ENVIRONMENT ACT PROPOSAL

R.M. OF MINIOTA

WASTEWATER STABILIZATION POND EXPANSION

Prepared for:

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Project No: 131-16657-00

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0.0 EXECUTIVE SUMMARY

WSP (formerly GENIVAR) was retained by the R.M. of Miniota to complete an assessment for the Miniota wastewater treatment lagoon in 2012. Following this assessment and upon selection of a plan for expansion, the R.M. of Miniota together with the Manitoba Water Services Board (MWSB) desired to move forward without delay to the preparation and submission of this EAP report.

The existing wastewater stabilization pond, “lagoon”, is located south and west of the Community of Miniota and consists of one primary (treatment) cell and one secondary (storage) cell, receiving wastewater from a gravity sewer system within the Community. Considering the existing capacities of the lagoon and the anticipated growth within the Community and potential contributors within the Municipality, expansion of the existing wastewater facility is required.

It is recommended to expand the existing primary cell and construct one additional secondary cell. The proposed expansion will be constructed with reworked 1.0 m surface clay liners based on the recommendations of the Geotechnical Report. The discharge route essentially remains unchanged. Major design appurtenances include a perimeter fence, valves, piping, rip rap and lagoon signage.

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

1.0 DEVELOPMENT INFORMATION

R.M. of Miniota – Wastewater Stabilization Pond Expansion
Name of development

R.M. of Miniota
Legal name of the proponent of the development

NE 25-13-27 WPM
Location of development

Contact Person for Proponent:

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Winnipeg, Manitoba R3T 6B8

Proposal Contents:

Section of Environmental Act Proposal Form		Section Number in Report
DESCRIPTION OF DEVELOPMENT:		
(i)	Legal description and map of development	2.1
(ii)	Mineral rights	2.2
(iii)	Existing land use	2.3
(iv)	Land use designation	2.3
(v)	Previous studies	2.4
(vi)	Proposed development	5.0
(vii)	Storage of gasoline or associated products	6.3.1
(viii)	Potential impacts	6.0
(ix)	Proposed environmental management	7.0
SCHEDULE:		8.0
FUNDING:		8.0

1.1 CANADIAN ENVIRONMENTAL ASSESSMENT INFORMATION

TABLE 1.1: CEAA PROPOSAL CONTENTS

Screening Report Outline		Section Number in Report
1.	Assessment Responsibility - Funding	8.0
2.	Project Description	
	2.1 General	2.0, 4.0, 5.0
	2.2 Project Components	5.2
	2.3 Construction Details	5.2.5
	2.4 Project Scoping	4.0
3.	Description of Environment	
	3.1 Land Uses and Ownership	2.1, 2.2, 2.3
	3.2 Local Soils, Topography, Geology	5.1
	3.3 Hydrology / Hydrogeology	6.3, 6.4
	3.4 Vegetation Communities	6.5
	3.5 Fish, Wildlife, and Habitat	6.5, 6.6, 6.7
	3.6 Endangered or Threatened Species	6.5
	3.7 Historic and Cultural Sites	6.8
4.	Environmental Impacts and Mitigation	
	4.1 Water Quality	6.3
	4.2 Odour	6.1
	4.3 Fisheries	6.3, 6.6
	4.4 Wetland / Wildlife Habitat	6.3
	4.5 Soils and Vegetation	6.2, 6.5
	4.6 Heritage Resources	6.8
	4.7 Navigable Waters	6.3
5.	Cumulative Effects	6.0
6.	Public Involvement	6.10
7.	Follow-Up	7.0
8.	Contacts	1.0
9.	Personal Communication	Appendix F
10.	Attachments	Appendix A, B, C, D, E, F, G

2.0 DESCRIPTION OF DEVELOPMENT

2.1 LEGAL DESCRIPTION AND OWNERSHIP

The existing lagoon is located in the northeast (NE) quarter of Section 25-13-27 WPM. The R.M. of Miniota is the registered owner of the existing lagoon land, as identified in Status of Title No. 1971354/5. Specifically, this area of ownership is Lot 1, Plan 41952 Neepawa Land Titles Office (NLTO).

The new development is to be located to the east and south of the existing lagoon facility in the same quarter section (NE 25-13-27 WPM), as shown in Figure 2.1. According to Status of Title No. 2062082/5, Robert and Deborah Fenty are the registered owners of the land proposed for development east of the existing lagoon in Parcel 4, Plan 5141 NLTO. According to Status of Title No. 1971356/5, Stanley and Bonnie Bryant are the registered owners of the land proposed for development south of the existing lagoon. Ownership purchase and transfer to the R.M. of Miniota for these pieces of land is underway and both signed Offers to Purchase are included in Appendix A. All aforementioned Status of Titles are included in Appendix B.

