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January 22, 2018
File: 2017-4681.000.E.400

Ms. Tracey Braun, M. Sc.
Director, Environmental Approvals
Sustainable Development
123 Main Street, Suite 160
Winnipeg Manitoba, R3C 1A5

Re: ENVIRONMENT ACT PROPOSAL - RM OF WEST INTERLAKE
ASHERN WASTEWATER TREATMENT FACILITY UPGRADES

Dear Ms. Braun:

On behalf of the RM of West Interlake, please find enclosed four (4) hardcopies and one (1) electronic PDF of our Environmental Act Submission for the above-mentioned project. The enclosed is also accompanied by a $7,500 cheque for the application fee.

The RM has obtained Funding under the **Canada Clean Water and Wastewater Fund** for the works. Generally, the works will consist of a new 40,000 m^3 secondary storage cell to increase hydraulic storage capacity over the winter period. The new cell will have a suitable clay liner. Project completion per the Funding agreement is November 2018, anticipating a final liner approval by the end of the 2018 season.

Note that the local paper for any advertising is Blue Raven – Around Town located at Unit B - #61 Main Street in the TBJ Mall in Ashern, MB. blueraven@mymts.net. Weekly deadlines are Friday for Wednesday Publication.

We trust that the enclosed application contains sufficient information for your staff to provide the necessary approvals. Should the reviewer require any additional information or require any clarifications, please do not hesitate to contact myself.

We thank you for your consideration of this application.

Yours truly,

Ken Anderson
Manager, Water

KA

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ENVIRONMENT ACT PROPOSAL

RM of West Interlake

LUD of Ashern
Wastewater Treatment Facility Upgrades

West Interlake RURAL MUNICIPALITY

January 2018

AE#:2017-4981

CANADA'S BEST MANAGED COMPANIES Platinum member

Environment Act Proposal Form

Manitoba Sustainable Development

Name of the development:
Ashern Wastewater Treatment Facility

Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):
Class II

Legal name of the applicant:
RM of West Interlake

Mailing address of the applicant: Box 370

Contact Person: Larissa Love

City: Ashern Province: MB Postal Code: R0C 0E0

Phone Number: (204) 739-2666 Fax: email: cao@rmofwestinterlake.com

Location of the development: Ashern Manitoba

Contact Person: Larissa Love

Street Address: -

Legal Description: NE 1/4 Section 22 - Twp 25 - Rge 7 WPM

City/Town: Ashern Province: MB Postal Code: R0C 0E0

Phone Number: (204) 739-2666 Fax: email: cao@rmofwestinterlake.com

Name of proponent contact person for purposes of the environmental assessment:
Ken Anderson, P. Eng.

Phone: (204) 942-6391 Fax: (204) 942-6399	Mailing address: 203 - 5 Donald Street Winnipeg, MB R3L 2T4

Email address: andersonk@ae.ca

Webpage address:

Date: 2018-01-22	Signature of proponent, or corporate principal of corporate proponent: K Anderson. Printed name: Ken Anderson

PRINT RESET

A complete **Environment Act Proposal (EAP)** consists of the following components:

- ☐ **Cover letter**
- ☐ **Environment Act Proposal Form**
- ☐ **Reports/plans supporting the EAP** (see "Information Bulletin - Environment Act Proposal Report Guidelines" for required information and number of copies)
- ☐ **Application fee** (Cheque, payable to Minister of Finance, for the appropriate fee)

Per Environment Act Fees Regulation (Manitoba Regulation 168/96):

Class 1 Developments	$1,000
Class 2 Developments	$7,500
Class 3 Developments:	
Transportation and Transmission Lines	$10,000
Water Developments	$60,000
Energy and Mining	$120,000

Submit the complete EAP to:

Director
Environmental Approvals Branch
Manitoba Conservation and Water Stewardship
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:
Phone: (204) 945-8321
Fax: (204) 945-5229
http://www.gov.mb.ca/sd/eal

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1 Introduction

The RM of West Interlake (RM) has retained Associated Engineering (AE) for design and contract administration for the LUD of Ashern's lagoon expansion. The scope of work also includes environmental approvals for the works.

During wet years, the community of Ashern can be challenged to have enough winter storage to last until the June 15th discharge. In the past, the RM has been required to request emergency discharges from the Province in later winter. So much so, that on August 22, 2013 a Director's Order 2019-09 was issued to the RM. The Order instructed the RM to retain the services of a professional engineer to assess the facility and the cause for the regular exceedances in operating levels.

Thus, in 2014 the RM retained the services of Associated Engineering who completed the *"RM of Siglunes Ashern Wastewater Lagoon Review"* in July of 2014. The report assessed the current and future hydraulic & organic loading to the facility, and investigated the reasons for the hydraulic overloading in the winter period. The report determined that the most likely cause for the hydraulic overloading was the prevalent weeping tile connections to the sewer system and the trend for higher groundwater levels in the area.

In February of 2017, the RM was successful in obtaining **$343,250** in funding under the **Clean Water and Wastewater Fund** (CWWF) for the Ashern Wastewater System upgrades. As part of the funding requirements, the project must be completed by April 2019. For lagoon upgrades, this actually translates to an October 2018 deadline due to the Provincial Approval process for lagoon upgrades. The Province is required to test the finished cell's liner prior to placing in operation, if this is not done prior to freezing temperatures (October/November) it must wait until May/June the following year. Therefore, it would exceed the April 2019 deadline; and this cannot occur.

The amount of funding, and more importantly the timeline for completing the work, then limited the options to address the hydraulic loading issues. The RM selected to pursue a lagoon storage expansion in order to deal with the issue as it was the most feasible option in the given timeline.

The proposed lagoon upgrades, therefore, consists of constructing a new 40,000 m^3 secondary storage cell to increase the winter storage capacity. The size of the new cell was also limited by the available funding and the RM's budget. The new cell will be earthen constructed complete with a clay liner at least 1.0m thick and with a hydraulic conductivity less than $1x10^{-7}$ cm/s.

1.1 BACKGROUND INFORMATION

The LUD of Ashern is a community of 565 residents (Statistics Canada 2016). It is located on Provincial Highway 6, 180 km North of Winnipeg. Domestic wastewater generated within the community is conveyed to an existing three-cell facultative lagoon system. Treated effluent from the lagoon system, is discharged to a drainage ditch that discharges through the Ashern Drain into the Moosehorn Lakes. The facility is generally discharged in the fall and in the spring.

In 2017, Associated Engineering completed an "LUD of Ashern Pre-Design Report" that described the recommended upgrades to construct the fourth cell for additional capacity. The 2014 Lagoon Review Report includes the assessment of the lagoon capacity for current and future population requirements. Based on the lagoon dimensions, it was determined that the facility is adequate for the organic loading, but can be hydraulically overloaded in winter depending upon precipitation and groundwater levels.

1.2 EXISTING FACILITIES AND ISSUES

The existing facility should have sufficient organic capacity for the current and future population when considering truck haul contributions. But in wet years, the facility is often overloaded and requires early discharges in May and June in order to prevent overtopping the berms.

In average dry years, the RM can meet the June 15th discharge date with the current storage. But, with the trend for higher groundwater levels, the volume of inflow and infiltration due to weeping tiles is increasing. In wet years, with a higher water table and infiltration, the added flows occur year-round, contributing to the winter storage volume.

The Ashern collection system consists of a gravity sewer collection with one main lift station and two smaller lift stations in the collection system. In the last few years, the RM has invested in inspecting the sewer system and manholes for infiltration. The investigations did not find excessive infiltration in the sewers and had some minor recommendations to patch some manholes. Therefore, the infiltration is assumed to be from the homes with weeping tiles directly connected to their sewer lines. Some action may be needed in the future to control the hydraulic loading if the LUD wants to create more capacity in the system.

Table 1-1 – Existing Lagoon Capacity Assessment

Parameter	Value
Area of Primary Cell #1 (1A+1B)	2.1 Ha
Calculated Design Organic Capacity of Lagoon (*56 kg-BOD_5/day/Ha)*	**117 kg-BOD_5/day**
Existing Primary (1A+1B) Cell Usable Volume	18,010 m^3
Existing Secondary Cell #2 Usable Volume	24,675 m^3
Exiting Secondary Cell #3 Usable Volume	35,360 m^3
Hydraulic Capacity – ½ Primary Cell + Secondary Cell Volumes	**78,045 m^3**

1.3 POPULATION AND LAGOON LOADING

A 20-year design horizon is used for this project. The population is projected to grow at an annual rate of 1.0% per year from 2017 to 2037. The historical population, average annual growth rate, and projected growth are outlined in **Table 1-2** below.

Table 1-2 – LUD of Ashern Population Projection

Year	Population	Annual Growth	Comment
2006	621		Stats Canada
2011	609		Stats Canada
2016	565		Stats Canada
2037	**690**	1.0%	RM Projection

Wastewater generation is estimated at ~300 L/cap/day for the population with an additional 30% to account for inflow and infiltration in the collection system in the wet years.

