ENVIRONMENT ACT PROPOSAL
PROPOSED DISCHARGE ALTERATION
OF THE WHITESHELL COLONY
WASTEWATER STABILIZATION POND

Prepared for:

Whiteshell Colony

Project No: 121-23047-00

September 2013

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0.0 EXECUTIVE SUMMARY

GENIVAR was retained by Whiteshell Colony to submit an Environment Act Proposal (EAP) regarding their existing domestic wastewater stabilization ponds, i.e. “lagoon”. Whiteshell Colony seeks an amendment to their current Environment Act Licence (EAL) to permit a piped discharge (to surface watercourse) and maintain their current ability to discharge by irrigation (injection) to their agricultural land.

As evidenced by the conditions in the spring of 2013, it is not always possible to discharge the lagoon by injection and the Colony had no other option but to seek an emergency discharge to an existing ravine which connects with the Whitemouth River. The emergency discharge followed the identical route as is now proposed for the piped discharge and provided an opportunity to sample for phosphorus at certain locations.

Construction will consist of installing a discharge pipe and gate valve through the dyke of the existing secondary cell to permit a piped discharge. A fence will also be constructed as part of the construction activities. Organic and hydraulic loadings to the lagoon are within the existing capacities of the two-cell lagoon and expansion is not required.

Upon approval from Manitoba Conservation and Water Stewardship and issuance of an Environment licence, it is anticipated that the tender and construction will begin in 2014.

1.0 DEVELOPMENT INFORMATION

Proposed Discharge Alteration of the Whiteshell Colony Wastewater Stabilization Pond
Name of development

Whiteshell Holding Co. Ltd.
Legal name of the proponent of the development

North of the Whiteshell Colony in SE 33-12-11 EPM
Location of development

Contact Person for Proponent:

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2.0 DESCRIPTION OF DEVELOPMENT

2.1 CERTIFICATE OF TITLE

The proposed development involves the existing domestic wastewater stabilization pond, "lagoon", and is located to the north of the Whiteshell Colony (R.M. of Whitemouth) in SE 33-12-11 EPM as shown in Figure 2.1. The Certificate of Title for that portion of SE 33-12-11 EPM that lies east of the Whitemouth River is included in Appendix A.