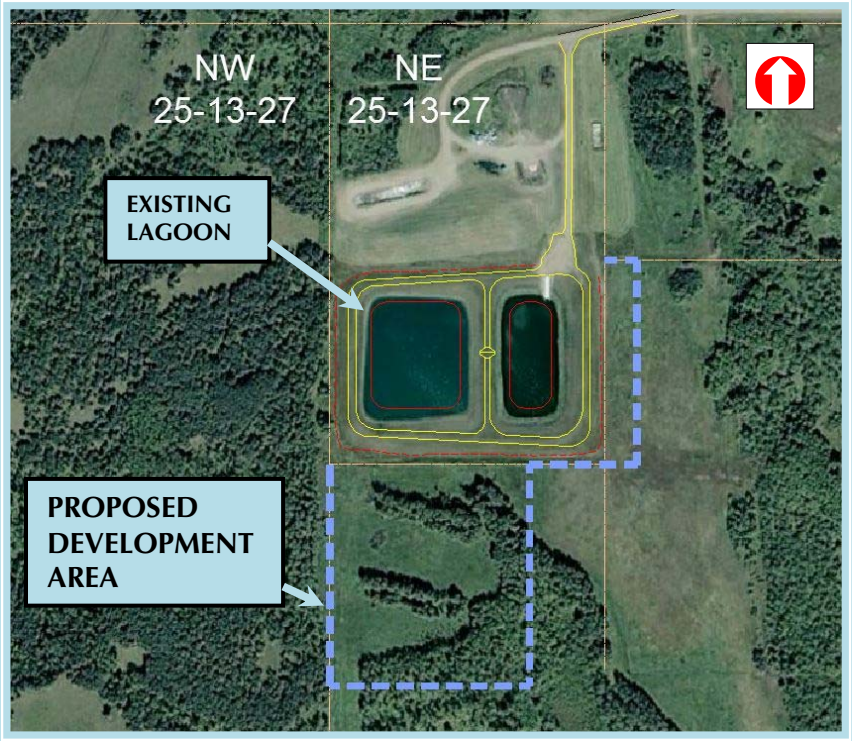

Figure 2.1: Location map of the existing and proposed development

2.2 MINERAL RIGHTS

The Crown Lands and Property Agency – Lands Branch and the R.M. of Miniota were contacted to provide information on the Mines & Minerals and Sand & Gravel ownership of the applicable lands discussed in the previous section. This correspondence is included in Appendix F. The R.M. of Miniota currently owns the Mines & Minerals and Sand & Gravel for their existing land, the Fenty's land and the Bryant's land as well.

2.3 DESCRIPTION OF EXISTING LAND USE

Through information provided by the R.M. of Miniota, the existing lagoon land and the land intended for lagoon development are zoned as "R80" – AG – Agriculture. A Conditional Use Order was obtained for the original construction (2005) and another is in process for the development area. With the exception of the land to the north which is utilized for solid waste disposal, the land surrounding the lagoon is grassland and treed and supports livestock grazing. The *Rural Municipality of Miniota Information Bulletin 98-13 – Soils and Terrain* identifies the land use as "Trees" and "Grassland".

2.4 PREVIOUS STUDIES

2013 *Geotechnical Report: "Proposed RM of Miniota WWSP Expansion"* prepared by GENIVAR (now WSP) for the *RM of Miniota*

This report provides a detailed geotechnical investigation of the proposed development site conducted by GENIVAR on May 30, 2013. The investigation included testhole drilling, sample collection and laboratory testing. The report concluded that based on soil conditions, the proposed expansion should be constructed with a 1-meter surface clay liner.

2012 *"Miniota Lagoon Capacity Review" Letter Report prepared* by GENIVAR (now WSP) for the *R.M. of Miniota*

This letter report reviews the background information in the 2002 Environment Act Proposal report and the 2005 lagoon construction documentation and identifies the existing capacities. The report concludes with recommendations to increase the hydraulic capacity for the existing and future loadings.

2002 Environment Act Proposal: *"Proposed Wastewater Treatment Lagoon – Village of Miniota"* prepared by Cochrane Engineering Ltd. (now WSP) for the *R.M. of Miniota*

This report outlines the proposed construction of the now existing lagoon to replace an older lagoon.

3.0 EXISTING WASTEWATER STABILIZATION POND

3.1 DESCRIPTION

The existing licence directing lagoon operation is Environment Act Licence No. 2598, dated April 16, 2003. The lagoon was constructed in 2005 to replace an older lagoon facility. The licence is attached in Appendix C.

The existing wastewater stabilization pond is located south and west of the Community of Miniota and consists of one primary cell and one secondary cell. The facility receives wastewater from a gravity sewer collection system in the Community, which also flows by gravity sewer to the lagoon.

The Miniota lagoon is the designated municipal lagoon to receive truck hauled wastewater and septage from the surrounding communities, halls and rural subdivisions, etc. In the previous design, Manitoba Conservation and Water Stewardship required the R.M. of Miniota to reserve capacity for other RM contributors. In practice, these loads are not currently ending up at the municipal lagoon.

3.2 EXISTING CAPACITY

The existing lagoon consists of one primary cell and one secondary cell. Information regarding the actual dimensions and elevations of the existing lagoon was based on a combination of the 2005 As Constructed drawings and data from a 2013 WSP (formerly GENIVAR) topographical survey.

The primary cell provides treatment to the incoming piped and trucked wastewater and was sized based on the calculated organic loading to the cell. 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.

Table 3.1 provides the details of the existing primary cell based on the 2005 As Constructed drawings.

TABLE 3.1: SPECIFICATIONS FOR THE EXISTING PRIMARY CELL

Parameter	Existing Primary Cell
Cell bottom	32.0 m x 82.4 m
Liquid surface (at full design depth)	44.0 m x 94.4 m
Operating depth	1.5 m
Freeboard height	1.0 m (min.)
Interior side slope	4:1±
Total volume (at operating depth)	5,056 m^3
Storage volume	2,528 m^3
Surface area (at operating depth)	0.415 ha
Liner system	Clay

The primary cell has a treatment capacity of (0.415 ha x 56 kg-BOD_5/d =) **23.2 kg-BOD_5/d**

The secondary cell is designed to provide the balance of the storage capacity necessary to store the incoming wastewater. 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. 2598 requires a 227-day storage period.

Table 3.2 provides the details of the existing secondary cell based on the 2005 As Constructed drawings.

The lagoon, as it currently operates, provides a storage volume of (2,528 + 6,770 =) **9,298 cubic metres (m^3)**.

TABLE 3.2: SPECIFICATIONS FOR THE EXISTING SECONDARY CELL

Parameter	Existing Secondary Cell
Cell bottom	69.3 m x 82.4 m
Liquid surface (at full design depth)	81.3 m x 94.4 m
Operating depth	1.5 m
Freeboard height	1.0 m (min.)
Interior side slope	4:1 – 5:1
Total volume (at operating depth)	10,002 m^3
Dead storage depth	**0.535 m**
Dead storage volume (at **0.535 m** depth)	3,232 m^3
Storage volume (at operating depth)	6,770 m^3
Liner system	Clay

3.3 EFFLUENT QUALITY AND DISCHARGE ROUTE

The existing discharge route will remain unchanged and the new secondary cell discharge pipe will be tied into the existing discharge pipe. From the existing secondary cell the effluent is discharged through an underground pipe that heads south and empties into a natural drainage channel of the Assiniboine River. To meet the requirements of the *Water Quality Standards, Objectives and Guidelines Regulation* under *The Water Protection Act (2011)*, the R.M. of Miniota (for the Miniota lagoon) will implement a nutrient reduction strategy consisting of trickle discharge. We propose to utilize the existing discharge route which entails connecting into the existing 560 metre long buried discharge pipe. As mentioned, the pipe discharges into approximately 1.0 kilometre of natural drainage channel before it reaches the Assiniboine River. The lagoon secondary cells will be trickle discharged during the spring (after June 15) and the fall (before October 31) periods.

