March 29, 2018

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Manitoba Sustainable Development
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Attention: Ms. Tracey Braun
Director

Engineering Assessment of the Landmark Lagoon

Dear Ms. Tracey Braun

Dillon Consulting Limited (Dillon) is submitting this letter on behalf of the R.M. of Taché (the R.M.), in regards to the engineering assessment completed for the Landmark Lagoon. Based on the letter received from Manitoba Sustainable Development (MSD) on November 9, 2017, the engineering assessment is to include:

- The determination of sources of wastewater and related liquid waste products being conveyed to the lagoon by truck haul;
- The total estimated quantities and qualities of the different types of sludge in each cell of this lagoon with special consideration with respect to the current primary cell; and,
- Assessment and discussion regarding options for future operation of the lagoon and options for removing or reducing the lagoon's accumulating sludge and grit/gravel materials.

Sources of Wastewater

The hydraulic load is based on the amount of water that residents use, estimated commercial loads, and the amount of water infiltrating into the sewer system through weeping tiles. The organic load is represented by the total mass of 5-day biochemical oxygen demand (BOD_5) in kg/day of the wastewater and septage discharged to the lagoon. The following assumptions from the L.U.D. of Landmark Sewage Lagoon Expansion Design Engineering Report (Dillon, 2007) were used to calculate hydraulic and organic loads:

- Estimated wastewater production rate from residents in Landmark is 227 L/person/day with a typical BOD_5 load of 0.077 kgBOD_5/person/day;

- Typical rural wastewater production rate is 400 L/person/year with a typical BOD_5 load of 7 $kgBOD_5/m^3$;
- Septage from all rural residents with septic tanks and fields within the RM are hauled to the Landmark Lagoon;
- Discharge of septage from rural residents into the lagoon is only permitted between June 1 and October 15 (135 days);
- A typical BOD_5 loading criterion of 1.5 kg/m^3 was utilized to assess the organic loading from the local restaurant in Landmark;
- Given the nature of Landmark Feeds and the Landmark Carwash establishments (i.e., sand with low organic content), a value of 0.1 kg/m^3 was assumed to estimate the organic strength of the wastewater produced by these facilities;
- Sludge from the drainage pits below the washing facility from Elite Swine Industry's (ESI) Truck & Trailer Wash facility is collected and hauled via septic truck to the Landmark lagoon on a weekly basis. The strength of this sludge is estimated to be approximately 6 kg/m^3; and,
- It is estimated that 3.4 m^3 of sludge is trucked to the lagoon on a daily basis between June 1 and October 15 from the ESI facility.

The total estimated residential, rural and commercial/industrial hydraulic and organic loads are outlined below in Table 1.

Table 1: 2018 Hydraulic and Organic Loads to Landmark Lagoon

Source	Hydraulic (m^3/day)	Organic ($kgBOD_5$/day)
Residential	531	180
Rural	19.5	136
Commercial/Industrial	58.3	24.4
Elite Swine Trailer Wash	23	20.4
Landmark Truck and Car Wash	8.7	0.9
Landmark Feeds	24.1	2.4
Local Restaurant	0.5	0.73
Infiltration	2	0.0
Total	609	341

Assessment of Sludge

To estimate the quantity of sludge in Cell # 2 and Cell # 3 (the NE and NW Cells) in the Landmark Lagoon, a sludge depth of 0.2 m was estimated, based on the length of time the cells have been in operation and the type of municipal wastewater managed. The quantity of sludge in Cell # 2 and Cell # 3 is approximately 3,500 m^3 and 4,500 m^3, respectively, based on a 0.2 m average sludge depth across the area of the cells. Cell # 4 was constructed in 2008, and a sludge depth of .05 m was assumed due to the length of time Cell # 4 has been in operation. The estimated quantity of sludge in Cell # 4 is approximately 3,600 m^3. A site plan outlining the cell layout is attached to this letter as **Figure 1**.

Approximately 920 m^3 of sludge from Cell # 1 was excavated and landfilled in November, 2017. The L.U.D. of Landmark Lagoon Desludging Letter (Dillon, February 2016) estimated there was approximately 7,500 m^3 of sludge in Cell # 1, therefore, approximately 6,580 m^3 is remaining.

Sludge characteristics in the primary cell are based on five (5) point sample locations taken October 30, 2015, and are outlined below in **Table 2**. The analytical results indicate that metal concentrations of copper and zinc will dictate sludge application rates with respect to the sludge quality. This complete sludge analysis compared to site specific soils analyses, will ultimately determine final application rates. The sludge analysis from the secondary cells is considered at this time to be similar to the primary cell sludge. Upper layers of the settled sludge in the storage cells may vary, with somewhat higher volatile suspended solids (VSS), and lower/older, more fully digested sludge will see VSS reduction. On average the VSS is considered to be similar throughout the lagoon, with the exception of the higher grit and inert concentrations at the inlet. Any variations in the final sludge quality in the different cells would be determined at the time of removal planning.

