities in the secondary cell construction, and challenges in staging the construction with temporary diversion to accommodate continuous operation of Meadowbrook's wastewater system.

1.4.2. New Lagoon, Adjacent to Existing

The second option is construction of a new facility adjacent to the existing lagoon. The benefit of this option over the previous is that construction sequencing is much simpler. Specifically, the existing lagoon could be used for storage and treatment of wastewater during construction of the new facility. Then, once the new facility has been constructed and commissioned, the existing lagoon could be decommissioned without the time sensitivity of the previous option.

The new lagoon would include a primary cell sized to treat all wastewater from the final build out of the expansion areas.

1.4.3. Recommendation

Due to the presence of an existing wastewater lagoon at this location, a lagoon was deemed to be the most feasible wastewater treatment option as compared to a regional or alternative treatment system. This is due to the fact that the mobile home park is reasonably isolated, as it is approximately 1.7 kilometers away from the nearest community (Chater, MB). Another consideration is the

ease of use and lack of maintenance required as compared to an alternative wastewater treatment system. Additionally, as there is an existing wastewater treatment lagoon on site, impacts to the surrounding area will be minimal. These combined factors make a lagoon treatment system the most logical method for treating wastewater in Meadowbrook Village.

BMCE choose to proceed with the new lagoon option versus rehabilitation of the existing lagoon. This is due to the staging challenges and unknowns with regards to the existing lagoon. This also allows for easy construction sequencing and involves significantly less risk to the absence of temporary wastewater diversion during construction. The remaining portion of this EAP will proceed with the design of a new lagoon and ultimately the decommissioning of the existing lagoon once construction is complete.

1.5. Community Consultation & Identified Concerns

Community consultation was not completed since this is an expansion to an existing lagoon facility.

2. Description of Proposed Development

2.1. Certificate of Title

The legal land description where the domestic wastewater lagoon is situated is NE 33-10-18 WPM. The legal landowner of the existing lagoon land is 6843191 Manitoba Ltd. also known as Meadowbrook Village. Refer to Appendix B for a copy of the Certificate of Title. Additional property purchases are not required for the proposed lagoon expansion.

2.2. Sealed Engineering Drawings

For sealed Engineering drawings detailing the proposed wastewater lagoon expansion, refer to Appendix C.

2.3. Proposed Lagoon Design

2.3.1. Lagoon Design Parameters

Table 4 details the lagoon design parameters which were utilized during the final design of the wastewater lagoon. These parameters are in conformance with the Information Bulletin – Design Objectives for Wastewater Treatment Lagoons published by Manitoba Sustainable Development.

Table 4: Lagoon Design Parameters

Parameter	Result
Winter Storage Period	Nov. 1 to Jun. 15
Detention Time (days)	230
Organic Loading Rate (kg BOD_5 / cap / d)	0.077
Organic Treatment Rate (kg BOD_5 / ha / d)	56.0
Active Storage Depth (m)	1.20
Freeboard (m)	1.00
Dead Space (m)	0.30
Total Depth (m)	2.50
Cell Interior Side Slope	4:1

An explanation of the various lagoon design parameters has been provided to outline the rationale behind them:

- The detention time was set at **230 days**. 227-230 days are commonly used detention times, based on the operational requirement that the wastewater effluent be discharged between June 15 and November 1.
- The design organic loading rate per person is set at **0.077 kg BOD/person/day**. This is a value used commonly in wastewater treatment design in Manitoba.
- The maximum organic loading rate is set at **56 kg BOD_5/ha/day**. This value is commonly used in wastewater lagoon design across Manitoba.
- As per common practice and design standards for wastewater lagoon design, the available storage will be 1.50m, and active storage will be 1.20m.
- As per common practice and design standards for wastewater lagoon design, the available freeboard will be 1.00m.
- The area below the interconnecting pipe inverts is considered dead storage, and is not part of the design storage volume or freeboard. The dead storage height is 0.30m, as per common design practice and Manitoba Sustainable Development Design standards.
- The interior slope of the primary and secondary cells will be 4:1. The outside berm slopes will be 5:1.
- For all other lagoon design details, refer to drawings in Appendix C.

2.3.2. Lagoon Design Rationale

BMCE completed the design of the new wastewater treatment lagoon. The new lagoon has been designed to be constructed in two phases. The first phase of

construction will include the primary cell and the east secondary cell, while the second phase will include the west secondary cell.

The primary cell will be sized to treat the wastewater from the final population of Meadowbrook Village and the community of Chater including the four phase expansion to ensure that no future upgrades are required to this cell. The east secondary cell will be sized to treat the wastewater from the exiting Meadowbrook Village and up to the second phase of the four phase expansion as well as the full population of Chater including future development. The west secondary cell will include the remaining capacity to treat wastewater from phases three and four of the expansion.