The RM is presently working with the Upper Assiniboine River Conservation District and Manitoba Conservation and Water Stewardship on a pilot project to discharge the lagoon by irrigation in order to reduce nutrient loading to the Assiniboine Basin upstream of Brandon.

The discharge route is illustrated in Figure 3.1.

The existing and proposed lagoon facility is in the Minnewasta Creek and Adjacent Area Watershed (No. 74).

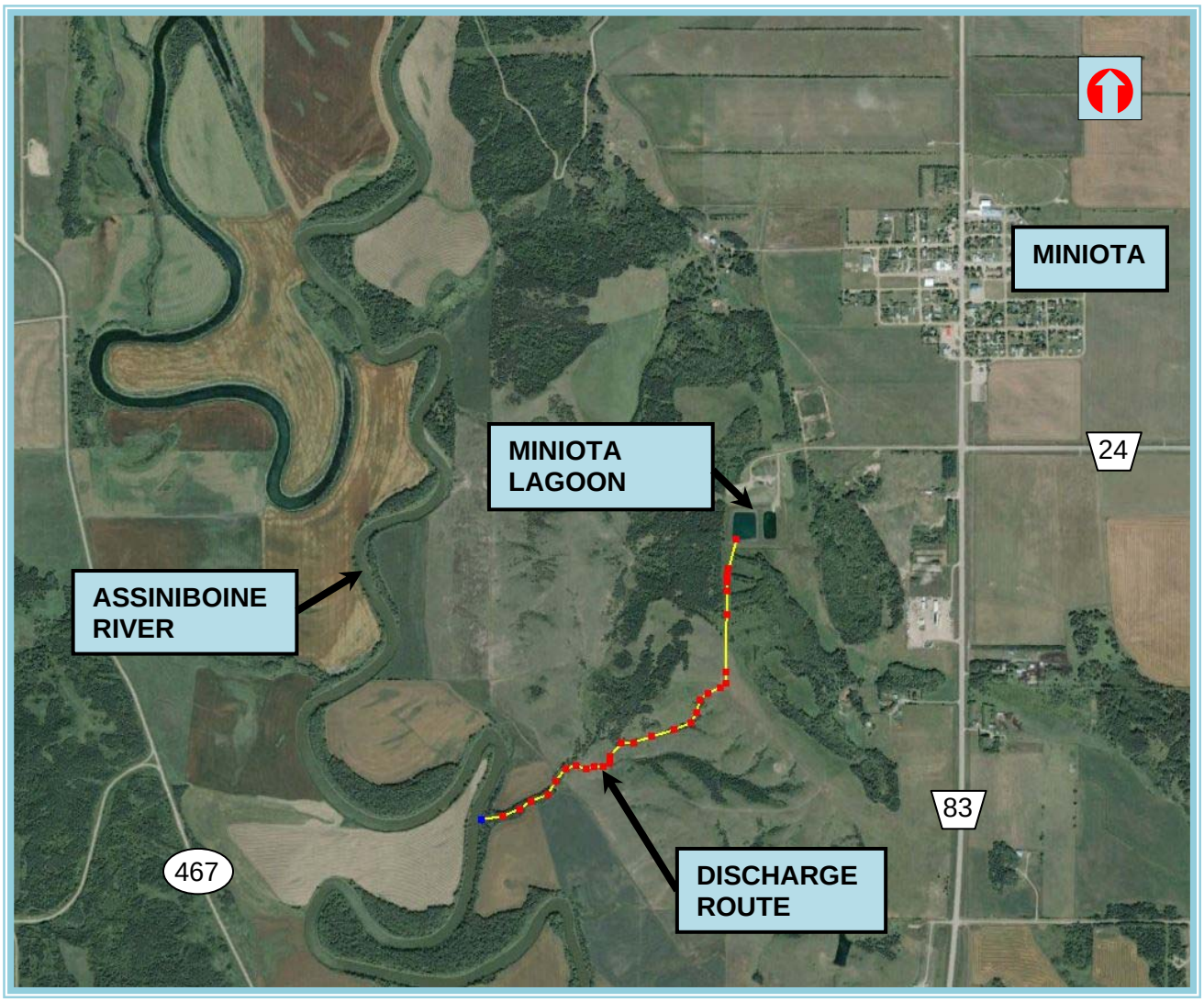

Figure 3.1: Effluent discharge route from the Miniota wastewater treatment lagoon

4.0 POPULATION SERVICED AND DESIGN LOADING

4.1 SOURCES OF WASTEWATER

The R.M. of Miniota lagoon primarily receives wastewater via gravity sewer from the Community of Miniota. In the previous lagoon construction completed in 2005, Manitoba Conservation and Water Stewardship required the R.M. of Miniota to reserve capacity for other RM contributors. In practice, these loads are not ending up at the municipal lagoon; however, it is prudent to expect that Manitoba Conservation will require a similar standard for any expansion.

The proposed wastewater loading includes all existing and potential sources as identified below:

- Community of Miniota (gravity sewer)
- Surrounding communities (septic tanks)
- Rural subdivisions less than 10 acres (septic tanks)
- Miniota Golf Course (holding tanks)
- Community halls – Beulah, Isabella, Arrow River (holding tanks)
- Hooper's Lake Campground (holding tanks)
- Miniota business (septic tank)

4.2 ASSESSMENT DETAILS

As typical, a 20-year projection is used to evaluate design populations and corresponding loadings from all contributing wastewater sources. Prior to the discussion of wastewater loading, the following approximations and assumptions are first outlined for the calculations used in assessing the wastewater loadings.