For the Ashern design population of 565, the average day wastewater generation rate is 170 m^3/day plus 200 m^3/day to account for inflow/infiltration (or future allocation).

Table 1-3 – Current and Future Wastewater Generation Summary

Design Population	Average Day Generation 270 L/cap/d	Additional for Inflow/Infiltration or Future Allocation	Total Average Day Flow
Current (2017) 565	170 m^3/d	200 m^3/day	370 m^3/day (4.3 L/s)
Future (2037) 690	207 m^3/d	200 m^3/day	407 m^3/day (4.7 L/s)

For the purpose of design, the average wastewater loading rates will be based on a per capita generation rate. **Table 1-4** summarizes the estimated wastewater loading for the LUD of Ashern at the project 2037 population of 690 residents.

Table 1-4 – Estimated Wastewater Loadings by Population

Parameter	Estimated Loading per Person kg/cap/day	Average Day Load (kg/day)	
		2017 565 residents	2037 690 residents
Total Suspended Solids (TSS)	0.060	34	**41**
Biochemical Oxygen Demand (BOD_5)	0.077	44	**53**
Carbonaceous BOD	0.110	62	**76**
NH_3-N	0.005	3	**3**
TKN	0.009	5	**6**
Total phosphorus	0.0027	2	**2**

Table 1-5 summarizes the additional loading from truck haul from the surrounding area. From the 2014 Lagoon Assessment Report, the number of loads is estimated to be ~100 loads/year at 6.81 m^3/load from septage sources. Thus, the volume contribution is negligible, and does not contribute over the winter storage period.

Table 1-5 – Estimated Wastewater Loading from Truck Haul

Parameter	Average Day Load (kg-BOD_5/day)	
	2017	2037
Truck Haul – (Hold Tanks)	0	**0**
Truck Haul – (Septic Tanks)	13	**13**

Table 1-6 summarizes the current organic loading and hydraulic loading estimate and projects it to the 20-year design horizon.

Table 1-6 – Current and Future Wastewater Generation Summary

Design Population	Organic Loading (0.077 kg BOD/cap/day)	227-day Hydraulic Loading
(2017) 565	57 kg-BOD_5/day	84,000 m^3
(2037) 690	66 kg-BOD_5/day	92,390 m^3

Table 1-7 compares the current and future loading to the existing lagoon cells. It demonstrates that the organic treatment right now could be near capacity depending upon actual truck haul loading. It will also likely exceed the facility's organic capacity in 20-years if the truck haul trend is maintained. It also demonstrates why the third cell is often required for additional storage in wet years. Based on the amount of assumed infiltration in the future, the projections indicate the potential to exceed the normal operating depth of the cells by 200-300 mm in these wet years.

The exceedances are based on an assumption of growth, and truck haul. It is expected that over the next 20 years, the RM will invest in the infrastructure, and/or enforce any weeping tile disconnections. This should reduce hydraulic loading to lagoon delay any need to expand storage and treatment capacity.

Table 1-7 – Current and Future Wastewater Generation Summary

Parameter	Current Estimate 2017	Future Projection 2037	Storage Capacity With New Cell #4
Organic Loading	57 kg-BOD_5/day (summer) 44 kg-BOD_5/day (winter)	66 kg-BOD_5/day (summer) 53 kg-BOD_5/day (winter)	**117 kg-BOD_5/day**
Hydraulic Loading (227-day storage)	84,000 m^3	92,390 m^3	**118,045 m^3**

1.4 REGULATORY FRAMEWORK

The current facility operates under Licence No. 1136 R, dated January 15, 1998 and Revised April 17, 2007. It is understood that the new upgrades are considered a Major Alteration and a full EAP is required for the works. A new Environment Act Licence will then be issued for the upgrades.

1.5 PREVIOUS STUDIES

LUD of Ashern – Pre-Design Report Wastewater Treatment Facility Upgrades, December 2017, by Associated Engineering.

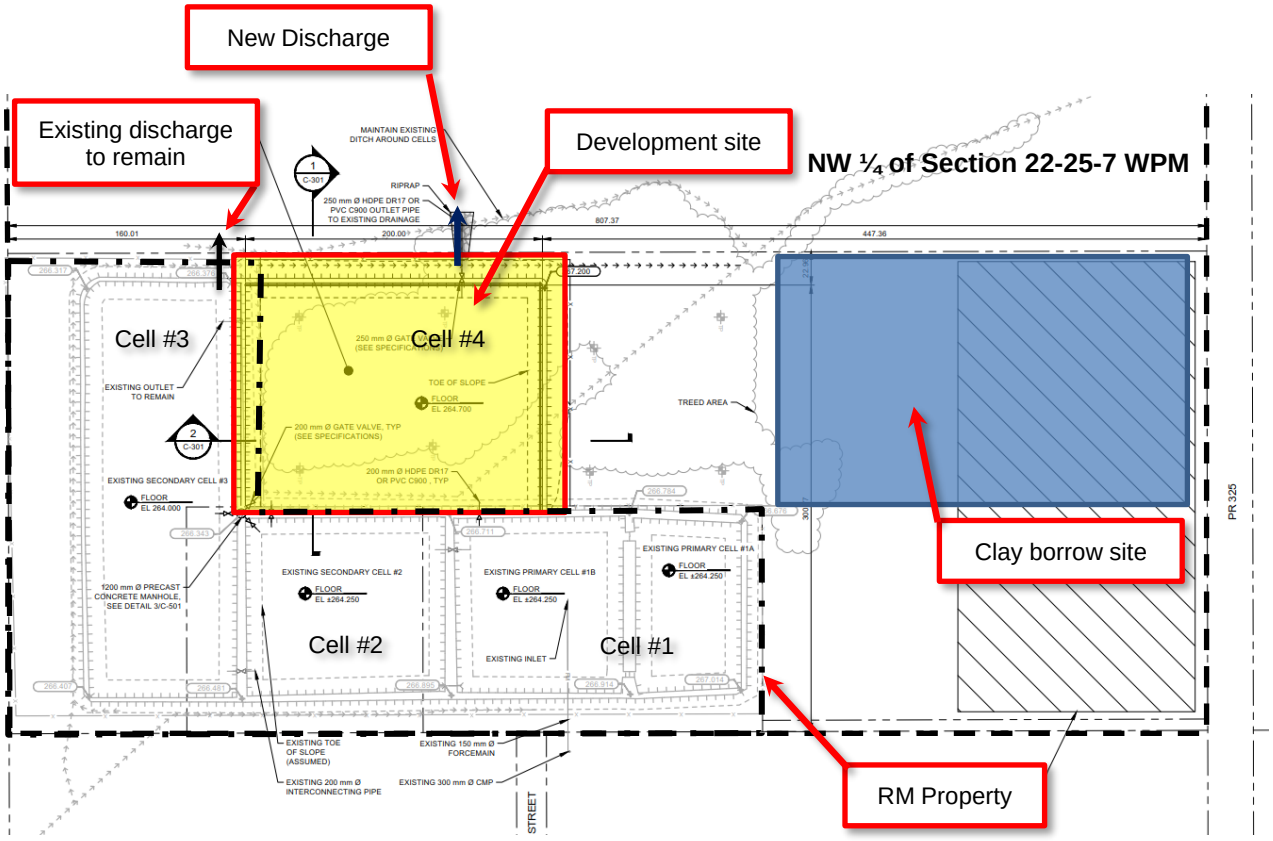
RM of Siglunes – Ashern Wastewater Facility Assessment, July 2014, by Associated Engineering.

2 Description of Proposed Development

2.1 PROJECT LOCATION AND OWNERSHIP

The existing wastewater treatment lagoon is located in the NW ¼ of Section 22, Twp 25, Rge 7 WPM. See . The land for the existing facility is owned by the RM under Title Number , refer to Appendices. The land for the expansion cell is not currently owned by the RM, but they are in the process of transferring ownership to the RM.

Figure 2-1 –Project Location Map



2.2 EXISTING AND ADJACENT LAND USE

The project will be next to the existing boundaries of the RM lagoon site. The proposed land that the new cell will be constructed on is comprised of trees and scrub. The existing lands surrounding the lagoon site are used for agriculture.

The nearest residence is located approximately 470 m to the north east of the new development, but this resident is also only 270 m from the original NE corner of the original primary cell. The original cell was constructed in 1965, and likely pre-dates the residence.