2.3.3. Primary Cell Design (Organic Loading)

The primary cell design has been completed and is outlined in Table 5. The organic loading rates calculated in Section 1.2.2 have also been included in the table to clearly demonstrate the proposed sizing can accommodate the organic loading for all four phases of expansion. The lagoon design parameters utilized were outlined in Section 2.3.1. The area outlined in the table was determined at the average active storage depth in the lagoon. This represents a depth of 0.6m from the high-water level or 0.9m from the bottom of cell which will represent the average water depth in the lagoon throughout the year. The organic treatment capacity provided was calculated by multiplying the area by typical organic treatment rate. As you can see in the summary table the primary cell provides 78.8 kg BOD_5 / day of treatment which equals the required loading rate of 78.8 kg BOD_5 / day.

Table 5: Primary Cell Design Summary

Parameter	Result
Top of Berm Dimensions - L x W (m)	See C1.2 of Drawings
Floor Dimensions - L x W (m)	See C1.2 of Drawings
Area at Average Active Storage Depth (m^2)	14,078
Organic Treatment Capacity Provided (kg BOD_5 / d)	78.8
Organic Loading Rate (kg BOD_5 / d) (Refer to Section 1.2.2)	78.8
Volume Provided (m^3)	17,269

2.3.4. Secondary Cell Design (Hydraulic Loading)

Refer to Table 6 for a summary of the secondary cell design with regards to the hydraulic capacity of the lagoon. The northwest secondary cell provides adequate hydraulic capacity to accommodate flows up to and including phase 2 of the expansion. The northeast secondary cell is intended to be constructed in

the future and has the hydraulic capacity to accommodate flows up to and including phase 4 of the expansion. This staged secondary construction allows Meadowbrook Village to bring a new lagoon online initially to meet the current and immediate needs of the existing park and expansion while limiting the required capital investment at this time. The future lagoon expansion then allows for an easy increase in capacity for the lagoon when Meadowbrook Village is ready to proceed with subsequent phases of expansion.

Table 6: Secondary Cells Design Summary

Parameter	Result
Secondary Cell #1	
Top of Berm Dimensions - L x W (m)	183.00 x 265.90
Floor Dimensions - L x W (m)	163.00 x 243.00
Secondary Cell #1 Volume Provided (m^3)	51,035
Primary Cell Volume Provided (m^3)	17,269
Total Active Storage Volume Provided (m^3)	59,670
Hydraulic Capacity Provided (m^3/d) (Using 230 day detention time)	259.4
Hydraulic Loading up to Phase 2 (Refer to Section 1.2.2)	260.2
Secondary Cell #2 (Future Expansion)	
Top of Berm Dimensions - L x W (m)	118.00 x 132.00
Floor Dimensions - L x W (m)	98.0 x 112.0
Secondary Cell #1 Volume Provided (m^3)	51,035
Secondary Cell #2 Volume Provided (m^3)	15,003
Primary Cell Volume Provided (m^3)	17,269
Total Active Storage Volume Provided (m^3)	74,673
Hydraulic Capacity Provided (m^3/d) (Using 230 day detention time)	324.7
Hydraulic Loading up to Phase 4 (Refer to Section 1.2.2)	317.6

The total active storage volume provided for the secondary cells was calculated using the volume of the secondary cell(s) plus half of the volume of the primary cell as per Manitoba Sustainable Development's Design Objectives for Wastewater Treatment Lagoons. The subsequent hydraulic capacity provided is then calculated by dividing the total active storage volume provided by the detention time to get an average inflow rate over this period of time that the lagoon can accommodate. This hydraulic capacity can then be compared to the hydraulic loading calculated from population projections in Section 1.2.2.

2.4. Lagoon Design

The lagoon containment will consist of a minimum 1.0m thick remolded clay liner at the surface of the berms surrounding and throughout the cells. BMCE anticipates that there will be adequate quantity of clay materials on site for liner construction which will meet the hydraulic conductivity requirement of 1 x 10^{-7} cm/s when remolded. Some additional exploration will need to be completed during construction to confirm the depth, location, and quantity of available clay liner material on site. If there is not enough clay available on site, there is a source 1.6 kilometers away that can be utilized.