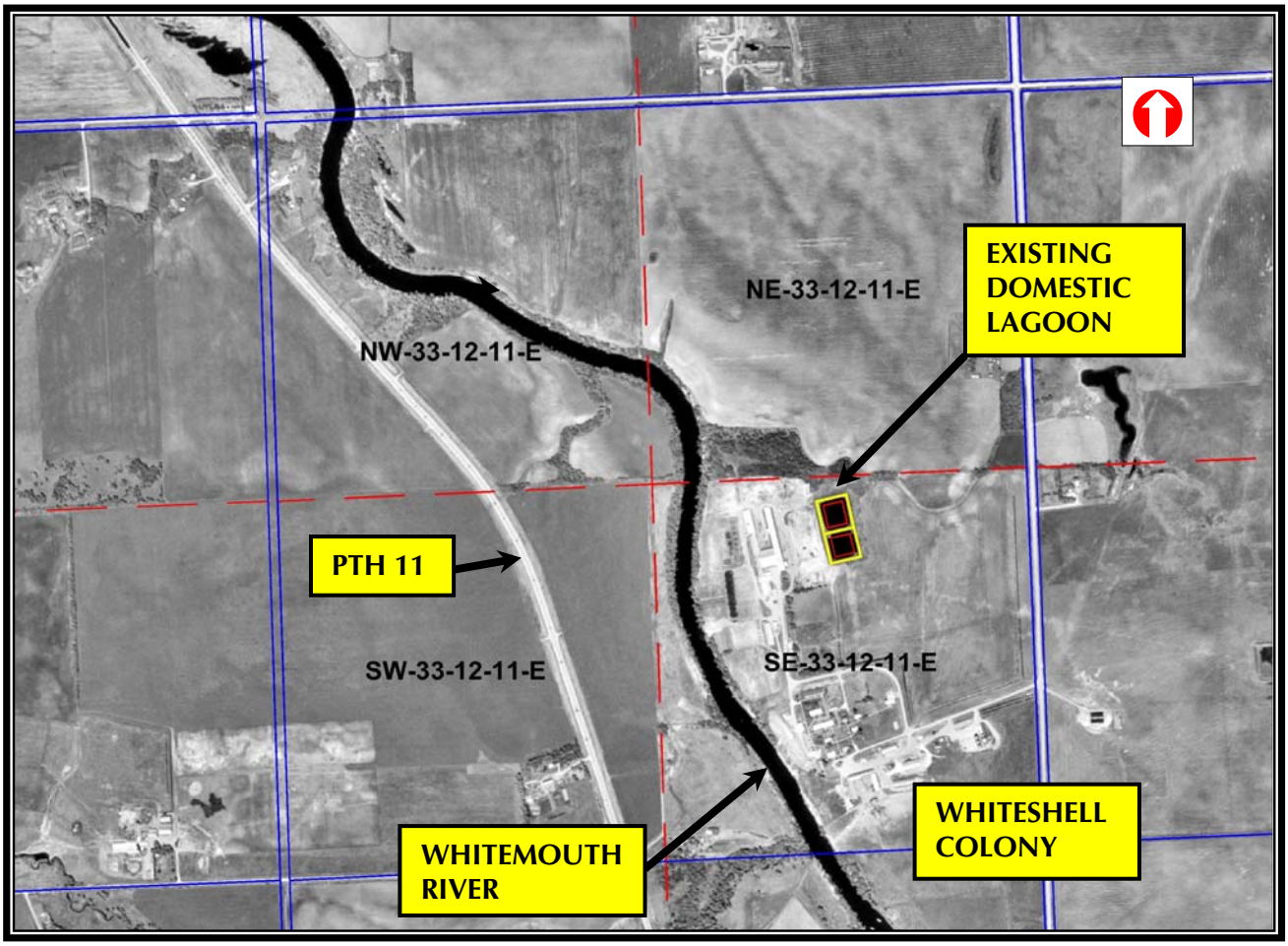

Figure 2.1: Location map of the existing site plan

2.2 NAME OF OWNER

The existing domestic lagoon area and the proposed development area are owned by the Whiteshell Holding Co. Ltd.

2.3 MINERAL RIGHTS

According to correspondence with Crown Lands & Property Agency – Lands Branch, the Crown has ownership of the mines & minerals in SE 33-12-11 EPM. The Certificate of Title is silent on the ownership of the sand & gravel. Correspondence is included in Appendix E.

2.4 DESCRIPTION OF EXISTING LAND USE

The land around the existing lagoon on the west, south and east sides is used for agricultural purposes by the Colony. Directly to the north of the existing lagoon is a treed and well vegetated ravine proposed to become part of the discharge route during the gravity flow discharge.

In correspondence with Manitoba Agriculture, Food and Rural Initiatives (MAFRI) as well as the R.M. of Whitemouth, SE 33-12-11 EPM is designated as RM2 – Rural Mixed Use Corridor Policy 2 and is zoned A80. Correspondence with MAFRI is included in Appendix E.

2.5 PREVIOUS STUDIES

We have no record of any previous studies, with the exception of the original lagoon licence submission.

2.6 EFFLUENT QUALITY AND DISCHARGE ROUTE

Irrigation by injection will continue as the main discharge option for the Colony. When the wastewater is discharge by gravity flow, the effluent will meander through an existing natural treed ravine for over 300 metres before reaching the Whitemouth River, as illustrated in Figure 2.2. The existing lagoon is in the Lower Whitemouth River Watershed (No. 83).