<u>Community of Miniota</u>

According to the R.M. of Miniota, the current population within the Community of Miniota is 239. In addition, the Community serves 28 bussed-in students. In calculating wastewater flow for these students, we use a ratio of 3:1 (3 bussed-in students are equivalent to 1 person in a dwelling), which totals 9 equivalent people. The **total equivalent population currently** serviced by the Miniota lagoon is **248**.

On the basis of accepted practice, the daily BOD_5 production (i.e. the organic loading) for piped domestic wastewater is 0.077 kg per person, which applies to the Community of Miniota.

In order to assess the hydraulic loading to the lagoon from the Community of Miniota, the lagoon depths were recently monitored. From this monitoring, WSP determined the wastewater generation range to be from 224-268 litres per person per day (L/c/d). It was decided to use 275 L/c/d as a conservative "upper limit" for the wastewater generation attributed to the Community of Miniota.

Surrounding Communities

The communities of Arrow River (20 people), Beulah (21 people), Crandall (10 people) and Isabella (4 people) have a total population of **55 people**.

According to *Statistics Canada*, the R.M. of Miniota population for the 2011 Census was 871. There are no individual community population breakdowns provided by Statistics Canada within the municipality. However, based on the Private dwellings occupied by usual residents, the municipality's persons per dwelling statistic is approximately 2.7. Based on the *Statistics Canada* information these communities would have approximately **21** homes in total, all of which are assumed to have septic tanks.

Rural Subdivisions

The rural subdivisions of less than 10 acres in size within the Municipality are also potential contributors to the Miniota lagoon facility. In total, there are 23 parcelled lots with **23** homes (or potential homes), all of which are assumed to have septic tanks.

Community Halls

There are community halls in Arrow River, Beulah and Isabella. The Arrow River hall is used very infrequently, but the Beulah and Isabella halls are utilized multiple times throughout the year. These halls each have a 1,000 Imperial gallon (Igal) or 4,550 litre (L) holding tank. We have assumed a wastewater strength of 400 mg-BOD_5/L for these holding tanks. The Beulah and Isabella holding tanks are each emptied 5-6 times per year.

Miniota Golf Course

The Miniota Golf Club is located southeast of Miniota and typically operates from May to the end of September. Based on information provided by the RM and local truck hauler, the Club's holding tank is 1,500 Igal (6,820 L) and is emptied approximately 10 times per year. We have assumed a wastewater strength of 400 mg-BOD_5/L for this holding tank.

The lagoon storage period is from November 1 – June 15 (227-days) and the discharge (non-storage) period is from June 16 – October 31 (138 days). These truck-hauled loads were divided up with 2 loads emptied during the lagoon storage period and 8 loads emptied during the non-storage period.

Campground

Hooper's Lake campground is located northwest of Beulah and typically operates from May to the end of September. Based on information provided by the RM and local truck hauler, the campground has holding tanks and approximately 2,000 Igal (9,100 L) are emptied during the non-storage period. Since the campground does not have water facilities, the wastewater would be considered high strength, which we have assumed to be 4,000 mg-BOD_5/L.

Miniota Business

There is a single business in Miniota that is not connected to the gravity sewer system. The business operates year-round with a septic tank that is emptied approximately 2 times per year.

Septic Tanks

In the rural areas, septic tank emptying (septage) relies on certain assumptions to determine its loading effects. The following calculations outline the methodology used in estimating the septage loading. Presumably, each household has one septic tank. It is estimated that approximately 75% of the total number of septic tanks are emptied in any given year. Typically, the peak septic tank emptying occurs within a 45-day period in the fall months. Essentially, in this time period, the septic tank systems will contribute the highest volume and therefore the greatest BOD_5 loading to a treatment system. It is estimated that

approximately 55% of tanks that are emptied in a year will be emptied into the facility during this peak period. In general, the average volume discharged during a single septic tank emptying is 2,725 L (600 Imperial gallons or Igal) and the average organic load contribution per tank was calculated to be 12 kg-BOD_5 (4,400 mg-BOD_5/L).

Holding Tanks

The holding tanks in the R.M. of Miniota all service businesses or community halls and not individual residences. Therefore our typical assumptions which we apply to holding tanks that service individual residences are not applicable. The R.M. of Miniota provided information on the size of the tanks and the approximate time periods over which these tanks are emptied.

4.3 WASTEWATER LOADING – CURRENT

As mentioned, the existing lagoon was sized to receive loadings from other parts of the Municipality, which in reality are not actually being hauled to this facility. The *current* wastewater loading presents the actual loading to the lagoon, which essentially is the Community of Miniota, with a very small component from the surrounding communities.

Community of Miniota

As presented in Section 4.2 the total equivalent population for the Community of Miniota is 248. With a *current* equivalent population of 248 (including bussed-in students), the *current* organic loading to the existing Miniota lagoon is **19.1 kg-BOD_5/d**.

The *current* hydraulic loading over the 227-day lagoon storage period is **15,481 m^3**.

Surrounding Communities

For septic hauling, we focus on a 45-day period in the fall months when the peak septic tank emptying occurs. For the *current* loading, we have allowed for one tank during this period which equates to **0.3 kg-BOD_5/d**.

The hydraulic loading attributed to this tank occurs outside of the lagoon storage period and therefore the hydraulic loading is nil.

A summary table of the *current* and *proposed* loading is included in **Section 4.5**.

4.4 WASTEWATER LOADING – PROPOSED

The *proposed* wastewater loading includes all of the existing and potential wastewater sources within the municipality as identified by the R.M. of Miniota.

Community of Miniota

According to the R.M. of Miniota, the 20-year design population for the Community of Miniota lagoon expansion is 375 people, which includes bussed-in-students.

With a *proposed* equivalent population of 375, the *proposed* organic loading to the existing Miniota lagoon is **28.9 kg-BOD_5/d**.

The *proposed* hydraulic loading over the 227-day lagoon storage period is **23,409 m^3**.