2.4.1. Geotechnical Report

A geotechnical investigation was completed by TREK Geotechnical on March 17, March 18, and June 3, 2016. The Geotechnical Investigation Report has been included in Appendix D. The report contains the test hole and test pit logs throughout the site including at the previously partially completed expansion site. The report makes the following recommendations for construction of the lagoon facility with a compacted soil liner:

- Clay till used for fill should be well mixed and homogeneous, unfrozen, free of deleterious materials, organic matter and debris.
- Topsoil or otherwise unsuitable materials (non-clay till material) should not be used for liner construction but may be selectively used for dyke construction and re-vegetation of exterior slopes.
- The clay till should be packed using a sheepsfoot compactor in 150mm maximum lifts to 95% of Standard Proctor Maximum Density (SPMDD) at or within 2% of the optimum moisture.

The report recommends that strict quality control will be required to prevent inclusion of undesirable soils and to confirm adequate compaction of the clay till throughout construction. BMCE will be on hand throughout the construction to monitor progress and ensure liner materials meets the requirements as set out in the geotechnical report.

2.5. Effluent Discharge

The existing lagoon is constructed adjacent to Meadowbrook Village. The proposed discharge location will continue to be into Glen Lea Golf Course's irrigation reservoir(s) via a natural drainage ditch, immediately south of the proposed future phases and west of Meadowbrook Village. See Figure 1.

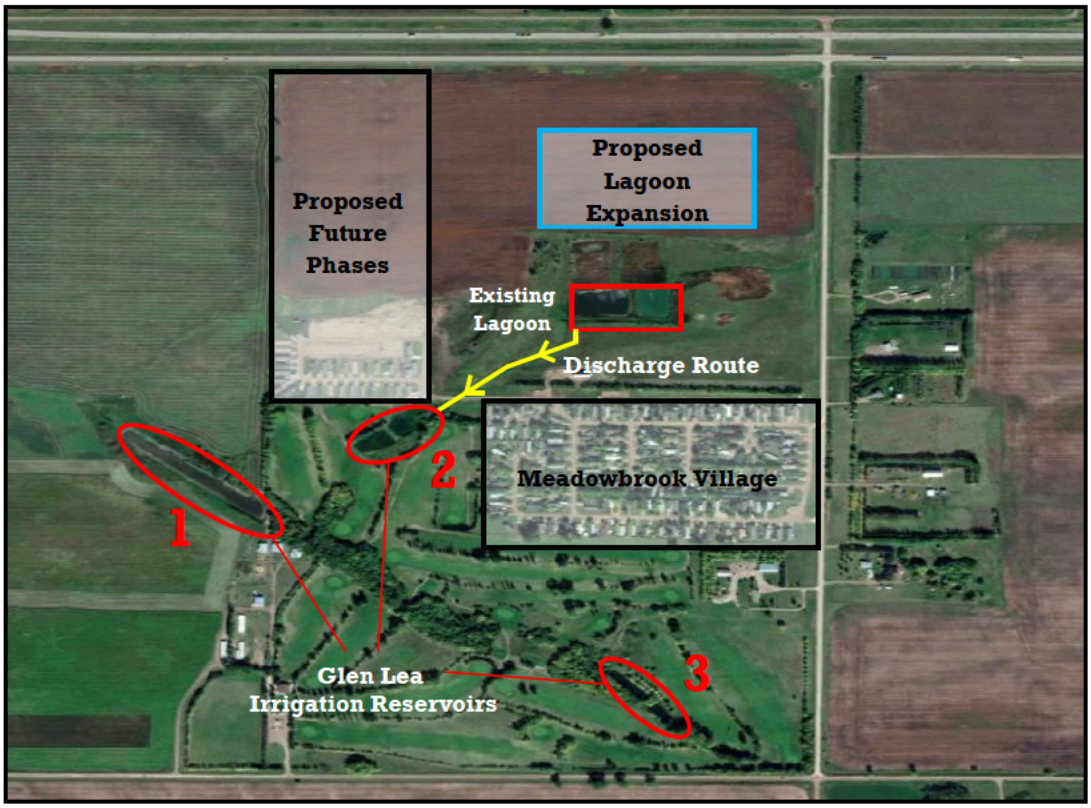

Figure 1: Discharge Route

Reservoir 2 has a 12,588m^3 storage capacity, Reservoir 1 has a 70,527m^3 storage capacity, and Reservoir 3 has a 13,026m^3 storage capacity. The combined total of golf course storage reservoirs is 96,141m^3. This combined storage volume is expected to increase in the future as Glen Lea Golf Course is currently planning to expand Reservoir 1 to the northwest. All reservoir capacities and irrigation rates were provided to BMCE by Glen Lea Golf Course.

As shown in Figure 2 below, there is only one natural drain in the immediate area of Meadowbrook Village. The effluent drains from the lagoon through approximately 320m of a heavily vegetated natural drain into the irrigation reservoirs located on the Glen Lea Golf Course. This drainage route is protected by an easement agreement between both property owners that was executed in 1999, see Appendix A. The agreement is also in the process of being updated. The effluent is diluted with existing reservoir water and is applied as irrigation water to Glen Lea Golf Course throughout the golf season.