Figure 2-2 – Map of Surrounding Area

2.3 PROJECT DESCRIPTION

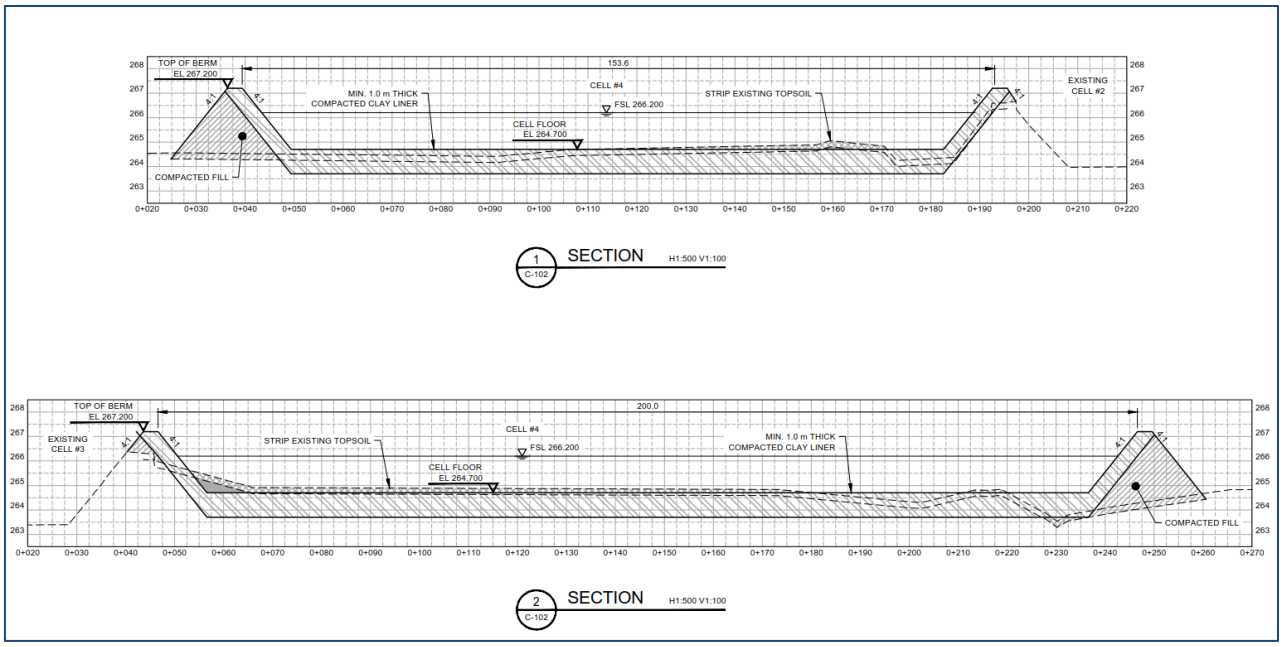
The project will generally consist of the construction of a new secondary storage cell (Cell #4) adjacent to the existing cells. The cell will have two new berms, and share a common berm with Cells #2 and #3. The 1.0 m clay liner will be placed over the existing berms (widening them) to maintain containment of the new cell.

The entire new cell will be lined with a 1.0 m thick clay liner with a hydraulic conductivity less than $1x10^{-7}$ cm/sec. The 2017 geotechnical investigation confirmed that the existing material on site can be re-worked and compacted to meet the liner requirements.

Table 2-1 – Upgraded Cell Design Parameters

Parameter	Value
Floor Width	**141 m**
Floor Length	**188 m**
Operating Depth	**1.5 m**
Freeboard	**1.0 m**
Interior Side Slopes	**4:1**
Exterior Side Slopes	**4:1**

Figure 2-3 – Cross Sections of New Cell #4



2.4 DESIGN CRITERIA

2.4.1 Wastewater Characteristics and Loadings

Table 2-2 summarizes the anticipated organic and hydraulic loading to the facility to the existing facility.

Table 2-2 – Current and Future Wastewater Generation Summary

Parameter	Current Estimate 2017	Future Projection 2037	Facility Capacity With New Cell #4
Organic Loading	57 kg-BOD_5/day (summer) 44 kg-BOD_5/day (winter)	66 kg-BOD_5/day (summer) 53 kg-BOD_5/day (winter)	**117 kg-BOD_5/day**
Hydraulic Loading (227-day storage)	84,000 m^3	92,390 m^3	**118,045 m^3**

2.4.2 Proposed Effluent Quality Criteria

Manitoba Conservation regulates the discharge of treated effluent in Manitoba, as legislated in the *Public Health Act* (P210). Based on current Provincial and Federal regulations, **Table 2-3** summarize the anticipated effluent requirements to the Ashern Drain.

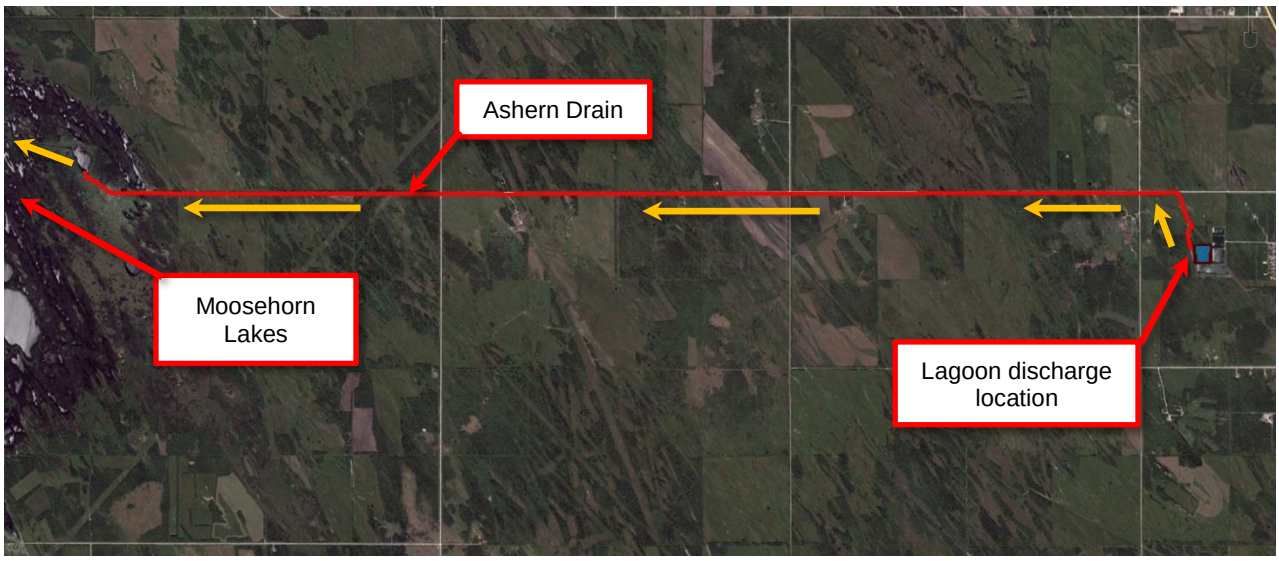
Table 2-3 – Anticipated Wastewater Effluent Requirements

Parameter	Effluent Limit	Comments
$cBOD_5$, (mg/L)	**≤ 25 mg/L**	
TSS, (mg/L)	**≤ 25 mg/L**	
Total Phosphorus, TP, (mg/L)	**< 1.0 mg/L**	
Total coliform, (MPN/100 mL)	**< 1500**	
E. coli, (MPN/100 mL)	**< 200**	
Unionized Ammonia (mg/L)	**< 1.25 mg/L**	Env. Canada (WSER) Expressed as N, sample at T=15ºC +/- 1ºC
Total Residual Chlorine (mg/L)	**<0.02**	Env. Canada (WSER) If chlorine is used in the process.
Acute Lethality	**< 50% rainbow trout mortality after 96 hr.**	Env. Canada (WSER) Fish submerged in 100 percent effluent.

2.5 DISCHARGE ROUTE

The Ashern lagoon discharges into a small drainage ditch that flows 670 m northward until it drains into the Ashern Drainage channel. The Ashern drain then travels approximately 11 km westward until it discharges into the Moosehorn Lakes. The Moosehorn Lakes then drain into the north half of Lake Manitoba 3.0km to the northwest. See **Figure 2-4** for the Ashern Drain and discharge route of the facility.

Figure 2-4 – Ashern Lagoon Discharge Route



The existing discharge pipe from Cell #3 will remain. A new discharge pipe will be added from Cell #4 approximately 150 m north of the existing.

2.6 OPERATIONS AND MAINTENANCE

The RM of West Interlake is responsible for operation and maintenance of the Ashern Lagoon. The RM has public works staff who will continue to operate the existing lagoon. The operator will be required to submit samples for laboratory analysis per the Environment Act Licence requirements.

Effluent would typically be released from the storage cells twice per year, once in spring and again in late fall, after sampling confirms that effluent meets the discharge criteria.

The majority of maintenance is carried out in the spring, summer and fall of each year as weather permits.