To meet the requirements of the *Water Quality Standards, Objectives and Guidelines Regulation under The Water Protection Act* (2011), the Colony will implement nutrient reduction strategies consisting of irrigation by injection and trickle discharge when discharging by gravity flow. The estimated maximum Whiteshell Colony population is 150

and thus the existing lagoon may be considered as a small wastewater treatment facility. Irrigation by injection allows the uptake of nutrients by the seasonal crops. Whereas, a trickle discharge extending from two to four weeks will allow the vegetation and the soil in the ravine to absorb nutrients and reduce nutrient loads to surface waters.

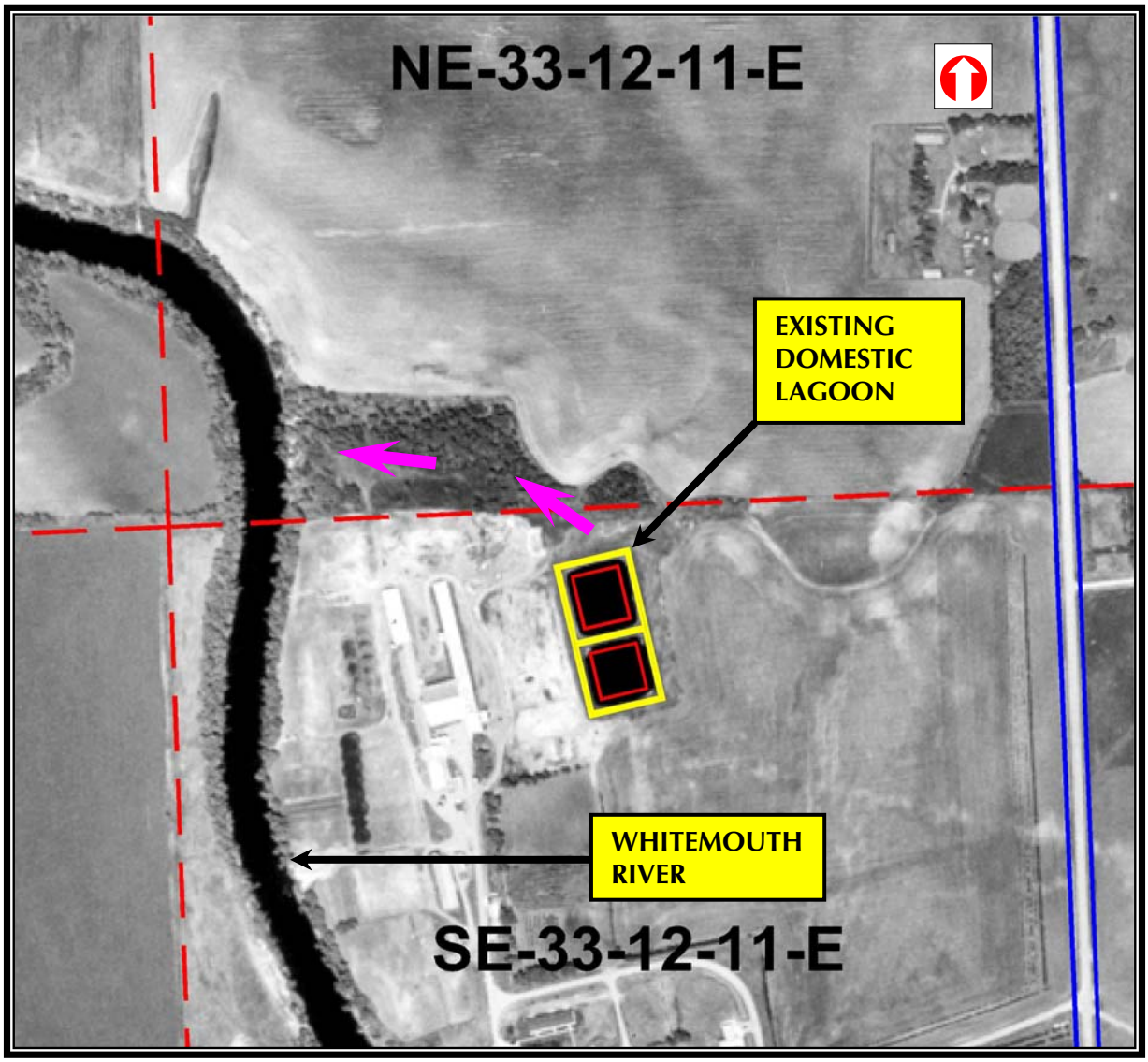

Figure 2.2: Gravity flow effluent discharge route from the Whiteshell Colony lagoon