It is common for Glen Lea Golf Course to deplete their stored reservoir water in mid-summer and require the lagoon effluent to supplement their irrigation needs. BMCE has been in ongoing discussions regarding the discharge with Glen Lea owners. Glen

Lea has advised that they are happy to continue to receive the discharges and look forward to working with the new park owners.

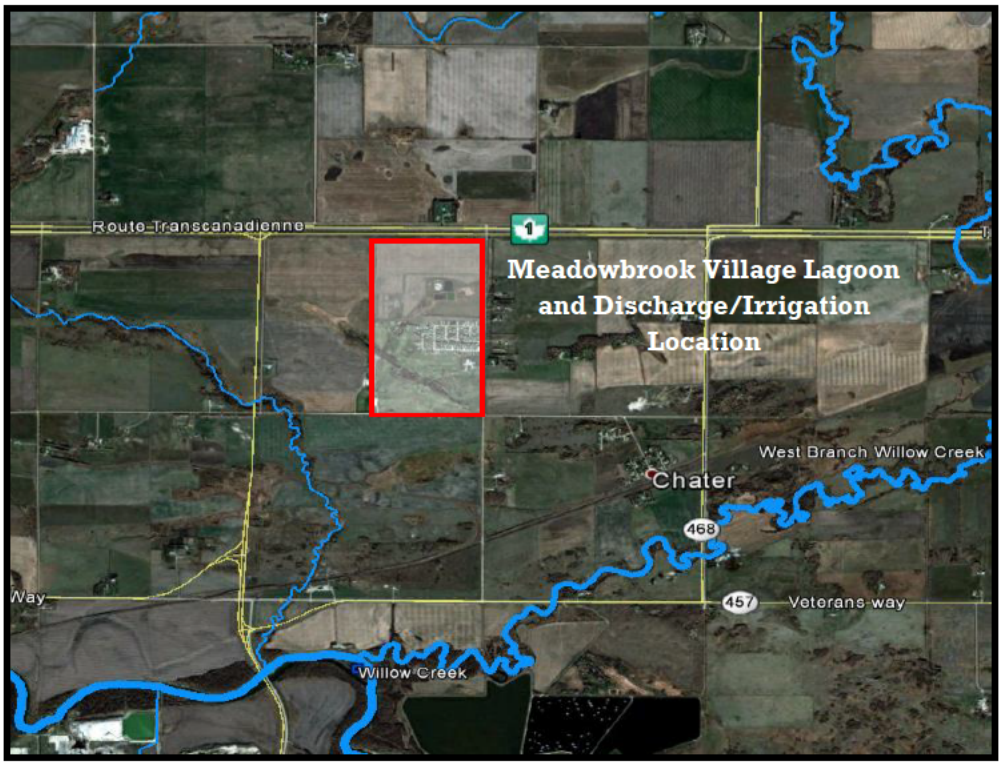

Figure 2: Nearest Drains

2.5.1. Effluent Use by Glen Lea Golf Course

The Glen Lea Golf Course has a multiple reservoir storage system with a combined capacity of 96,141m^3 to supply their irrigation needs throughout the summer months.

The golf course has provided the total water utilized annually for irrigation purposes is 65,940m^3 or approximately 802m^3/day on average, with a max rate of 1,455m^3/day during peak irrigation season when a lagoon discharge would occur. The irrigation season is between April-October. As determined in Section 2.3, the maximum discharge volume from the lagoon will be 59,670 m^3 after the construction of the lagoon for up to Meadowbrook phase 2 and the current Chater loading and up to 74,673 m^3 after the construction of the second secondary cell. During lagoon discharge, Glen Lea Golf Course will receive approximately 4,973 m^3/day over the course of twelve days after the construction of the lagoon for up to Meadowbrook phase 2 and the current Chater population. After the construction of the second secondary cell the golf course will receive the same discharge rate over the course of fifteen (15) days. The lagoon discharge rate was hydraulically calculated as an Outlet-Controlled Culvert with a Submerged Inlet, using a typical high-density polyethylene

discharge pipe size and length of 150mm and 22m respectively. These discharge rates are based on a single discharge event of the lagoons secondary cell(s) with a gate valve opened to accommodate the flows. Discharge volumes will also be reduced by infiltration/evaporation of the effluent along the 425m long drainage ditch.

Meadowbrook Village lagoon discharge will drain into Reservoir 2, see Figure 1. In the event Reservoir 2 is full, effluent will then be pumped from Reservoir 2 to Reservoir 1, via an underground transfer pipe. In the event Reservoir 1 is full, overflow will both extend northwest of Reservoir 1 onto the agricultural land and follow a natural drainage ditch through the golf course to Reservoir 3.