Typical maintenance tasks include:

- Cutting grass on the dykes of the lagoon on a regular basis. Deep rooted weeds should be removed to prevent deterioration of the dykes;
- Inspecting the fencing and gate for damage and repairing as required;
- The outfall ditch should be kept clear of obstructions (including overgrown vegetation);

- If encountered, animals burrowing on the dykes of the lagoon should be removed and the holes filled;
- An inspection for erosion on the dykes and the outfall ditch should be conducted. If erosion is present, erosion repairs should be undertaken, which may include re-grading, seeding or installing rip-rap;
- Regular road maintenance should be undertaken to ensure access to the site at all times. Culverts should also be cleared of blockage;
- Ensure the discharge valve is closed when not draining;
- Snow clearing of the access road is required to ensure lagoon access; and,
- The lagoon liquid levels should be maintained at a minimum of 0.15 meters.

2.7 FACILITY CLASSIFICATION

The LUD of Ashern wastewater lagoon is currently classified as a Class 1 Wastewater Treatment Facility. The new storage cell will not change any operational parameters and the lagoon will remain a Class 1 Facility.

2.8 DECOMMISSIONING

No aspects of the facility will be decommissioned.

2.9 BIOSOLIDS DISPOSAL

There will be no work done in the existing cells, thus there will be no handling of biosolids for this project.

For information only, the 2014 Wastewater Assessment Report conducted a sludge survey and found minimal accumulation in the cells. Approximately 150 mm – 300 mm of sludge was found in the primary cell, approximately 150 mm of sludge was found in Cell #2, and negligible sludge was found in Cell #3.

2.10 PROJECT FUNDING

The current work program is funded by the **Clean Water and Wastewater Fund** (CWWF), this funding provides 75% coverage from government and 25% from the RM.

A key concern with this funding program is that the works need to be 100% complete and paid for by April 1, 2019. This could be a fairly tight deadline for these works if works start too late in 2018. An early start in July 2018 is required to meet an October 2018 deadline for testing of the new lagoon cell clay liners. This cannot be deferred to 2019 given the strict funding deadline.

As of January 2018, the cells are within normal operating levels. Levels are such that there could be sufficient capacity remaining to meet the June 15 discharge. This assumes the current trend in precipitation and snowfall.

2.11 PROJECT SCHEDULE

The proposed work program is currently funded by the CWWF. The two critical tasks that will delay start of these works will be the environmental approvals process (i.e. Draft EAL) and the land negotiations to acquire the property for the new cell. Also, as previously noted, the funding is contingent on 100% completion by April 2019, but liner acceptance is required in 2018.

The table below summarises the timelines for the Works.

Table 2-4 – Project Timeline

	2018												2019			
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A
EAP Submission (January 29)	★															
EAP Approvals		▬	▬	▬	▬											
Tendering Works					▬											
Draft EAL						★										
Award Contract						★										
Construct New Cell #4						▬	▬	▬	▬							
Liner Approvals										▬						
Substantial Completion											★					
Funding Deadline															★	

2.12 PUBLIC CONSULTATION

Public Consultation is not expected to be required for this work program. The RM may decide to hold a public information session in the early spring to summarize the coming works program and impacts to their taxes.

3 Existing Physical Environment

3.1 PHYSIOGRAPHIC SETTING, SOILS AND CLIMATE

Ashern is in the Ashern Ecodistrict, which is part of the Interlake Plain Ecoregion and the Boreal Plains Ecozone (Smith et al, 1998). This area is characterized by low, flat Palaeozoic limestone. This area is greatly shaped by glacial activity that left glacial sediment, remnants and till deposits over the limestone. Water bodies are prevalent with large bodies including Lake Winnipeg (Smith et al, 1998).

Chernozemic Dark gray soil that have a range of drainage attributes are the most predominant soil of the landscape with a large portion of the remainder made up of Chernozemic Black soil. Soils rich in clay and till are found in a large area of the region as well as fluvial-glacial formations including sand and gravel deposits (Smith et al, 1998).

The region contains common Manitoba species such as black bear, coyote, ruffed grouse, beaver, and various waterfowl (Smith et al, 1998).

Table 3-1 provides climatic data that was taking from an Environment Canada Weather Station (2014) located in Fisher Branch, MB from 1981 to 2010.

Table 3-1 – Climatic Averages for the Region (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year
TEMPERATURE (ºC)													
Daily Average	-18.4	-15.1	-7.6	1.4	9.3	16	18.9	18.2	11.6	4.4	-6.3	-15.5	1.4
Daily Max	-13	-9.3	-1.7	7.3	15.5	21.4	24.1	23.3	16.2	8.1	-2.6	-10.8	6.5
PRECIPITATION (mm)													
Monthly Average	30.8	26	26	26.3	43.6	87.9	76.8	91.1	75	57.9	50.1	40.5	632

*Environment Canada (http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=Fisher+Branch&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=3733&dispBack=1)

3.2 GROUNDWATER

Table 3-2 is a summary of the groundwater well search conducted on the provincial database.

Table 3-2 – Attributes of Nearby Water Wells

Borehole Identifier	Date Drilled	Length (m)	Water Level (m)	Water Use	Location	Purpose
34935	1978	15.54	2.44	Livestock	22-25-07W	Production
34091	1978	10.36	3.05	Domestic	22-25-07W	Production
50360	1984	16.76	4.57	Domestic	22-25-07W	Production
50359	1984	39.62	7.32	Domestic	22-25-07W	Production
76827	1993	42.67	4.57	Domestic	22-25-07W	Production
67427	1989	29.57	9.14	Domestic	22-25-07W	Production
118382	2001	21.35	3.96	Domestic	22-25-07W	Production
65703	1989	21.34	8.23	Domestic	22-25-07W	Production
101846	1996	36.60	4.88	Municipal	22-25-07W	Production
102033	1996	12.20	3.36	Domestic	22-25-07W	Production

3.3 FISH AND FISH HABITAT

Moosehorn Lakes is the eventual discharge point of treated effluent from the Ashern lagoon facility. Moosehorn Lakes is a wildlife management area that provides habitat in wetlands and lake habitat for various species of fish.

Table 3-1 – Fish Species that may Inhabit Moosehorn Lakes

Scientific Name	Common Name
Acipenser fulvescens	Lake Sturgeon
Ambloplites rupestris	Rock Bass
Ameiuris nebulosis	Brown Bullhead
Ameiurus melas	Black Bullhead
Aplodinotus grunniens	Freshwater Drum

Scientific Name	Common Name
Carpiodes cyprinus	Quillback
Catostomus	Longnose Sucker
Catostomus commersoni	White Sucker
Coregonus artedi	Cisco
Coregonus clupeaformis	Lake Whitefish
Coregonus zenithicus	Shortjaw Cisco
Cottus bairdii	Mottled Sculpin
Cottus cognatus	Slimy Sculpin
Cottus ricei	Spoonhead Sculpin
Culaea inconstans	Brook Stickleback
Cyprinus carpio	Carp
Esox lucius	Northern Pike
Etheostoma nigrum	Johnny Darter
Hiodon alosoides	Goldeye
Hiodon tergisus	Mooneye
Ichthyoinyzon castaneus	Chestnut Lamprey
Ictalurus punctatus	Channel Catfish
Lota lota	Burbot
Macrhybopsis storeriana	Silver Chub
Morone chrysops	White Bass
Moxostoma anisurum	Silver Redhorse
Moxostoma erythrurum	Golden Redhorse
Moxostoma macrolepidotum	Shorthead Redhorse
Notemigonus crysoleucas	Golden Shiner
Notropis atherinoides	Emerald Shiner
Notropis blennius	River Shiner

Scientific Name	Common Name
Notropis heterolepis	Blacknose Shiner
Notropis hudsonius	Spottail Shiner
Osmerus mordax	Rainbow Smelt
Perca flavescens	Yellow Perch
Percina caprodes	Logperch
Percina shumardi	River Darter
Percopsis otniscomaycus	Trout-Perch
Pimephales promelas	Fathead Minnow
Platygobio gracilis	Flathead Chub
Pungitius puitgitius	Ninespine Stickleback
Rhinichthys cataractae	Longnose Dace
Rhinichthys obtusus	Blacknose Dace
Sander canadensis	Sauger
Sanders vitreus	Walleye

3.4 VEGETATION AND WILDLIFE

The Project is in the Ashern Ecodistrict, which is part of the Interlake Plain Ecoregion and the Boreal Plains Ecozone (Smith et al, 1998). The vegetation surrounding the Project area is comprised of.

Characteristic wildlife of the Ecozone includes woodland caribou moose, White-tail deer, moose, black bear, wolf, coyote, and chipmunk.

Representative birds include waterfowl such as ducks, white pelican, cormorant, haring gull, franklin's gull and geese, blue-jay, raptors such as boreal owl and red-tailed hawk, as well as rose-breasted and evening grosbeak and brown-headed cowbird.

3.5 PROTECTED SPECIES AND SENSITIVE HABITATS

Upon completion of a search of the MB Sustainable Development's Data Centre's rare species database, no occurrences of rare species were found for the area of interest at this time.