Due to the late spring in 2013, the Colony was not able to discharge their lagoon and they obtained permission to discharge (by pump) to the ravine over the course of a two week period. The average flow rate over the two week period was approximately 3.8 L/s. Total

phosphorus samples were taken at the end of pipe at the beginning, middle and end of the discharge. In addition, two samples were taken in the ravine, just before the effluent reached the Whitemouth River. These samples were taken at the beginning and near the end of the discharge (July 2013). Table 2.1 provides a summary of the results of the sampling. The actual laboratory reports are included in Appendix D.

TABLE 2.1: WASTEWATER SAMPLE RESULTS – JULY 2013

Timing of sampling	**Total Phosphorus**		
	At Discharge [mg/L]	End of Ravine [mg/L]	Percent Reduction
Beginning	2.76	1.49	46%
Middle	2.37	-	-
End	2.16	1.15	47%

The results show a near 50% reduction of the total phosphorus to levels nearing 1.0 mg/L as a result of the liquid flowing through the ravine.

If the Environment Act Licence holds the Colony to a 1.0 mg/L total phosphorus limit at the end of the ravine for the times that they discharge to the Whitemouth River, they will be receiving absolutely no credit for the majority of the times that they discharge by injection. Even if the Colony were to discharge their secondary cell once by injection and once by pipe per year they would annually average a 1.0 mg/L limit even if the phosphorus in the cell averaged 4.0 mg/L. We understand that a 1.0 mg/L phosphorus limit could be considered an encouragement to always discharge by injection wherever possible, but this approach in our opinion would hardly be considered a *fair and equitable manner* of applying the regulation. It also would be a cause of *undue economic hardship* in the present and future for a population of less than a 150 people who would then have to implement chemical precipitation of phosphorus in their secondary cell.

3.0 POPULATION SERVICED AND DESIGN LOADING

3.1 SOURCES OF WASTEWATER

The existing lagoon services the domestic wastewater from the Whiteshell Colony, with a current population of 104.

3.2 ORGANIC LOADING

Organic loading refers to the quantity of organic material present in the incoming wastewater and is measured as the five day Biochemical Oxygen Demand (BOD_5). The organic loading becomes the total mass of BOD_5 in kg/d in the wastewater discharged to a lagoon. A primary treatment cell is typically sized in accordance with a Manitoba Conservation guideline that requires one hectare of liquid surface area per 56 kg-BOD_5 daily loading.

On the basis of accepted practice, the daily BOD_5 production for domestic wastewater is 0.077 kg per person. Therefore, with a current population of 104, the organic loading to the existing lagoon is (104 people x 0.077 kg-BOD_5/d =) **8.0 kg-BOD_5/d**. The existing primary cell provides a surface area of 2,916 m^2 (0.29 ha) at an operating depth of 1.5 m. Therefore, the primary cell has a treatment capacity of **16.2 kg-BOD_5/d**, which corresponds to a population of 210 people, well above the typical maximum Colony population of 150. Table 3.1 provides the details of the existing primary cell based on the 1989 design drawings. These drawings are included in Appendix C.