In the event of a wet year and all reservoirs are at full capacity when the lagoon needs to be discharged, flow from Reservoir 3 will overflow and follow a natural drainage ditch to Curtis Road and continue south until it reaches Willow Creek and shortly thereafter, the Assiniboine River; the total drainage path from Reservoir 3 to Willow Creek is approximately 3.1km long. See Figure 3 for details on the overflow drainage path.

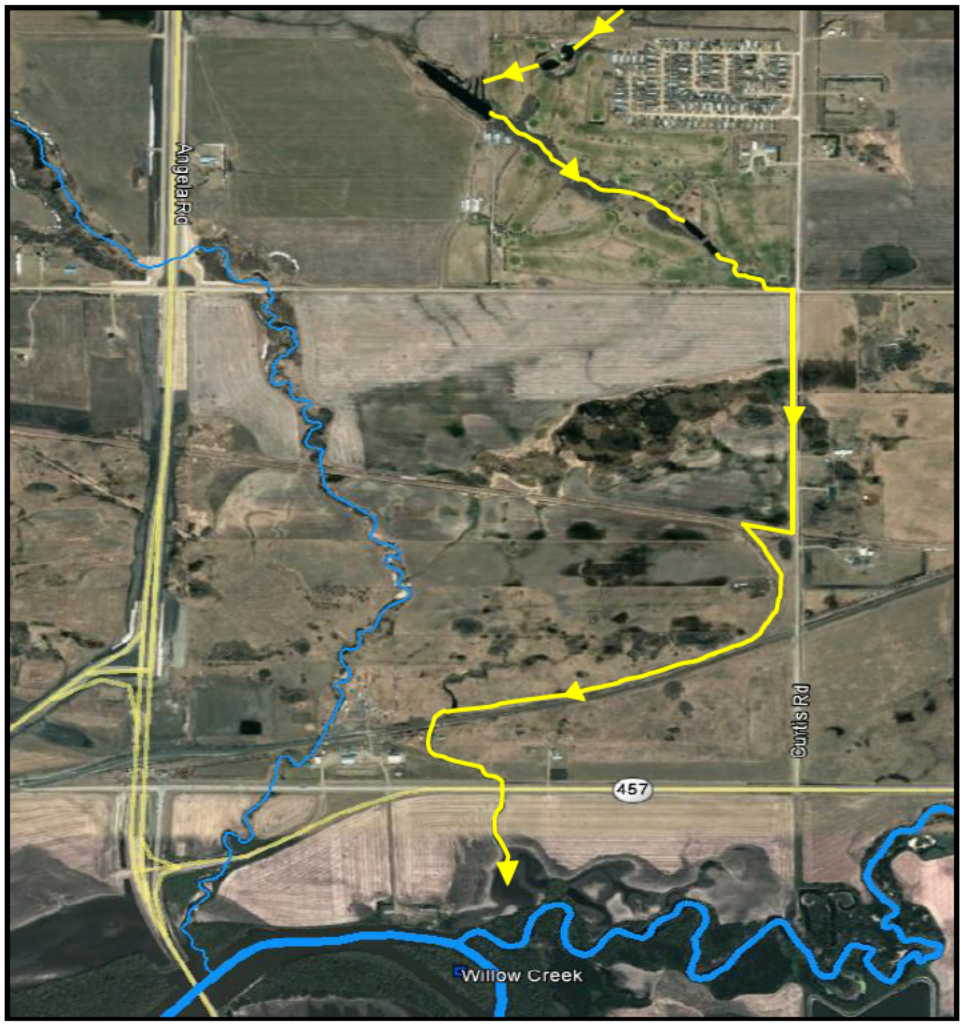

Figure 3: Overflow Drainage Path

Since the lagoon will be discharged during peak summer months, when golf course irrigation reservoirs are expected to be low, the occurrence of discharge along this drainage path is unlikely. All effects will be made to coordinate discharge with Glen Lea to ensure they are ready and can utilize the effluent. This may include discharge timing, duration, multiple discharges etc.

In the event of overflow, the 3-reservoir dilution process and lengthy, vegetated, drainage path to dilute and polish the wastewater; no impacts are expected to the fish habitat in Willow Creek and the Assiniboine River.

Communication between Glen Lea Golf Course and Meadowbrook Village will be upheld to ensure adequate warning when a lagoon discharge will be taking place, as well as confirming the capacity of the golf course to receive the lagoon discharge. If necessary, Meadowbrook Village will discharge the lagoon twice to reduce the volume of effluent received at one time. Glen Lea has also

advised they can move water between reservoirs to assist in the discharge process.