Surrounding Communities

As discussed in Section 4.2 these communities would have approximately 21 homes in total, all of which are assumed to have septic tanks.

From the assessment details, 16 of the 21 septic tanks (~75%) are emptied in any given year and approximately 9 of those 16 (~55%) will be emptied into the lagoon facility during the 45-day peak period in the fall months. The wastewater strength of each tank is approximately 12-kg-BOD_5 for a *proposed* loading of **2.4 kg-BOD_5/d**.

The hydraulic loading attributed to these tanks essentially occurs outside of the lagoon storage period and therefore the hydraulic loading is nil or negligible.

Rural Subdivisions

As discussed in Section 4.2, there are 23 parcelled lots with 23 homes (or potential homes), all of which are assumed to have septic tanks.

From the assessment details, 17 of the 21 septic tanks (~75%) are emptied in any given year and approximately 9 of those 17 (~55%) will be emptied into the lagoon facility during

the 45-day peak period in the fall months. The wastewater strength of each tank is approximately 12-kg-BOD_5 for a *proposed* loading of **2.4 kg-BOD_5/d**.

The hydraulic loading attributed to these tanks essentially occurs outside of the lagoon storage period and therefore the hydraulic loading is nil or negligible.

Community Halls

There are community halls in Arrow River, Beulah and Isabella. The Arrow River hall is used very infrequently, but the Beulah and Isabella halls are utilized multiple times throughout the year. These halls each have a 1,000 Imperial gallon (Igal) or 4,550 litre (L) holding tank. We have assumed a wastewater strength of 400 mg-BOD_5/L for these holding tanks. The Beulah and Isabella holding tanks are each emptied 5-6 times per year.

The lagoon storage period is from November 1 – June 15 (227-days) and the discharge (non-storage) period is from June 16 – October 31 (138 days). These truck-hauled loads were divided up with 7 loads emptied during the lagoon storage period and 5 loads emptied during the non-storage period.

The organic loading during the non-storage period is most of interest, because it overlaps with the 45-day peak septic hauling period in the fall months. Over the course of the non-storage period the *proposed* organic loading is **0.1 kg-BOD_5/d**.

The hydraulic loading is most of interest during the storage period. Over the course of this period, the *proposed* hydraulic loading is **32 m^3**.

Miniota Golf Course

The Miniota Golf Club is located southeast of Miniota and typically operates from May to the end of September. Based on information provided by the RM and local truck hauler, the Club's holding tank is 1,500 Igal (6,820 L) and is emptied approximately 10 times per year. We have assumed a wastewater strength of 400 mg-BOD_5/L for this holding tank.

The lagoon storage period is from November 1 – June 15 (227-days) and the discharge (non-storage) period is from June 16 – October 31 (138 days). These truck-hauled loads

were divided up with 2 loads emptied during the lagoon storage period and 8 loads emptied during the non-storage period.

The organic loading during the non-storage period is most of interest, because it overlaps with the 45-day peak septic hauling period in the fall months. Over the course of the golf club's operation during the non-storage period, the *proposed* organic loading is **0.2 kg-BOD_5/d**.

The hydraulic loading is most of interest during the storage period. Over the course of this period, the *proposed* hydraulic loading is **14 m^3**.

Campground

Hooper's Lake campground is located northwest of Beulah and typically operates from May to the end of September. Based on information provided by the RM and local truck hauler, the campground has holding tanks and approximately 2,000 Igal (9,100 L) are emptied during the non-storage period. Since the campground does not have water facilities, the wastewater would be considered high strength, which we have assumed to be 4,000 mg-BOD_5/L.

Over the course of the campground's operation during the non-storage period, the *proposed* organic loading is **0.3 kg-BOD_5/d**.

The hauling attributed to this business occurs outside of the lagoon storage period and therefore the hydraulic loading is nil.

Miniota Business

There is a single business in Miniota that is not connected to the gravity sewer system. The business operates year-round with a septic tank that is emptied approximately 2 times per year.

We will assume that the loads are hauled during the non-storage period and that one of the loads occurs during the 45-day peak hauling period for septic tanks. The wastewater

strength of each tank is approximately 12-kg-BOD_5 for a *proposed* loading of **0.3 kg-BOD_5/d**.

The hydraulic loading attributed to these tanks essentially occurs outside of the lagoon storage period and therefore the hydraulic loading is nil or negligible.

A summary table of the *current* and *proposed* loading is included in **Section 4.5**.

4.5 WASTEWATER LOADING – SUMMARY

Table 4.1 summarizes the *current* and *proposed* loading to the Miniota lagoon.

TABLE 4.1: SUMMARY OF LOADINGS TO THE MINIOTA LAGOON

Source	Current Loading		Proposed Loading (20-year design)	
	Organic [kg-BOD_5/d]	Hydraulic [m^3]	Organic [kg-BOD_5/d]	Hydraulic [m^3]
Miniota	19.1	15,481	28.9	23,409
Surrounding Communities	0.3	-	2.4	-
Rural subdivisions	-	-	2.4	-
Community halls	-	-	0.1	32
Miniota golf course	-	-	0.2	14
Campground	-	-	0.3	-
Miniota business	-	-	0.3	-
Total	**19.4**	**15,481**	**34.6**	**23,455**

The totals shown in Table 4.1 will be compared to the existing capacities identified in Section 3.0. As presented in Section 3.0, the existing lagoon has an organic capacity of **23.2 kg-BOD_5/d** and a hydraulic capacity of **9,298 m^3**.

Existing Capacity vs. *Current* Loading

The lagoon is currently operating at approximately 83% of the organic capacity and 166% of the hydraulic capacity. To service the *current* loading, the lagoon requires a storage expansion in the order of 6,183 m^3.

Existing Capacity vs. *Proposed* Loading

When compared to the *proposed* loading data, the lagoon would be operating at approximately 149% of the organic capacity and 252% of the hydraulic capacity. To service the *projected* loading, the existing lagoon requires a treatment expansion of 11.4 kg-BOD_5/d and a storage expansion in the order of 14,157 m^3.