TABLE 3.1: SPECIFICATIONS FOR THE EXISTING PRIMARY CELL

Parameter	Existing Primary Cell
Cell bottom	42.0 m x 42.0 m
Liquid surface (at full design depth)	54.0 m x 54.0 m
Top of dyke (inside to inside)	62.0 m x 62.0 m
Operating depth	1.5 m
Freeboard height	1.0 m
Interior/Exterior side slope	4:1 / 3:1
Total volume (at operating depth)	3,474 m^3
Storage volume	1,737 m^3
Surface area (at operating depth)	0.29 ha
Liner system	Clay

3.3 HYDRAULIC LOADING

Hydraulic loading refers to the volume of wastewater directed to the lagoon. Lagoons that discharge to surface watercourses are presently designed for a 227-day storage period beginning November 1st and ending June 15th of the following year. The current Environment Act Licence (EAL) No. 1377 issued June 12, 1990 (see Appendix B) requires storage from October 1st of any year to the May 15th of the following year for discharge by irrigation, which is also 227 days. Hydraulic loading over the 227-day storage period is used to check the volume of storage provided by the existing lagoon facility.

There are no hour meters on the lift station pumps and no water consumption data is available. In order to determine a wastewater generation figure, the lagoon levels were monitored from September 18, 2012 through June 26, 2013. Realizing that precipitation and evaporation affect the accuracy of this method of determining the wastewater, a range of 136 – 176 litres per person per day (L/c/d) was attributed to the Colony over this period. Conservatively, a wastewater generation of 176 L/c/d is attributed to the Colony.

Therefore, with a current population of 104, the hydraulic loading to the existing lagoon over 227 days is **4,155 m^3**. At an operating depth of 1.5 metres, the existing lagoon provides a storage volume of **5,005 m^3**, based on half of the volume of the primary cell and a 0.3 metre deadspace in the secondary cell. Therefore, the existing lagoon has the storage capacity to support a population of 125 at the specified wastewater generation rate of 176 L/c/d.

Table 3.2 provides the details of the existing secondary cell based on the 1989 design drawings. These drawings are included in Appendix C.

TABLE 3.2: SPECIFICATIONS FOR THE EXISTING SECONDARY CELL

Parameter	Existing Secondary Cell
Cell bottom	42.0 m x 48.0 m
Liquid surface (at full design depth)	54.0 m x 60.0 m
Top of dyke (inside to inside)	62.0 m x 68.0 m
Operating depth	1.5 m
Freeboard height	1.0 m
Interior/Exterior side slope	4:1 / 3:1
Total volume (at operating depth)	3,906 m^3
Dead storage depth	0.3 m
Dead storage volume (at 0.3 m depth)	638 m^3
Storage volume (at operating depth)	3,268 m^3
Liner system	Clay

4.0 PROPOSED DEVELOPMENT

Whiteshell Colony seeks an amendment to their current EAL to permit a piped discharge (to surface watercourse) and maintain their current ability to discharge by irrigation (injection) to their agricultural land. As evidenced by the conditions in the spring of 2013, it is not always possible to discharge the lagoon by injection and the Colony had no other option but to seek an emergency discharge. Depending on the timing of the harvest, injection in the fall may also prove difficult because the crops must be harvested first. Therefore, when discharging effluent by irrigation it is requested that consideration be given to permit irrigation between May 15th and October 15th of the following year. This request is further weighted by the fact that the preferred method of discharge in terms of nutrient uptake is by injection, which would be considered a nutrient reduction strategy. When the Colony discharges to surface watercourse, they will do so by trickle discharge as a nutrient reduction strategy over the course of a two to four week period.

Construction is proposed to install a discharge pipe and gate valve through the dyke of the existing secondary cell. Rip rap or other erosion control measure will be implemented as necessary to prevent any erosion at the point of discharge. A fence will also be constructed as part of the construction activities.

A drawing of the proposed development is included in Appendix C.

4.1 SITE CONDITIONS

GENIVAR did not conduct a geotechnical investigation at the site. Information for site conditions is based on soils and groundwater reports as well as the well logs for the site.

4.1.1 Local Topography

The site is located on a fairly rugged area known as Precambrian Drift Plain. This area occurs along the eastern side of Lac du Bonnet area. Surficial deposits are composed of glacio-lacustrine deposits of silty and clayey material deposited on lake floors. The topography of Precambrian is very rugged, hummocky and characterised by numerous rock outcrops and peat bogs interspersed with small lacustrine clay areas.