2.6. Facility Operation

Wastewater effluent will be collected via a gravity sewer network and pumped from lift stations into the lagoon, where the wastewater will be stored and treated until it is released in the summer/fall.

After development of a low pressure sewer network in Chater the wastewater effluent will be collected and pumped from a lift station in Chater to the lagoon. The low pressure sewer network will only be pumping liquid effluent from Chater to the Meadowbrook Lagoon. All solids will continue to be collected in the property owner's two STEP tank and pumped and hauled to the City of Brandon Municipal Wastewater Treatment Facility. The wastewater will travel approximately 2.5 km northwest via forcemain into the Meadowbrook Village lagoon.

The discharge operation is summarized in the following steps:

Two weeks prior to the time of sampling the valve permitting flow between the primary and secondary cell(s) will be closed. This will ensure a representative water sample can be taken from the secondary cell.

Two weeks after the valve has been closed, a water sample from the secondary cell(s) will be obtained, using sample bottles supplied from an accredited laboratory. Water sampling and submission procedures will be performed in accordance with Manitoba Conservation and Climate and laboratory guidelines.

If the water samples meet Manitoba Conservation and Climate requirements, water from the secondary cell(s) can be discharged. Water will only be discharged within the May 1 to November 1 time period. If the samples do not meet Manitoba Conservation and Climate requirements, testing will be repeated until the samples have passed the testing criteria. Additional time will allow for natural processes such as sunlight and settling to positively affect the wastewater effluent quality.

Once the effluent has been drained from the secondary cell(s), the discharge valve will be closed and the valve permitting flow between the primary and secondary cell will be opened.

Once the water level between the primary and secondary cell has been equalized, the secondary cell can be drained a second time if necessary to ensure adequate capacity for winter. In this event, the valve between the primary and secondary cell will again need to be closed for two weeks, and the secondary cell wastewater will need to be re-tested prior to discharge. However, we do not anticipate a second discharge will be necessary.

2.7. Seasonal Maintenance

Regular observation of the lagoon will be undertaken by Meadowbrook Village Staff to ensure that there are no damages to the lagoon structure. The following tasks will be performed to ensure that the integrity of the lagoon is maintained and that it functions properly:

The lagoon will be inspected for signs of wildlife. Any wildlife burrowing into the berm or otherwise causing damage will be removed.

Valves and drainage areas will be checked and cleared of obstructions on a regular basis.

Snow will be cleared on the access road so that the lagoon may be accessed at any time.

2.8. Decommissioning

Decommissioning of the existing lagoon will be completed following construction and commissioning of the new lagoon facility. Once the existing facility is taken offline, the liquid will be transferred via pump to the new facility for treatment. Once all liquids have been removed, the biosolids will need to be land applied. Refer to Section 2.8.1 for more info on biosolids application. Once the existing lagoon has been emptied and biosolids removed, the existing piping will all be removed and disposed of followed by the leveling of the existing berms. Once the surface has been leveled, topsoil and seed will be placed to remediate the lagoon site to a natural condition.

2.8.1. Biosolids Application

Disposal of biosolids is regulated under The Classes of Development Regulation (Manitoba Regulation 164/88). According to the regulation, disposal of biosolids is classified as a Class 2 Development, and will require preparation and submission of an Environment Act Proposal. The required application will be prepared and submitted separately from this report at a later date.

3. Description of Pre-Development Environment

3.1. Land Use

The current land use is cultivated farmland on the north half of the section and the location of the existing wastewater lagoon as well as some low lying swamp area on the southern half. A local farmer is actively using the north half of this section to grow crops. Zoning is currently designated as Agricultural General Zone (AG80) of all of the quarter section except the western 219.45m which was rezoned to Residential Mobile Home Park (RMP) to allow for the proposed four phase expansion.

3.2. Topography

The location of the lagoon will be adjacent to Meadowbrook Village on NE 33-10-18 WPM. The land is relatively flat, with a gradual slope to the south west. Most runoff from the land eventually exists to the south west on to Glen Lea Golf Course where it is stored for irrigation purposes. There is an agreement in principal between Meadowbrook Village and Glen Lea Golf Course to accept this drainage. The existing agreement will be formalized, pending design approval.

3.3. Soil Conditions

The general soil stratigraphy in descending order from ground surface consists of organic topsoil followed by a veneer of glacio-fluvial sediment (mixtures of sand, silt, and clay) overlying clay till. The clay till is silty, contains trace sand, trace gravel, is brown, moist, firm to very stiff, and of intermediate to high plasticity. Geotechnical information was provided by a Geotechnical Investigation Report prepared by Trek Geotechnical and dated July 11, 2016; see Appendix D.