5.0 PROPOSED DEVELOPMENT

Servicing the projected population and potential sources from within the R.M. of Miniota requires both an organic and hydraulic expansion of the existing facility. The proposed development consists of the expansion of the existing primary cell and the construction of one new secondary cell, as illustrated in the design drawings (Appendix E).

5.1 SITE CONDITIONS

On May 30, 2013, WSP (formerly GENIVAR) conducted a geotechnical investigation at the proposed development area during which a drill rig was used to drill a total of sixteen testholes (TH1 to TH16) to a 4.6 m (15.0 ft) depth below grade. The complete Geotechnical Report is included in Appendix D.

5.1.1 Local Topography

The proposed expansion site is located locally on an undulating topography. The topography drops suddenly at the edge of the valley approximately 400 m to the west. The land slopes towards the Assiniboine River which is located approximately 1 km west of the lagoon. Surficial deposits are composed mainly of loamy textured glacial till (morainal) deposits over shale bedrock. Areas of deep sand and gravel glaciofluvial deposits are usually sandy at the surface, becoming coarser with depth. The proposed expansion site is developed on a layer of sand and gravel followed by lacustrine clay over glacial till and followed by grey shale bedrock.

5.1.2 Soil Conditions

The general soil profile revealed a consistent soil profile: a topsoil/peat moss layer of 50 to 750 mm in thickness underlain by an *upper thin clay* over a *sand / sand and gravel* layer followed by a *high plasticity clay* layer which extended to the bottom of the testholes.

Seepage from the *sand / sand and gravel* layer was observed in some of the testholes five minutes after completion of drilling. However, surface seepage beneath the topsoil/peat moss should be expected as some water ponding on the low areas was noted during our investigation.

A detailed description of the soil profile is presented in the attached logs, Appendix B (Geotechnical Report).

5.1.3 Groundwater

Ground Water Pollution Hazard Maps indicate that the subject area is on the edge of a groundwater pollution hazard area. At present, there is a groundwater report (synopsis) prepared by the Planning Branch of the Water Resources Division on this area. Based on this synopsis, groundwater bearing formations or aquifers are formed by surface sand and gravel, lenses of sand and gravel interbedded with glacial till and other surficial deposit (extensive sand and gravel confined to buried bedrock valleys and hard fractured shale bedrock). In the vicinity of our proposed site the main aquifer in this area is *lenses of sand and gravel*. The potential well yield is 0.1 to 1.0 L/s. Water quality ranges from poor to fair potable water.

Based on the drainage map of the area, groundwater flow is towards the west to the Assiniboine River Valley which flows in the south-east direction towards Brandon.

5.1.4 Site Investigation

As classified during our field investigation, the lower clay layer encountered at the site is medium to high plasticity brown clay between 1.2 - 2.7 m depth with the exception of testholes, TH1, TH4 and TH5. At these testholes, the brown clay is encountered between 3.3 - 4.3 m. The hydraulic conductivity of the in-situ massive brown clay at about 1.5 m of TH2 was tested.

The brown clay material is a CL material based on Atterberg limit tests. The estimated hydraulic conductivity of this material, if remoulded or reworked, should range between 10^{-7} to 10^{-9} cm/sec. This estimate is in line with the hydraulic conductivity testing that was performed at the completion of the existing lagoon when it was constructed in 2005. The results were 7.2 $x10^{-9}$ cm/sec and 7.3 $x10^{-9}$ cm/sec.

The hydraulic conductivity of the in-situ clay obtained at 4 m of testhole 2 (TH2) in 2013 was 1.0 $x10^{-7}$ cm/sec. It is important to note that this result was achieved without remoulding or reworking the clay before testing.

Manitoba Conservation and Water Stewardship require a 1.0 m (3.3 ft) clay liner with a hydraulic conductivity of 1.0 $x10^{-7}$ cm/sec or less. Therefore, the clay identified during the investigation would be suitable for use as a liner. The clay used for the liner will be reworked and compacted.

5.2 SUMMARY OF PROPOSED DEVELOPMENT

As presented in Section 4.5, the existing Miniota lagoon is organically and hydraulically undersized for wastewater needs within the Municipality. The proposed development involves:

- expansion of the primary cell 22.0 m to the east
- lowering of the discharge pipe in the existing secondary cell from 0.535 m to 0.3 m
- construction of a new secondary cell to the south of the existing cells

The expansion work is to be completed while the facility remains in operation and will require a temporary diversion of the incoming wastewater into a secondary cell while the primary cell is under construction. A segment of the existing discharge pipe may also require minor relocating depending on the actual limits of the borrow area.

5.2.1 Expanded Primary Cell

The existing Primary Cell will be expanded as illustrated in the design drawings (Appendix E). The cell will be extended to the east with a surface clay liner having a permeability of $1x10^{-7}$ cm/s or less. Based on providing for the 20-year needs within the Municipality, the cell is designed to provide a surface area of 0.623 ha. This surface area equates to a treatment capacity of 34.9 kg-BOD_5/d. The cells will be expanded with 4:1/5:1 interior side slopes and 4:1 exterior side slopes and will have a normal operating depth of 1.5 metres with a minimum 1.0 metre freeboard. Table 5.1 provides the details for the preliminary design specifications for the Expanded Primary Cell.

5.2.2 Existing Secondary Cell

The Existing Secondary Cell will remain unchanged with the exception of lowering the discharge pipe as illustrated in the design drawings (Appendix E). When the cell was constructed, the discharge pipe was installed at an elevation of 0.535 m above the cell bottom. Lowering the discharge pipe to the typical elevation of 0.3 m above the cell bottom

will increase the storage capacity of the cell. Table 5.2 provides the details for the preliminary design specifications for the Existing Secondary Cell.