4.1.2 Soil Conditions

Information for the site conditions is based on the available well log for Whiteshell Colony in SE 33-12-11 EPM. The general soil profile reveals a 1.83 m thick (6 ft) sandy layer followed by a 13.4 m (44 ft) clay layer. Beneath the clay layer are layers of hardpan, sand and gravel/granite.

4.1.3 Groundwater

At present, there is a groundwater report prepared by the Planning Branch of the Water Resources Division on this area. Based on the well logs and groundwater availability maps, groundwater bearing formations or aquifers are formed by surficial deposit (extensive sand and gravel or lenses of sand and gravel) and the Precambrian bedrock aquifer. In the vicinity of our proposed site, the aquifers in this area are the sand and gravel lenses and the granitic bedrock with fractures. The Whiteshell Colony is drawing their water from an aquifer at a depth of 18.9 m to 20.7 m. In addition, any sand and gravel deposits, which are laid down directly on the carbonate rock, are hydraulically connected to the fractures and included in the bedrock aquifer. The yield usually is minor to adequate (about 0.013 to 0.9 litres per second). Water quality in the bedrock aquifer ranges from poor to excellent potable water.

The proposed site is not in a groundwater hazard area.

4.2 SUMMARY OF PROPOSED DEVELOPMENT

The proposed development consists of the construction involved in installing a pipe and gate valve into the existing north dyke of the secondary cell along with a fence and any erosion control measures necessary. The existing lagoon is situated adjacent to an existing ravine and therefore, no ditching should be required as part of this development.

4.2.1 Construction Details

Several tasks must be completed before beginning construction. After the secondary cell contents have passed the testing requirements, the effluent should be applied to the land according to the procedures and limitations specified in the terms of the existing Licence. The installation of a 150 mm (diameter) PVC discharge pipe complete with gate valve will occur after complete discharging of the secondary cell and when conditions permit.

Directional drilling is the recommended installation for the new pipe. Before the pipe is inserted, a bentonite slurry should be applied to the exterior of the pipe to provide adequate sealing. Alternatively, the entire dyke may be excavated for the installation. Any disturbance or excavation of the dyke must be repaired and re-compacted to 95% of the Standard Proctor Maximum Dry Density.

Rip rap is proposed for the inlet and outlet areas of the inter-cell piping.

A fence surrounding the lagoon has yet to be constructed and is scheduled to be part of these proposed construction activities.

5.0 ENVIRONMENTAL IMPACTS

5.1 ODOUR CONSIDERATIONS

The only time of the year that some minor odours may be present is during the spring while the ice thaws. During the winter, ice cover largely prevents free oxygen from entering the water. This condition leads to the production of hydrogen sulphide gas (H_2S) during the winter by bacteria that do not require free oxygen. These accumulated gases dissipate quickly into the atmosphere when the ice breaks and the pond returns to a non-odorous condition.

The closest residence (Colony) to the existing lagoon is located approximately 265 metres away. No neighboring residence is within the minimum setback distance of 300 metres.

5.2 LAND IMPACT

Construction activities are limited to the existing lagoon area. Natural native land and habitat is not being disturbed by the proposed development.

5.3 SURFACE WATER

If approved, treated effluent will be discharged by one of two ways: injection into agricultural land or by gravity flow into the existing ravine. When the effluent is injected into the Colony's agricultural land, surface water should not be impacted. When effluent will be discharged into the existing treed and well vegetated ravine, it will flow over 300 metres before reaching the Whitemouth River.

Of note, it would appear that the community of Whitemouth, located approximately 10 km south of Whiteshell Colony also discharges to the Whitemouth River.

The Whiteshell Colony and lagoon are located in the Lower Whitemouth River Watershed (No. 83).

The Water Licensing Branch of Manitoba Water Stewardship was consulted to provide a list of water users along the Whitemouth River from the discharge point up to its confluence with

the Winnipeg River. There are no active licensed water users on the discharge route. Correspondence is included in Appendix E.