3.4. Groundwater

Groundwater was encountered at depths of approximately 1.7m to 2.1m in two of the test holes completed within the proposed lagoon site. The test holes completed along the southern side of the proposed wastewater lagoon all were dry with no seepage or sloughing at the completion of drilling. Groundwater impacts are anticipated to be minimal during construction, if at all.

3.5. Wildlife in Project Area

3.5.1. Existing Wildlife

Existing wildlife in the area is not likely to be affected by the construction of the new lagoon facility. As an existing facility has been in place for many years with negligible effects on the wildlife, it is anticipated the new facility will function in a similar manner. The proposed lagoon expansion is being constructed in a previously disturbed area, and existing agricultural land. Due to this existing land use it is anticipated that no wildlife habitat will be affected.

3.5.2. Fish Habitat

The lagoon discharge is not being transmitted to, or stored within, a fish bearing water body.

3.5.3. Protected or Endangered Species

Due to the relatively close proximity of the proposed expansion to the current lagoon location, and the fact that the area of land being developed into residential lots was previously actively cultivated agricultural land, effects to protected and endangered species are considered to be minimal.

A request was submitted to the Manitoba Conservation Data Centre to inquire about any protected or endangered species known to be in the area. The search revealed that no protected or endangered species are known to be in close proximity to the proposed lagoon expansion.

3.6. Socioeconomic Environment

The socioeconomic environment is not a large factor in the development, as the lagoon expansion is being constructed adjacent to the existing Meadowbrook Village, north of the existing lagoon. The nearest neighbouring residence not associated with Meadowbrook Village will be located approximately 300 meters away, as per Figure 4.

Figure 4: Neighbouring Residences

The nearest residence within the existing Meadowbrook Village is approximately 183 meters away from the existing lagoon. With the lagoon location shifting north, this distance will increase to 380 meters from the proposed lagoon to nearest existing residence. The residences to the west will be located 100 meters away from the proposed lagoon. The proposed lagoon will be less than 300 meters away from the proposed future phases, which exceeds setbacks as outlined in the *Information Bulletin – Design Objectives for Wastewater Treatment Lagoons* by Manitoba Sustainable Development. The setbacks have been determined to be acceptable

however as existing setbacks are not being decreased and residents affected are part of Meadowbrook Village, which is serviced by the wastewater lagoon.

One important factor to take into consideration would be the odour produced by the facility. As the existing facility is overloaded both organically and hydraulically, it likely produces more odour than a properly designed and sized facility. The new facility will not be overloaded, and it is likely that the odours would be reduced below existing levels minimizing the socioeconomic impact to the residences in the area.

4. Description of Environmental and Health Effects of the Proposed Development

4.1. Impact on Biophysical Environment

4.1.1. Construction

Construction of the new lagoon will involve land clearing, excavation, and construction of the lagoon berm walls, infrastructure, and liner. As the existing land use is currently agricultural and used for the existing lagoon, the impact on the natural terrestrial environment is expected to be minimal. Furthermore, as the lagoon expansion is being constructed directly between Meadowbrook Village and PTH No.1, the site should not be attractive to wildlife.

4.1.2. Operation

Following lagoon construction, no impact is expected on local groundwater. A properly designed and functioning lagoon will not allow wastewater to infiltrate into the surrounding environment except during wastewater discharge, which only occurs once wastewater has been treated to acceptable levels. For a detailed review of the facility operation, please refer back to Section 2.6.

4.2. Type, Quantity and Concentration of Pollutants

4.2.1. General

Treated effluent, tested according to the Manitoba Sustainable Development license requirements, will be discharged into the natural drainage ditch leading to Glen Lea Golf Course's irrigation reservoir as shown in Appendix C and Figure 1. As is commonly allowed in lagoon licenses, effluent will be discharged between June 15th and November 1st of any year. Effluent must be tested to determine whether it is consistent with Manitoba Sustainable Development guidelines. Regulations for nutrient concentrations are laid out in The Water Protection Act. The Act sites Manitoba Water Quality Standards, Objectives, and Guidelines for the limits on acceptable wastewater discharge.

Odour is only expected to be a factor during spring and fall turnover, as this the time when noxious gases are released. This will be mitigated by the fact that the prevailing wind should direct the odours away from Meadowbrook Village. Furthermore, the nearest neighboring community is approximately 1.7 km away, giving time for the odour to disperse. The period which odours are released is short and likely will not be a nuisance for residents in the immediate area.

4.2.2. Phosphorus

The limit for phosphorus concentration for an equivalent population less than 2,000 is 1 mg/L or a demonstrated nutrient reduction strategy. Testing will be performed two weeks prior to discharge to determine whether the effluent is suitable for release. The plant-life along the drainage ditch will uptake additional phosphorus as part of their natural processes, effectively cleansing the effluent. As per typical lagoon discharge operations, a trickle discharge over a 2 week interval will be utilized to minimize phosphorus concentrations from impacting the water quality at one specific point.