TABLE 5.1: PRELIMINARY DESIGN SPECIFICATIONS FOR THE EXPANDED PRIMARY CELL

Parameter	**Expanded Primary Cell**
Cell bottom	82.4 m x 54.0 m
Liquid surface (at 1.5 m depth)	94.4 m x 66.0 m
Top of dyke (inside to inside)	varies
Operating depth	1.5 m
Freeboard height	1.0+ m
Interior side slope	4:1/5:1
Exterior side slope	4:1
Total volume (at 1.5 m depth)	7,974 m^3
Storage volume	**3,987 m^3**
Surface area (at operating depth)	**0.623 ha**
Liner system	1.0 m surface clay liner

TABLE 5.2: PRELIMINARY DESIGN SPECIFICATIONS FOR THE EXISTING SECONDARY CELL

Parameter	**Ex. Secondary Cell**
Cell bottom	69.3 m x 82.4 m
Liquid surface (at full design depth)	81.3 m x 94.4 m
Operating depth	1.5 m
Freeboard height	1.0 m (min.)
Interior side slope	4:1 – 5:1
Total volume (at operating depth)	10,002 m^3
Dead storage depth	**0.3 m**
Dead storage volume	**1,768 m^3**
Storage volume (at operating depth)	**8,234 m^3**
Liner system	Clay

5.2.3 Proposed Secondary Cell

A new secondary cell will be constructed to provide the remainder of the required storage, as illustrated in the design drawings (Appendix E). The cell will be designed with a 1.0 m surface clay liner having a permeability of $1x10^{-7}$ cm/s or less. The cell will be constructed with 4:1 interior side slopes and 4:1 exterior side slopes and will have a normal operating depth of 1.5 metres with a minimum 1.0 metre freeboard. Table 5.3 provides the details for the preliminary design specifications for the Proposed Secondary Cell (2).

TABLE 5.3: PRELIMINARY DESIGN SPECIFICATIONS FOR THE PROPOSED SECONDARY CELL

Parameter	Proposed Secondary Cell
Cell bottom	132.0 m x 63.0 m
Liquid surface (at 1.5 m depth)	144.0 m x 75.0 m
Top of dyke (inside to inside)	152.0 m x 83.0 m
Operating depth	1.5 m
Freeboard height	1.0 m
Interior side slope	4:1
Exterior side slope	4:1
Total volume (at 1.5 m depth)	14,300 m^3
Dead storage volume (at 0.3 m depth)	2,566 m^3
Storage volume	**11,734 m^3**
Liner system	1.0 m surface clay liner

If lowering the discharge pipe in the existing secondary cell is found to be impractical, the new secondary cell will be extended approximately 9.0 metres in the east-west dimension to provide a similar level of total lagoon storage.

5.2.4 Summary

After expansion the Miniota lagoon will be a three-cell lagoon. One primary cell will provide adequate treatment and storage for a population of 375 people within the Community of Miniota and for the potential contributors within the RM. Table 5.4 summarizes the expanded lagoon capacities.

TABLE 5.4: EXPANDED WASTEWATER STABILIZATION POND CELL CAPACITIES

Cell Type	Surface Area [ha]	Total Volume [m^3]	Dead Storage Volume [m^3]	Storage Volume [m^3]
Expanded Primary Cell	0.623	7,974	-	3,987
Existing Secondary Cell (1)	0.767	10,002	1,768	8,234
Proposed Secondary Cell (2)	1.080	14,300	2,566	11,734
Total	**2.47**	**32,276**	**4,334**	**23,955**

5.2.5 Construction Details

According to the subsurface profiles in the 2013 Geotechnical Report, the depth of topsoil in the *proposed construction and borrow areas* was approximately 100 mm - 150 mm. Organic soil from the lagoon area will be stockpiled and reapplied at the end of construction on the applicable disturbed areas and on the dykes as shown in the drawings.

For lagoon construction, Manitoba Conservation's Environmental guidelines require that the proposed dykes and bottom of the proposed cell be provided with a layer consisting of at least one metre of soil having a permeability of less than $1x10^{-7}$ cm/s. The proposed expansion location consists where such clay is present. The brown clay material is a CL material with an estimated hydraulic conductivity range between 10^{-7} to 10^{-9} cm/sec, if remoulded or reworked. This estimate is in line with the hydraulic conductivity testing that was performed at the completion of the existing lagoon when it was constructed in 2005. The results were 7.2 $x10^{-9}$ cm/sec and 7.3 $x10^{-9}$ cm/sec.

The hydraulic conductivity of the in-situ clay obtained at 1.5 m (5 ft) of testhole 2 (TH2) in 2013 was 1.0 $x10^{-7}$ cm/sec. It is important to note that this result was achieved without remoulding or reworking the clay before testing.

The new and expanded cells will be constructed as detailed in the drawings. The dykes will be constructed with in-situ material in 150 mm lifts compacted to 95% Standard Proctor

density. The moisture content of the material should be minus two percent to plus 3 percent of optimum moisture as determined by the Standard Proctor test. Any unsuitable material such as course gravel and boulders should be removed. The top of the dykes will be 3.0 m (min.) wide to permit vehicle access to all points of the lagoon. The 1.0 m surface clay liners of the new and expanded cells will be tested and the results of the testing will be reported to Manitoba Conservation.

A perimeter drainage ditch will be constructed around the new cells, if required. Other ditching will be located as shown on the drawings. For disturbed areas where sediment or erosion control is deemed necessary, the contractor will be required to employ appropriate measures.

The discharge pipe from the Proposed Secondary Cell will be connected to the discharge pipeline from the existing Secondary Cell.

The interior dykes will be armoured with rip rap to prevent wave erosion. Rip rap is also proposed for the inlet and outlet areas of the inter-cell and discharge piping, as required. All inter-cell and discharge piping and valves will be located as shown on the design drawings.

6.0 ENVIRONMENTAL IMPACTS

6.1 ODOUR CONSIDERATIONS

It is expected that the expanded facility will operate without causing any significant odour problems. The expanded primary cell is sized to provide treatment for the 20-year design flows with a 56 kg-BOD_5/ha/d loading. 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 to the lagoon is located approximately 600 metres away (to the southeast), which meets the Manitoba Conservation minimum setback distance of 300 metres.