3.6 SOCIOECONOMIC

Expansion of the Ashern lagoon will allow for economic and residential expansion of the LUD, providing future flexibility to Ashern. The proposed lagoon is an addition to the already existing cells so significant adverse effects are not expected. The new upgrades should reduce the need to apply for emergency discharges in the spring.

The nearest First Nations community is over 15 km away and the opposite direction of treated effluent discharge.

Per the Office of Drinking Water there are no rural municipalities, industries, or campgrounds withdrawing water for domestic use from Moosehorn Lakes.

3.6.1 Heritage Resources

The Heritage Resources Branch of Manitoba Sport, Culture, and Heritage was contacted to identify whether any heritage resources are located within in the proposed lagoon expansion area. Per the branch records, the potential to impact heritage resources was low, and the Heritage Resources Branch does not require a Heritage Resources Impact Assessment (HRIA).

4 Potential Environmental Effects

4.1 ENVIRONMENTAL EFFECTS DURING CONSTRUCTION

4.1.1 Air Quality Impacts

Construction activities will create dust and emissions from construction machinery. Dust suppression using water sprays or mists will be used to alleviate potential dust from being raised. Air quality effects from any dust generation during construction would be localized and temporary and is considered to have a low or negligible environmental effect. Emissions from construction equipment will be temporary and minimized by having machinery operating within normal limits and outfitted with mufflers (where application) to reduce air emissions. Contributions from construction activities and operations to greenhouse gas emissions are not expected to be significantly above background levels and are unlikely to contribute significantly to overall greenhouse gas inventories from the area.

4.1.2 Soils Impacts

A risk exists, during the construction of the facility, for a spill to occur from construction machinery and vehicle equipment. To reduce this risk storage of fuel, other petroleum products and lubricants will not be permitted within the area of the water supply. Therefore, the risk of occurrence is small based and additionally standard construction best practices for managing clean-up and removal of any impacted soils will be used to prevent any impacts.

4.1.3 Surface Water and Fish Habitat

Potential environmental impacts to surface water and fish habitat are expected to be negligible during construction as there are no nearby fish bearing waters. The installation of a new effluent discharge line could potentially increase erosion and sedimentation into the drainage channel, but standard construction best management practices for sedimentation and erosion control will be implemented during construction to reduce potential effects to any aquatic life.

4.1.4 Vegetation

The proposed expansion at the Ashern WWTF is comprised of a treed area that will need to be cleared and grubbed before construction can begin. An examination of the area indicates that the potential for rare plants to occur is low with no historical occurrence of protected species at the Project site. The location of the discharge ditch will not change and best management practices will be followed to manage erosion control and sedimentation. Any areas beyond the expansion footprint which are disturbed will be restored to their natural state.

The operating and maintenance activities of the proposed development are minimal and will be restricted to established areas within the area allotted for the WWTF. Potential impacts to vegetation beyond the expansion footprint are minor and short term.

4.2 ENVIRONMENTAL EFFECTS FROM OPERATING NEW FACILITY

4.2.1 Air Quality Odour Considerations

It is anticipated that during the operation of the lagoon facility there would not be any release of pollutants to the air. The proposed upgrades will not change the general operation of the existing facility. Status quo will be maintained.

4.2.2 Soils Impacts

The new cell will be constructed with a liner to current standards. Potential adverse impacts to soil quality are assessed to be negligible. Disposal of any biosolids in the future to surrounding agricultural lands will be done through controlled and approved procedures.

4.2.3 Groundwater Impacts

The proposed activities associated with the lagoon upgrades are not expected to impact groundwater resources. The new cell will be lined with compacted clay liner, thereby providing suitable containment of any wastewater stored in this cell. The potential environmental effects to groundwater resources are therefore expected to be minimal after construction.

4.2.4 Wildlife Habitat

The potential effects to wildlife habitat loss were assessed to be negligible as all activities are occurring in areas that have previously been disturbed or have regular visits from community staff that are responsible for the operation of the WWTF. In general, any animals that occupy the Project site are anticipated to be common and widespread, such that protected animal species are not expected to occur within the Project site. Suitable habitat for these common species occurs in the adjacent treed areas in the region, such that potential impacts to wildlife habitat are minor and short term.

4.2.5 Surface Water and Fish Habitat

The proposed new facility is expected to result in a general improvement to wastewater effluent to the Ashern Drain over the current facultative treatment process. The regular use of the new cell for operations will allow more storage in regular years, and mitigate against early discharges in spring. The additional storage could extend the spring discharge to allow more time for treatment. The new cell also allows more flexibility in any coagulation process to help reduce phosphorus levels. Surface broadcast of alum is the preferred phosphorus treatment solution at this time for this facility.

When allowing more time for treatment prior to spring discharge, after the ice cover is off, there is potential for further ammonia reduction in the effluent. This can result in reduced impacts to receiving streams.

5 Environmental Mitigation Measures

Long-term residual effects are not anticipated, but short-term residual effects are considered local, minor in magnitude, short term in duration, and reversible over time after environmental protection and mitigation measures are applied.

Annual monitoring reports for the proposed lagoon upgrades and expansion will be provided to Manitoba's Sustainable Development Branch, along with reporting for the existing lagoon, according to the facility's licence to operate.

5.1 ENVIRONMENTAL MITIGATION DURING CONSTRUCTION

5.1.1 Air Quality

Well maintained vehicles and equipment and reduction of unnecessarily transportation and idling of vehicles will assist in mitigating air quality impacts.

The control of dust with water sprays or an approved dust suppressant will limit the impact of dust to the air quality. Prompt re-establishment of vegetation disturbed during construction and limiting certain work to periods of low winds will also help mitigate air quality impacts.

5.1.2 Soils

Preparation of an emergency response plan to mitigate potential impacts to soil by contaminants from petroleum products as well as use and availability of on-site spill clean-up equipment and materials, using properly maintained equipment and fuelling procedures.

The reestablishment of vegetation and backfill of any impacted areas will occur as soon as possible after construction to reduce the loss of soil due to wind or water erosion.

5.1.3 Surface Water

Surface water issues may be mitigated during construction by redirecting surface run-off, pumping accumulated water to adjacent ditches and installing proper erosion control practices such as silt fences and erosion control blankets.

Properly maintained, operated and fueled equipment will assist with the mitigation of potential fuel or petroleum spills. Manitoba Sustainable Development will be notified through the emergency response line and appropriate measures will be taken according to Manitoba Sustainable Development requirements.

Washing, refueling and servicing machinery and storage of fuel and other materials for the machinery will occur in such a way to prevent any deleterious substances from entering the water. Vehicles will stay on established roads and not unnecessarily disturb riparian zones. Any disturbed vegetation will be re-established as soon as possible.

5.1.4 Groundwater

The same mitigation efforts as described for surface water can be applied to as mitigation measures to reduce potential impact to any groundwater.

5.1.5 Vegetation and Wildlife

The establishment of vegetation will occur as soon as practically possible for disturbed areas. Minimizing laydown areas and construction activities will act as a measure to reduce disturbance to soils, and vegetation. Proper noise control and dust control as previously discussed will be implemented to mitigate potential impacts.

Clearing of the new footprint will require avoidance of nesting birds. If, prior to construction, a nest is observed within the Project site, measures will be taken to relocate the nest to suitable location outside of the Project site.

On-site waste materials (e.g., garbage, construction waste) will be managed to prevent the attraction of wildlife (e.g., disposed at approved sites in a timely and consistent manner). Waste bins with secure lids will be available on the site, and excess materials will not be permitted to accumulate on the site;

5.1.6 Fisheries

Fisheries impacts will be mitigated by controlling run-off and any construction related discharge to the watercourse to reduce potential harmful effects. The work area will be set back from riparian zones and a vegetated buffer will remain intact to minimize any sediment from entering the Ashern Drain. Proper erosion and sedimentation control measures for working near water will be implemented. These measures will limit any short term temporary impact to fisheries during construction activities.

5.1.7 Noise and Vibration

Unnecessary operation of equipment, properly muffled vehicles and equipment on site and properly maintained equipment will be assist in mitigating noise and vibration issues.

5.2 ENVIRONMENTAL MITIGATION DURING OPERATION OF UPGRADED FACILITY

5.2.1 Biosolids Management

The current work program does not include any biosolids removal or disposal. It is anticipated it will many years before the facility is in need to remove accumulated sludge. At that time, the RM will find a nearby famer willing to accept the biosolids on their land and that quantitative and qualitative analysis will be conducted on the sludge. Based on the data, an application rate will be determined and a contractor will be retained to dredge the cells and land apply the biosolids.