If there is consistent difficulty in meeting the phosphorus concentration targets or if regulations become more conservative in the future, a more intensive nutrient reduction strategy will be implemented. Phosphorus reduction will have to include the addition of aluminum sulfate (alum) to cause phosphorus to settle. Once the flocculent has settled, it can be collected off the cell bottom once the lagoon is drained.

4.2.3. Other Nutrients

Other nutrients of concern during testing include nitrogen, total coliforms / fecal coliforms, 5-day biochemical oxygen demand, and total suspended solids. All parameters will be tested according to the standards set out in the Manitoba Water Quality Standards, Objectives and Guidelines 2011 document. In the event that any of the tests fail, water will be re-tested according to the procedure set out in Section 2.6.

4.3. Fish Habitat

The Department of Fisheries and Oceans has made available on their website maps detailing fish habitat across Manitoba. The maps are part of a report published by D.W. Milani titled, "Fish community and fish habitat inventory of streams and constructed drains throughout agricultural areas of Manitoba (2002 - 2006)". We have included a map showing the Meadowbrook Village lagoon discharge location in Appendix E. As the map demonstrates, the discharge location is near a Habitat E location, unconnected to any other habitat location and approximately 1.5 km away from a Habitat C location

which has been marked "B-04-088" as a "No Catch" location. Habitat E indicates the absence of sufficient flow duration for fish to complete one or more of their life processes. The flow rate is slowed by plant-life which improves sedimentation processes and allows for increased absorption into the stream bed. This also allows for increased absorption by native plant-life. Overall, the discharge route makes use of the natural cleansing processes of streams and rivers to fully treat the effluent; therefore, no fish impact is expected.

4.4. Socio-Economic, Climate Change Implications

Meadowbrook Village requires a new wastewater treatment system to adequately provide wastewater treatment to the existing park residents, as well as for future development and expansion to the park.

As this lagoon and proposed expansion is taking advantage of natural treatment processes, no significant climate change impacts are expected.

4.5. Potential Impact on Human Health and Safety

The site location is adjacent to Meadowbrook Village. Common practice according to Manitoba Sustainable Development guidelines is to construct a lagoon with a minimum setback of 300 meters from any individual residence. However, this is an existing facility, and the use of a lagoon in this location has already been established, see Section 3.6.

Safety features will include a 6-foot tall fence and descriptive signs to discourage unauthorized access to the lagoon, and to make known the potential danger. In the event that someone enters the lagoon facility area unauthorized and falls in, the 4:1 slopes armoured with rip-rap should provide sufficient surface to assist the person in exiting the water.

The effluent discharge route was examined to determine if there were any downstream users within sufficient range to be affected. As per Section 2.5, effluent discharge does not impact any nearby drains and subsequently will not affect any public downstream users.

Therefore, no impact on human health and safety is expected.

4.5.1. Wastewater Irrigation on Glen Lea Golf Course

BMCE conducted a review of available documentation to determine the potential impact of human health and safety from the use of wastewater for irrigation purposes on the adjacent golf course. Manitoba does not currently have any regulations associated with wastewater irrigation; therefore, BMCE will use the Alberta *Guidelines for Municipal Wastewater Irrigation 2000* and the

Alberta *Code of Practice for Wastewater Systems Using a Wastewater Lagoon 2003* for the basis of our rationale.

BMCE also conducted a review of the current License No. 2441 issued February 18, 2000 for the existing lagoon and found the discharge requirements stated to be equal to or more stringent than the Alberta guidelines for wastewater irrigation of a golf course or park.

Therefore, if irrigation is conducted in accordance with the new license issued by Manitoba Sustainable Developments and the Alberta guidelines for wastewater irrigation, impacts to human health and safety will be negligible.

5. Mitigation Measures and Residual Environmental Effects

5.1. Protection

Practices to be used during construction of the lagoon are common to projects of a similar nature. As there is already an existing facility, and the expansion will be built on previously cultivated farmland, we anticipate that the proposed design will not adversely affect the environment. A clay-lined lagoon will provide environmentally sound storage and treatment of wastewater.

5.2. Monitoring

On-going monitoring of the lagoon will be performed to ensure the proper functioning of the lagoon. Regular inspection will ensure that there is no damage to the lagoon from erosion, failures or other causes. Further attention will be paid to odour, and if excessive odour is noticeable the cause will be identified and dealt with accordingly. The general condition of the lagoon will be observed on an ongoing basis during all seasons.