5.3.1 Fuel Storage on Site

The proposed facility does not require the onsite storage of gasoline or diesel fuel. During construction and upgrading, the contractor will be required to ensure that all equipment is properly maintained to prevent leaks and spills of fuel and motor fluids. Refuelling of equipment will not be within 100 metres of a water body, stream or wetland.

5.4 GROUNDWATER

The lagoon development and the discharge route are not within a groundwater pollution hazard area, based on the Selkirk Area map. Groundwater flow at the site is expected to be to the west towards the Whitemouth River. No groundwater monitoring is proposed for the existing site. See section 4.1.3 for further information.

The design of the existing lagoon complies with Manitoba Conservation guidelines and will sufficiently contain the influent wastewater. The treated effluent intended for discharge will comply with the parameters listed in the new Environment Act Licence.

5.5 SPECIES IMPACT

A file search with the Biodiversity Conservation Wildlife and Ecosystem Protection Branch of Manitoba Conservation resulted in no occurrences found near the development site. Correspondence is included in Appendix E.

5.6 FISHERIES

When discharged by gravity flow, the treated effluent will flow into an existing ravine that connects to the Whitemouth River (Figure 2.2). According to Fisheries and Oceans Canada (DFO) the identified ravine would be type E habitat (indirect fish habitat), but it becomes type A (complex habitat, with indicators present) in the Whitemouth River. Correspondence is included in Appendix E. DFO also noted that the Whitemouth River is home to the Carmine Shiner, a species at risk, which spawns from May 15 to July 15. According to a DFO factsheet on the Carmine Shiner available at:

http://www.dfo-mpo.gc.ca/species-especes/species-especes/pdf/carmine_shiner-tete_carmin-eng.pdf

> *This species may be threatened by activities that alter turbidity, flow and/or substrate such as channelization, impoundment, drainage that increases sediment loading, streambed gravel removal and shoreline development. It has a narrow range of habitat requirements and may respond quickly to changes in habitat and water quality. During the past century, impoundments that have increased turbidity and decreased riffle habitat may have caused a decline in the abundance of this fish in the Winnipeg River system. Species introductions and bait harvesting may also pose a threat.*

We would argue that the release of treated effluent from the Whiteshell Colony lagoon to the Whitemouth River does not contribute to any of the activities that threaten the Carmine Shriner. The treated effluent discharged to the Whitemouth River will not alter the turbidity, flow, sediment loading or water quality in any appreciable way. Environment Canada hydrometric data was consulted for the Whitemouth River. Station 05PH003 located on Whitemouth River near Whitemouth has historical data from 1942-2011. Over this time period, the monthly mean average for flow in June is 32.9 cubic metres per second (m^3/s) or 32,900 litres per second (L/s). The monthly minimum flow in June over this same 70-year period was 0.304 m^3/s or 304 L/s, which incidentally occurred in 1988. The Whiteshell Colony secondary cell contains a storage volume of 3,268 m^3. If this discharge were to occur over a minimum two week period as we propose, the expected flow would be 0.0027 m^3/s or 2.7 L/s. To put this into the context of the mean and minimum flows experienced in the Whitemouth River, the Whiteshell Colony treated effluent would be 0.0082% and 0.9% of the flow respectively. Further, even though the minimum flow in the Whitemouth River (in the last 70 years) is used for comparison, it would be expected that conditions would be very dry in these cases and the Colony would naturally discharge by injection during these times of low flow. Adding the treated effluent at a flow of this rate into a river with a mean average over 12,000 times greater should not threaten any of the fish species present. Therefore, we propose the implementation of a surface watercourse discharge period from June 15th – October 31st.

5.6.1 Fisheries Act Information

As noted from Fisheries and Oceans Canada (DFO), the deposit of deleterious substances into water frequented by fish is prohibited under the *Fisheries Act*. In addition, according to subsection 35(1) of the *Fisheries Act*, "no person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat."

5.7 FORESTRY

There is no known forestry activity in or near the development area.

5.8 HERITAGE RESOURCES

In a letter received August 22, 2013 from the Historic Resources Branch (Appendix E), it was stated that no areas of potential concern were found regarding heritage resourses for this project.