6 References

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Appendix A – Certificate of Title

Appendix B – Current Licence

THE ENVIRONMENT ACT
LOI SUR L'ENVIRONNEMENT

LICENCE

Manitoba

Licence No. / Licence n° 1136 R

Issue Date / Date de délivrance January 15, 1988

Revised / Revisee April 17, 2007

In accordance with The Environment Act (C.C.S.M. c. E125)
Conformément à la Loi sur l'environnement (C.P.L.M. c. E125)

Pursuant to Sections 11(1) and 14(2) / Conformément au Paragraphe 11(1) et 14(2)

THIS LICENCE IS ISSUED TO: / CETTE LICENCE EST DONNÉÉ À:

RURAL MUNICIPALITY OF SIGLUNES; "the Licencee"

for the construction and operation of the Development being a wastewater collection system and a wastewater treatment lagoon located on NW 22-25-7WPM in the Rural Municipality of Siglunes and with discharge of treated effluent to the Moosehorn Lakes via existing road drainage ditches and a swamp, with eventual drainage to Lake Manitoba via Mossehorn Creek, in accordance with the Notice of Alteration filed under The Environment Act on September 18, 2006 and subject to the following specifications, limits, terms and conditions:

DEFINITIONS

In this Licence,

"accredited laboratory" means an analytical facility accredited by the Standard Council of Canada (SCC), or accredited by another accrediting agency recognized by Manitoba Conservation to be equivalent to the SCC, or be able to demonstrate, upon request, that it has the quality assurance/quality control (QA/QC) procedures in place equivalent to accreditation based on the international standard ISO/IEC 17025, or otherwise approved by the Director;

"appurtenances" means machinery, appliances, or auxiliary structures attached to a main structure to enable it to function, but not considered an integral part of it;

"as constructed drawings" means engineering drawings complete with all dimensions which indicate all features of the Development as it has actually been built;

"ASTM" means the American Society for Testing and Materials;

"bentonite" means specially formulated standard mill grade sodium bentonite conforming to American Petroleum Institute Specification 13-A;

"Director" means an employee so designated pursuant to The Environment Act;

"effluent" means treated wastewater flowing or pumped out of the wastewater treatment lagoon;

"fecal coliform" means aerobic and facultative, Gram-negative, nonspore-forming, rod-shaped bacteria capable of growth at 44.5° C, and associated with fecal matter of warm-blooded animals;

"five-day biochemical oxygen demand" means that part of the oxygen demand usually associated with biochemical oxidation of organic matter within five days at a temperature of 20° C;

"flooding" means the flowing of water onto lands, other than waterways, due to the overtopping of a waterway or waterways;

"high water mark" means the line on the interior surface of the primary and secondary cells which is normally reached when the cell is at the maximum allowable liquid level or the line of the exterior of the perimeter dykes which is reached during local flooding;

"hydraulic conductivity" means the quantity of water that will flow through a unit cross-sectional area of a porous material per unit of time under a hydraulic gradient of 1.0;

"in-situ" means on the site;

"low water mark" means the line on the interior surface of the primary and secondary cells which is normally reached when the cell is discharged;

"MPN Index" means the most probable number of coliform organisms in a given volume of wastewater which, in accordance with statistical theory, would yield the observed test result with the greatest frequency;

"primary cell" means the first in a series of cells of the wastewater treatment lagoon system and which is the cell that receives the untreated wastewater;

"riprap" means small, broken stones or boulders placed compactly or irregularly on dykes or similar embankments for protection of earth surfaces against wave action or current;

"secondary cell" means a cell of the wastewater treatment lagoon system which is the cell that receives partially treated wastewater from the primary cell;

"septage" means the sludge produced in individual on-site wastewater disposal systems such as septic tanks;

"sewage" means household and commercial wastewater that contains human waste;

"sludge" means the accumulated solids separated from liquids, such as water or wastewater, during processing;

"Standard Methods for the Examination of Water and Wastewater" means the most recent edition of Standard Methods for the Examination of Water and Wastewater published jointly by the American Public Health Association, the American Waterworks Association and the Water Environment Federation;

"total coliform" means a group of aerobic and facultative anaerobic, Gram-negative, nonspore-forming, rod-shaped bacteria, that ferment lactose with gas and acid formation within 48 hours at 35 ^{o}C, and inhabit predominantly the intestines of man or animals, but are occasionally found elsewhere and include the sub-group of fecal coliform bacteria;

"wastewater" means the spent or used water of a community or industry which contains dissolved and suspended matter;

"wastewater collection system" means the sewer and pumping system used for the collection and conveyance of domestic, commercial and industrial wastewater; and

"wastewater treatment lagoon" means the component of the development which consists of an impoundment into which wastewater is discharged for storage and treatment by natural oxidation.

GENERAL TERMS AND CONDITIONS

This Section of the Licence contains requirements intended to provide guidance to the Licencee in implementing practices to ensure that the environment is maintained in such a manner as to sustain a high quality of life, including social and economic development, recreation and leisure for present and future Manitobans.

1. The Licencee shall direct all wastewater generated within the Community of Ashern toward the wastewater treatment lagoon or other approved sewage treatment facilities.

2. In addition to any of the limits, terms and conditions specified in this Licence, the Licencee shall, upon the request of the Director:
   a) sample, monitor, analyze and/or investigate specific areas of concern regarding any segment, component or aspect of pollutant storage, containment, treatment, handling, disposal or emission systems, for such pollutants or ambient quality, aquatic toxicity, leachate characteristics and discharge or emission rates, for such duration and at such frequencies as may be specified;
   b) determine the environmental impact associated with the release of any pollutant(s) from the Development; or
   c) provide the Director, within such time as may be specified, with such reports, drawings, specifications, analytical data, descriptions of sampling and analytical procedures being used, bioassay data, flow rate measurements and such other information as may from time to time be requested.

3. The Licencee shall, unless otherwise specified in this Licence:
   a) carry out all preservations and analyses on liquid samples in accordance with the methods prescribed in "Standard Methods for the Examination of Water and Wastewater" or in accordance with an equivalent analytical methodology approved by the Director;
   b) have all analytical determinations undertaken by an accredited laboratory; and
   c) report the results to the Director, in writing or in a format acceptable to the Director, within 60 days of the samples being taken.

4. The Licencee shall, in case of physical or mechanical breakdown of the wastewater collection and/or treatment system:
   a) notify the Director immediately;
   b) identify the repairs required to the wastewater collection and/or treatment system;
   c) undertake all repairs to minimize unauthorized discharges of wastewater; and
   d) complete the repairs in accordance with any written instructions of the Director.

5. The Licencee shall, during construction and operation of the Development, report spills of fuels or other contaminants to an Environment Officer in accordance with the requirements of *Manitoba Regulation 439/87* respecting *Environmental Accident Reporting* or any future amendment thereof.

SPECIFICATIONS, LIMITS, TERMS AND CONDITIONS

6. The Licencee shall notify the assigned Environment Officer not less than two weeks prior to beginning construction or approved alteration of the Development. The notification shall include the intended starting date of construction.

7. The Licencee shall locate all fuel storage and equipment servicing areas established for the construction and operation of the Development a minimum distance of 100 metres from any waterbody, and shall comply with the requirements of *Manitoba Regulation 188/2001* respecting *Storage and Handling of Petroleum Products and Allied Products Regulation* or any future amendment thereof.

8. The Licencee shall, prior to the construction of the dykes for the wastewater treatment lagoon:
   a) remove all organic topsoil from the area where the dykes will be constructed; or
   b) remove all organic material for a depth of 0.3 metres and a width of 3.0 metres from the area where the liner will be constructed.

9. The Licencee shall construct and maintain the wastewater treatment lagoon, with a continuous liner under all interior surfaces of the cells in accordance with the following specifications:
   a) the liner shall be made of clay;
   b) the liner shall be at least one metre in thickness;
   c) the liner shall have a hydraulic conductivity of 1×10^{-7} centimetres per second or less at all locations; and
   d) the liner shall be constructed to an elevation of 2.5 metres above the floor elevations of the primary cells and the secondary cells.

10. The Licencee shall operate and maintain the wastewater treatment lagoon in such a manner that:
    a) the organic loading on the primary cells, as indicated by the five-day biochemical oxygen demand, is not in excess of 56 kilograms per hectare per day;
    b) the depths of liquid in the primary cells and secondary cells do not exceed 1.5 metres; and
    c) the release of offensive odours is minimized.

11. The Licencee shall construct and maintain an all-weather access road and a sewage dumping station for delivery of truck handled sewage to the wastewater treatment lagoon. The dumping facility shall have a surface splash ramp with a smooth hard surface that can be easily washed free of solids.

12. The Licencee shall not discharge septage into the wastewater treatment lagoon between the 15th day of October of any year and the 1st day of June of the following year.

13. The Licencee shall install and maintain a fence around the wastewater treatment lagoon to limit access. The fence shall be a minimum of 1.2 meters high and have a locking gate, which shall be locked at all times except to allow access to the wastewater treatment lagoon.