6.2 LAND IMPACT

Through information provided by the R.M. of Miniota, the existing lagoon land and the land intended for lagoon development are zoned “R80” – AG – Agriculture. The land surrounding the lagoon is used for the following:

- North: solid waste disposal ground
- East: grassland and treed area used as pasture land
- South: grassland and treed area used as pasture land
- West: treed area

It will be necessary to clear and grub approximately 1.4 ha of trees in order to construct the Proposed Secondary Cell.

6.3 SURFACE WATER

From the lagoon secondary cells, the treated effluent will flow through a buried discharge pipe that empties into a natural drainage channel of the Assiniboine River. Perimeter ditching will be constructed to provide positive drainage for surface water around the lagoon, if required.

The proposed lagoon facility is in the Minnewasta Creek & Adjacent Area Watershed (No. 74). Figure 3.1 illustrates this discharge route in the specified watershed.

The water licensing branch of Manitoba Conservation and Water Stewardship was consulted to provide a list of water users along the drainage route within approximately 5 kilometres of the discharge point into the Assiniboine River. There were no registered/licensed surface water users. However, there were two licensed groundwater projects in SE 24-13-27 W and SW 30-13-26 W (Appendix F).

6.3.1 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.

6.4 GROUNDWATER

There is a groundwater report (synopsis) prepared by the Planning Branch of the Water Resources Division on this area. Based on this synopsis, groundwater bearing formations or aquifers are formed by surface sand and gravel, lenses of sand and gravel interbedded with glacial till and other surficial deposit (extensive sand and gravel confined to buried bedrock valleys and hard fractured shale bedrock).

The main aquifer in this area is lenses of sand and gravel. The potential well yield is 0.1 to 1.0 L/s. Water quality ranges from poor to fair potable water.

A well drillers log is also available in the same quarter section (NE 25-13-27 WPM) as our development area and is attached in the Geotechnical Report.

A review of the Groundwater Pollution Hazard Map and Flowing and High Water Level Well Map shows that the proposed site is located within the designated groundwater pollution hazard area.

Based on the drainage map of the area, groundwater flow is toward the west to the Assiniboine River Valley which flows in the south-east direction towards Brandon.

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

6.5 SPECIES IMPACT

A file search with the Biodiversity Conservation Wildlife and Ecosystem Protection Branch of Manitoba Conservation resulted in no occurrences in the specified area of NE 25-13-27 WPM. Correspondence is included in Appendix F.

6.6 FISHERIES

According to the 2013 Milani Report, the drainage channel that the buried discharge piped empties into is considered type C habitat (complex habitat, no indicators present), until reaching the type A habitat (complex habitat, indicators present) of the Assiniboine River.

In order to protect any potential fish in the critical springtime spawning season, when effluent un-ionized ammonia tends to be high, the lagoon has been designed to the 227-day storage period. The lagoon currently and will continue to discharge after June 15th and will allow for significant conversion of toxic un-ionized ammonia into relatively benign nitrates.

6.6.1 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.”

6.7 FORESTRY

According to the R.M. of Miniota, there is no known forestry activity within the Municipality.

6.8 HERITAGE RESOURCES

At the time of printing, we had yet to receive a response from Historic Resources Branch. Correspondence will be submitted separately.

6.9 SOCIO-ECONOMIC IMPACTS

The lagoon construction will result in a short-term boost to the construction industry in the area.

6.10 PUBLIC INVOLVEMENT

The R.M. of Miniota held an information meeting on March 5, 2014 to discuss the lagoon expansion with interested residents. In addition, comments from concerned members of the public will be solicited as part of Manitoba Conservation and Water Stewardship review prior to issuing a licence.

7.0 MANAGEMENT PRACTICE

The expanded wastewater treatment lagoon is specifically designed to provide wastewater treatment and storage capacity for the existing and proposed (20-year) infrastructure within the Community of Miniota and the potential contributors from within the RM. The expanded Miniota lagoon is designed to treat wastewater up to an average loading of 34.9 kg-BOD_5/d and store the treated effluent for 227 days. The facility will normally discharge in spring soon after June 15th, and again in fall prior to October 31st. Treated effluent will be discharged from the isolated secondary cell(s). After the new development, the lagoon will consist of one primary and two secondary cells.

Manitoba Conservation and Water Stewardship generally requires treated effluent to have total suspended solids <25 mg/L, BOD_5 <25 mg/L, fecal coliform MPN of <200 organisms/100 mL, total coliform MPN <1500 organisms/100 mL, and chlorine <0.02 mg/L and some nutrients removal requirements. The proposed facility will meet the new licence requirements.

7.1 DISCHARGE PROCEDURE

1) Manipulate the valve to isolate one or two secondary storage cells 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(s). Allow at least one week to analyze the sample(s), plus shipment time.

3) If the total coliform MPN index does not exceed 1500 organisms per 100 mL, the faecal coliform MPN index does not exceed 200 per 100 mL of sample, and the BOD_5 does not exceed 25 mg/L, then the bacteriological and BOD_5 component of the testing is satisfied. Further discharge parameters may be instituted in the new Environment Act Licence that should be satisfied prior to discharge.

4) While discharging, the valve(s) between the primary cell and the secondary cell(s) remain closed to prevent the primary cell from simultaneously discharging effluent into the discharging secondary cell(s).

5) Once the secondary cell(s) are discharged, close the discharge valve(s), and reopen the valve(s) between the primary cell and the secondary cell(s). 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(s) 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 season.

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

7.2 RECORD KEEPING AND INSPECTION ROUTINE

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

1) Daily Records – Any available information applicable to wastewater generation within the Community should be collected and retained for future estimation of flows to the wastewater treatment lagoon. Truck hauling records (dates and volumes) from the individual haulers trucking to the lagoon should also be collected and retained, if applicable.
2) Weekly Records - The weekly summer inspection would consist of recording the following: the 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.

8.0 SCHEDULE AND FUNDING

It is anticipated that the Environment Act Licence process will be finalized by the summer of 2014 and construction will begin in the summer of this year as well. The project is funded in part by Manitoba Water Services Board (MWSB) and the funding is time sensitive. A project schedule is included in Appendix G.

9.0 REFERENCES

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