Table 2: Lagoon Sludge Characteristics

Parameter	Average Concentration (ppm)	Max Allowable Cumulative Concentration in Soil (ppm)[1]
Arsenic	2.75	12
Cadmium	0.585	1.4
Chromium	43.5	64
Copper	145	63
Lead	8.4	70

Parameter	Average Concentration (ppm)	Max Allowable Cumulative Concentration in Soil (ppm)[1]
Nickel	24	45
Zinc	400	200
Mercury	0.079	6.6
Acid Ext. P	5600	-
Ammonia-N	270	-
Nitrate	0	-
TKN	12,140	-
Total Organic N	11,750	-
Total Solids	34.25%	-
Volatile Solids	57.1%	-

(1) CCME Soil Quality Guidelines for the Protection of Environmental and Human Health

Future Operation

The Landmark Lagoon will continue to be used to treat residential, rural and commercial/industrial wastewater from Landmark. Based on the 2018 hydraulic and organic loading rates calculated above, the required hydraulic winter storage (240 days) volume is 146,160 m^3. The total available lagoon storage and estimated sludge quantity for each cell is outlined below in **Table 3**.

Table 3: Available Storage

Cell Identification	Available Storage (m^3)[1]	Estimated Sludge Quantity (m^3)
Primary Cell # 1[2]	40,775	6,580
Primary Cell # 2[2]	11,309	3,500
Secondary Cell # 3[3]	24,090	4,500
Secondary Cell # 4[3]	100,700	3,600
Sum	**176,874**	**18,180**

(1) Volumes from L.U.D. of Landmark Sewage Lagoon Expansion - Design Engineering Report (Dillon, 2007)
(2) Available storage is half of total volume.
(3) Available storage is measured above 0.3 m depth.

Future options for removing the sludge in the Landmark lagoon include:

1. Land application; and,
2. Landfilling.

Land application (considered beneficial reuse) of the sludge is the preferred option by MSD. However, landfilling the sludge may be considered acceptable if the sludge is unsuitable for land application or suitable land is unavailable. A combined approach of both land application and landfilling may be utilized in the future, which would be based on future sludge testing results.

The deposition of grit/gravel materials in the lagoon was associated with one facility user within the RM of Taché, and those activities have been modified to mitigate this issue, as of 2016. Upon removal of the excess grit/gravel materials in November 2017, the lagoon will be periodically visually assessed by the RM (with technical assistance as may be required) to monitor the efficacy of the actions taken in 2016 (i.e., to determine the effectiveness of action taken to reduce the conveyance and deposition of grit/gravel materials at the lagoon).

Other further actions could include:

A septage receiving station could be installed to reduce the lagoon's accumulating sludge and grit/gravel materials that build up around the truck dump spillway. Septage receiving stations can be used to screen septage, grease, or sludge to remove unwanted debris from wastewater. Properly implemented, a septage receiving station may increase the treatment efficiency of lagoons by reducing the impact of inert solids, foreign material, and large organics. The operation of a septage receiving station is as follows:

- Haulers connect to the inlet of the septage receiving station and start the flow of septage;
- Large solids such as rocks are segregated and collected;
- Septage is further screened to remove large solids/debris;
- Screened solids and debris are captured, dewatered and discharged to a bin for offsite (landfill) disposal; and,
- Screened septage flows into the lagoon.

We trust that the information provided herein is satisfactory for your present requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Sincerely,

DILLON CONSULTING LIMITED

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Project Manager

Katie Whyte, M.Sc., E.I.T.
Project Design

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John Ewing, M.Sc., P.Eng.
Engineering Review

KAW:lf

Attachments: Figure 1 – Site Plan

cc: Robert Boswick, Manitoba Sustainable Development
Curt Bueckert, Manitoba Sustainable Development
Christine Hutlet, Rural Municipality of Taché
Pete Skjaerlund, Rural Municipality of Taché

Our file: 17-6645

RURAL MUNICIPALITY OF TACHE, MANITOBA

SITE PLAN

★ Site Location

DILLON CONSULTING

MAP DRAWING INFORMATION:
DATA PROVIDED BY MLI
MAP CREATED BY: KAW
MAP CHECKED BY: IK
MAP PROJECTION: NAD 1983 UTM Zone 14N

0 25 50 100 150 Meters

N W E S

PROJECT: 17-6645 STATUS: DRAFT DATE: 28/03/2018

Document Path: G:\GIS\163407 - Landmark Lagoon Expansion\GIS Data\MXD\Figure 1 Site Plan and Figure Location.mxd