14. The Licencee shall, if, in the opinion of the Director, significant erosion of the interior surfaces of the dykes occurs, repair the dyke and place rip rap on the interior dyke surfaces from 0.6 metres above the high water mark to at least 0.6 metres below the low water mark to protect the dykes from wave action.

15. The Licencee shall provide and maintain a grass cover on the dykes of the wastewater treatment lagoon and shall regulate the growth of the vegetation so that the height of the vegetation does not exceed 0.3 metres on all dykes.

16. The Licencee shall annually remove by mechanical methods all reeds, rushes and trees located above the low water mark in every cell of the wastewater treatment lagoon.

17. The Licencee shall implement an ongoing program to ensure that burrowing animals are removed from the site of the wastewater treatment lagoon.

18. The Licencee shall not discharge effluent from the wastewater treatment lagoon:
    a) where the organic content of the effluent, as indicated by the five day biochemical oxygen demand, is in excess of 30 milligrams per litre;
    b) where the fecal coliform content of the effluent, as indicated by the MPN index, is in excess of 200 per 100 millilitres of sample;
    c) where the total coliform content of the effluent, as indicated by the MPN index, is in excess of 1500 per 100 millilitres of sample;
    d) between the 1st day of November of any year and the 15th day of June of the following year;
    e) when flooding from any cause is occurring along the effluent drainage route; or
    f) when such a discharge would cause or contribute to flooding in or along the effluent drainage route.

MONITORING AND REPORTING

19. The Licencee shall prior to each effluent discharge campaign obtain grab samples of the treated wastewater and have them analyzed for:
    a) the organic content as indicated by the five day biochemical oxygen demand and expressed as milligrams per litre;
    b) the fecal coliform content as indicated by the MPN index and expressed as MPN per 100 millilitres per sample; and
    c) the total coliform content as indicated by the MPN index and expressed as MPN per 100 millilitres per sample.

20. The Licencee shall:
    a) during each year maintain records of:
        i) wastewater sample dates;
        ii) original copies of laboratory analytical results of the sampled wastewater; and
        iii) effluent discharge dates;
    b) make the records being maintained pursuant to sub-Clause 20 (a) of this Licence available to an Environment Officer upon request; and
    c) keep the maintained records of any one calendar year available for inspection for a period of three years following the respective calendar year in which they were recorded.

21. The Licencee shall, upon written request of the Director:
    a) arrange with the designated Environment Officer a mutually acceptable time and date for any required soil sampling between the 15th day of May and the 15th day of October of any year;
    b) take and test undisturbed soil samples, in accordance with Schedule "A" attached to this Licence, from the liner of the wastewater treatment lagoon; the number and location of samples and test methods to be specified by the designated Environment Officer up to a maximum of 40 samples; and
    c) submit to the Director the results of the tests carried out pursuant to sub-Clause 21 b) of this Licence within 90 days of the soil sampling.

22. The Licencee shall actively participate in any future watershed-based management study, plan and/or nutrient reduction program, approved by the Director, for Lake Manitoba, the Moosehorn Lakes and associated waterways and watersheds.

23. The Licencee shall:
    a) prepare "as constructed drawings" for the Development and shall label the drawings "As Constructed"; and
    b) provide to the Director, on or before the 30th day of November, 2007, two sets of "as constructed drawings" of the wastewater treatment lagoon.

REVIEW AND REVOCATION

A. Environment Act Licence No. 1136 is rescinded.

B. If, in the opinion of the Director, the Licencee has exceeded or is exceeding or has or is failing to meet the specifications, limits, terms, or conditions set out in this Licence, the Director may, temporarily or permanently, revoke this Licence.

C. If the Licencee has not commenced construction of the Development within three years of the date of this Licence, the Licence is revoked.

D. If, in the opinion of the Director, new evidence warrants a change in the specifications, limits, terms or conditions of this Licence, the Director may require the filing of a new proposal pursuant to Section 11 of The Environment Act.

Tracey Braun

Tracey Braun, M.Sc.
Director
Environment Act

Client File No.: 114.20

Schedule "A" to Environment Act Licence No. 1136 R

Soil Sampling:

1. The Licencee shall provide a drilling rig, acceptable to the designated Environment Officer, to extract soil samples from the liner which is not placed or found at the surface of the lagoon structure. This includes all wastewater treatment lagoons constructed with clay cutoffs at the interior base of the dyke or with a clay cutoff in the centre of the dyke. The drill rig shall have the capacity to drill to the maximum depth of the clay cutoff plus an additional 2 metres. The drill rig shall be equipped with both standard and hollow stem augers. The minimum hole diameter shall be 5 inches.

2. For lagoon liners placed or found at the surface of the lagoon structure, the Licencee shall provide a machine, acceptable to the designated Environment Officer, capable of pressing a sampling tube into the liner in a straight line motion along the centre axis line of the sample tube and without sideways movement.

3. Soil samples shall be collected and shipped in accordance with ASTM Standard D 1587 (Standard Practice for Thin-Walled Tube Sampling of Soils), D 4220 (Standard Practice for Preserving and Transporting Soil Samples) and D 3550 (Standard Practice for Ring-Lines Barrel Sampling of Soils). Thin-walled tubes shall meet the stated requirements including length, inside clearance ratio and corrosion protection. An adequate venting area shall be provided through the sampling head.

4. At the time of sample collection, the designated Environment Officer shall advise the Licencee as to the soil testing method that must be used on each sample. The oedometer method may be used for a sample were the Environment Officer determines that the soil sample is taken from an undisturbed clay soil which has not been remoulded and which is homogeneous and unweathered. The triaxial test shall be used for all samples taken from disturbed and remoulded soils or from non homogenous and weathered soils.

5. The Licencee shall provide a report on the collection of soil samples to the designated Environment Officer and to the laboratory technician which includes but is not limited to: a plot plan indicating sample location, depth or elevation of sample, length of advance of the sample tube length of soil sample contained in the tube after its advancement, the soil test method specified by the Environment Officer for each soil sample and all necessary instructions from the site engineer to the laboratory technician.

6. All drill and sample holes shall be sealed with bentonite pellets after the field drilling and sampling has been completed.

Soil Testing Methods:

1. Triaxial Test Method
   a) The soil samples shall be tested for hydraulic conductivity using ASTM D 5084 (Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter).
   b) Soil specimens shall have a minimum diameter of 70 mm (2.75 inches) and a minimum height of 70 mm (2.75 inches). The soil specimens shall be selected from a section of the soil sample which contains the most porous material based on a visual inspection. The hydraulic gradient shall not exceed 30 during sample preparation and testing. Swelling of the soil specimen should be controlled to adjust for: the amount of compaction measured during sample collection and extraction from the tube and the depth or elevation of the sample. The effective stress used during saturation or consolidation of the sample shall not exceed 40 kPa (5.7 psi) or the specific stress level, that is expected in the field location were the sample was taken, which ever is greater.
   c) The complete laboratory report, as outlined in ASTM D 5084, shall be supplied for each soil sample collected in the field.

2. Oedometer Test Method
   a) The soil samples shall be tested for hydraulic conductivity using ASTM D 2435 (Standard Test Method for One-Dimensional Consolidation Properties of Soils).
   b) Soil specimens shall have a minimum diameter of 50 mm (2 inches) and a minimum height of 20 mm (0.8 inches). The soil specimens shall be selected from a section of the soil sample which contains the most porous material based on a visual inspection. The soil specimen shall be taken from an undisturbed soil sample. The soil specimen shall be completely saturated.
   c) The complete laboratory report, as outlined in ASTM D 2435, shall be supplied for each soil sample collected in the field.

Water & Wastewater Facility Operators Certification Program

This is to certify that the

Ashern Wastewater Lagoon

owned by

Rural Municipality of Siglunes

has been classified as a

Class 1 Wastewater Treatment Facility

in accordance with the Water and Wastewater Facility Operators Regulation under

The Environment Act.