5.9 SOCIO-ECONOMIC IMPACTS

The project involves very little construction and the socio-economic impacts are believed to be negligible.

5.10 PUBLIC INVOLVEMENT

Comments from concerned members of the public will be solicited as part of Manitoba Conservation review prior to issuing a licence.

6.0 MANAGEMENT PRACTICE

The existing lagoon facility was designed to provide wastewater treatment and storage capacity for the Whiteshell Colony. The existing lagoon was constructed to treat wastewater up to an average loading of 16.2 kg-BOD_5/d and provide storage up to 5,005 m^3 for 227 days. The facility will normally discharge in spring after May 15th if by injection or after June 15th if by gravity flow. The lagoon will again be discharged in the fall prior to the respective dates for irrigation or surface watercourse discharge. When discharged to surface watercourse, the average two-week flow is expected to be 2.7 L/s, with a maximum discharge of 3,268 m^3.

Manitoba Conservation generally requires treated effluent to have a BOD_5 < 25 mg/L, fecal coliform MPN of <200 organisms/100 mL, and total coliform MPN <1500 organisms/100 mL. The proposed facility should not have difficulty meeting these requirements. We anticipate that the continued implementation of irrigation (injection) and proposed implementation of trickle discharge will satisfy the requirements of a demonstrated nutrient reduction strategy for facilities servicing under 2,000 people and the Colony will not be required to meet the 1 mg/L phosphorus limit in the secondary cell.

6.1 DISCHARGE PROCEDURE

1) Manipulate the valve to isolate the secondary storage cell at least two weeks before collecting the BOD_5, bacteriological, and any other samples required in the new Environment Act Licence.

2) Sample the isolated secondary cell. Allow at least one week to analyse the sample(s), plus shipment time.

3) If wastewater effluent quality meets licence requirements the effluent can be discharged. If wastewater effluent quality does not meet licence requirements, continue re-testing until they meet the requirements. Further discharge requirements may be instituted in the new Environment Act Licence that should be satisfied prior to discharge.

4) While discharging, the valve between the primary cell and the secondary cell remains closed to prevent additional liquid from transferring into the discharging secondary cell.

5) Once the secondary cell is discharged, reopen the valve between the primary cell and the secondary cell. This will allow the water levels in the cells to equalize. In many cases a sufficient amount of treated effluent is discharged from the secondary cell using this procedure to permit operation until the next scheduled discharge period. However, it may be necessary to discharge additional treated effluent to have enough storage for the wastewater flows in the following operational year.

6) If further discharging is necessary, repeat the isolation, testing and discharge process.

6.2 RECORD KEEPING AND INSPECTION ROUTINE

A record book, organized in five sections, should be maintained:

1) Daily Records – If available, pumping records for the lift station should be collected and retained for future estimation of flows to the wastewater treatment facility, i.e. elapsed time meter readings on the lift station pumps or flow meter.
2) Weekly Records - The weekly summer inspection would consist of recording the following: water level, presence of odours and their source, and presence of floating objects (removal). The summer maintenance should also include grass cutting on the dykes, if necessary, elimination of emergent vegetation, extermination of burrowing animals, repair of the dykes and rip rap if damaged by wind erosion and wave action, repair of the fence and gate.
3) Periodic Winter Inspection is confined to inspecting for frozen piping, checking if the water level in the cells is as it should be.
4) Discharge Records - The records should contain all treated effluent quality analyses, dates of discharge, discharge procedure followed, water levels and other pertinent data.
5) Service Records - The lift station pumps should be serviced according to the manufacturer's instructions.

7.0 SCHEDULE

It is anticipated that the Environment Act Licence process will be finalized by the spring of 2014 and construction will begin in the summer of 2014.

8.0 FUNDING

The construction project is to be funded primarily by the Whiteshell Colony. The Colony will pursue any and all applicable funding sources for this project.

Submitted by:
GENIVAR

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Environmental Engineer

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