Dated at Winnipeg, Manitoba *this* 27th *day of* June 2011

Certificate No. 2006-519
Expires: 27 June 2016

Director, Manitoba Conservation

Certificate is the property of Manitoba Conservation and must be surrendered upon request

Protecting & Managing our Air, Land and Water

Manitoba
Building for the Future

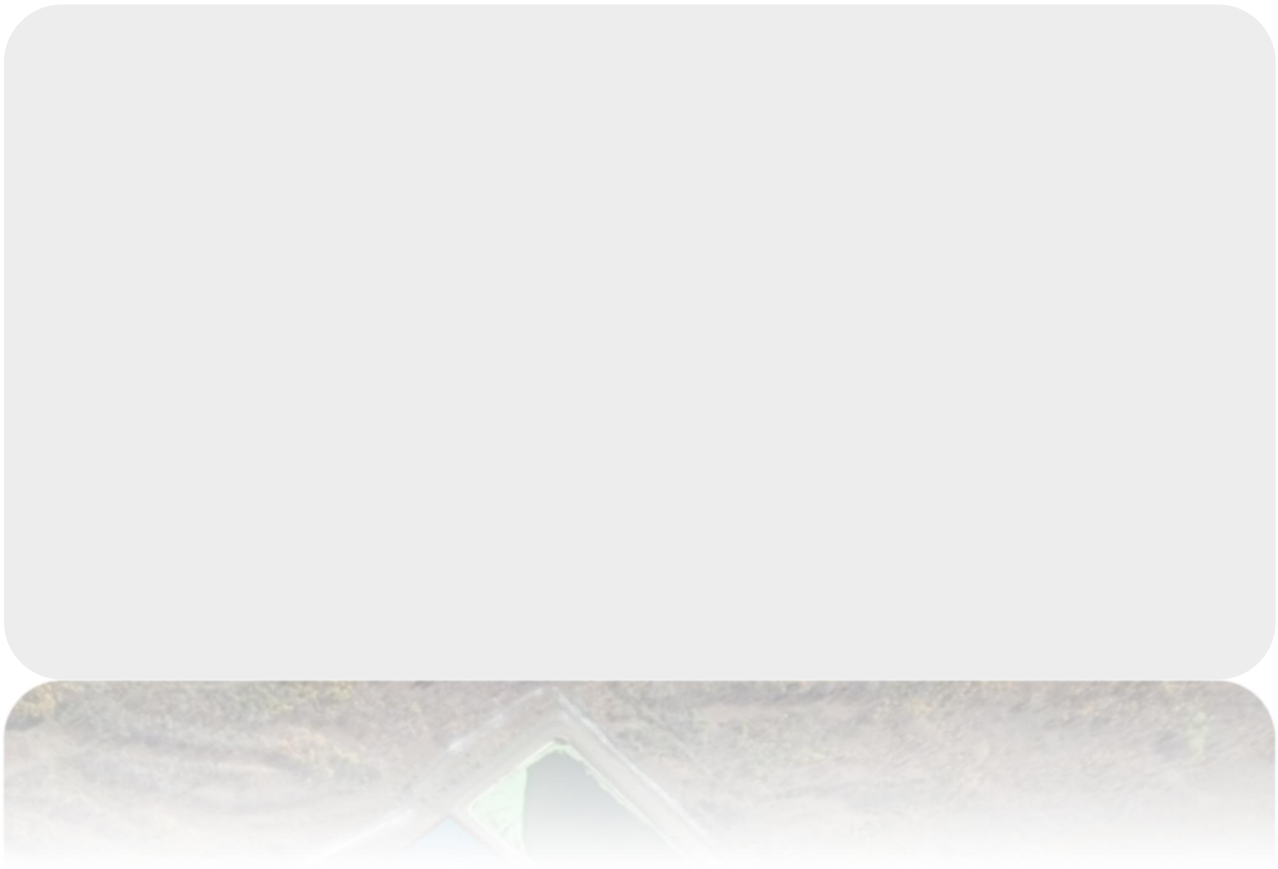
Appendix C – Pre-Design Report

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

The RM of West Interlake

Ashern Wastewater Treatment Facility Lagoon Expansion

West Interlake RURAL MUNICIPALITY



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1 Introduction

The purpose of this Technical Memorandum is to confirm the sizing of the new lagoon storage cell that is to be constructed. The new cell should be sized to accommodate the additional flows over the winter storage period in order to reduce the frequency of emergency discharge frequency.

1.1 BACKGROUND

Ashern is a community of with 565 residents (Statistics Canada. 2017) located on Provincial Trunk Highway Six, 191 km North west of Winnipeg. Domestic wastewater generated within the community is conveyed to an existing three cell facultative lagoon system for treatment and storage via a low-pressure collection system with three lift stations within Ashern. The system includes a combined 2.11 Ha treatment cell (Cell #1A and #1B), 24,675 m^3 (Cell #2) and 35,360 m^3 (Cell #3) secondary cells.

In 2014, Associated Engineering (AE) completed the 'Ashern Wastewater Lagoon Review' which evaluated the potential causes for an above average amount of emergency discharges of the lagoon. The study was mandated by Director's Order 2013-09 issued on August 22, 2013.

The 2014 report found that the effective storage capacity of the existing facility is ~78,000 m^3, depending on how much wastewater is discharged in from the three cells in November. The 2014 report estimated that the facility would need to expand their storage an additional 76,000 m^3 to 96,000 m^3 in order to accommodate some of the wettest years (2010/2011).

In March of 2016, the RM of West Interlake received Clean Water and Wastewater Funding ($343,250) for upgrading the Ashern Wastewater System.

The funding deadline for completion was April 2018, however, given the approvals process and time needed to acquire the necessary land for a lagoon expansion, an extension request was submitted to extend the completion to November 2018 (approval is pending).

Based on available funding and timelines to spend the funds, the preferred option to address the hydraulic overloading is the construction of an additional storage cell. The new storage cell will be ~**40,000 m^3**, provided that it can meet the RM budget. This volume should meet most of the normal wet years seen in the historical records. In order to accommodate some of the peak years (~100,000 m^3), all the cells may need to operate ~650 mm into their 1.0 m freeboard until they can be discharged. Thus, it is anticipated that the need for emergency discharge requests (Suspension of Licence) will be notably reduced or eliminated.

Additional efforts on managing infiltration in the community over the next 10-20 years can also address some of the hydraulic load during the winter storage period.

This lagoon expansion will require an Environment Act Proposal (EAP) to be submitted for the new facility. This means that the upgraded facility will need to meet all the current regulations in effect at this time.

1.2 OBJECTIVES

The objectives of this predesign report are:

- Confirm the layout, alignment and size of the additional lagoon cell.
- Confirm location of clay borrow and negotiations for access and use of clay and cell expansion;
- Develop the preliminary design of the process civil components of the facility.
- Develop the information that will be required for the EAP.

2 Design Basis

2.1 DESIGN POPULATION

A 20-year design horizon is used for this project. The population is projected from an estimated 2017 population of 565 people at 1% annual growth to a design population of **690** in the year 2037.

The average day wastewater generation from the population is assumed to be 300 L/c/d. The amount of inflow and infiltration dramatically changes from year to year, given precipitation amounts and groundwater levels. For the Ashern design population of 690, the average day wastewater generation rate is 186 m^3/day plus 37 m^3/day to account for inflow/infiltration or future allocation.

Table 2-1 – Current and Future Wastewater Generation Summary

Design Flow	Average Day Generation	Additional 20% for Inflow/Infiltration or Future Allocation	Total
Current (2017)	170 m^3/d	34 m^3/day	204 m^3/day
Future (2037)	207 m^3/d	43 m^3/day	250 m^3/day

2.2 TREATMENT CELL REQUIREMENTS

The treatment cell requirements for the design year population of 690 is based on a per capita BOD loading of 0.076 kg BOD_5/person/day and a maximum BOD_5 lagoon loading rate of 56 kg BOD_5/ha/day.

Thus 690 residents' x 0.076 kg/person/BOD_5/day = 52.44 kg/BOD_5/day.

Based the 2014 report, the estimated loading from truck hauling is ~8 kg/BOD_5/day

For the total daily design loading rate of 60.44 kg/BOD_5/day, the total treatment area required for the design year is1.1 Ha. The current facility has ~2.0 Ha of surface area in its primary cells, thus the facility is adequate for organic loading requirements.

2.3 STORAGE CELL REQUIREMENTS

The storage cell requirements are based on the design year (i.e. 2037) wastewater generation projection of 250 m^3/day and a storage requirement of 227 days. Based on these initial design parameters, the total storage volume required for domestic wastewater production is the design year is 60,000 m^3.

As determined in the 2014 study, during wet years the facility should be able to accommodate over 180,000 m^3 of total influent volume due to excessive inflow and infiltration. This means a new storage cell of 100,000 m^3 would be the preferred size provided it suits the available budget. But due to funding constraints, the maximum volume of the new storage cell will be 40,000 m^3.

Table 2-2 summarizes the basic design parameters for the proposed new storage cell to comply with regulations.

Table 2-2 – Treatment and Storage Cell Sizing

Parameter	Value	Reference
Minimum storage volume	74,000 m^3	Section 5.2.1 Ashern Wastewater Lagoon Review (AE, 2014) 2010 flows.
<u>Recommended</u> Storage Volume **Based on available funding for project.**	**40,000 m^3**	74,000 m^3 would be achievable by operating all cells 380 mm into freeboard.
Maximum / minimum normal operating depth	1.5 m / 0.3 m	Design Objectives for Wastewater Treatment Lagoons (Manitoba Sustainable Development)
Steepest embankment slope	4:1	Design Objectives for Wastewater Treatment Lagoons (Manitoba Sustainable Development)
Minimum freeboard	1.0 m	Design Objectives for Wastewater Treatment Lagoons (Manitoba Sustainable Development)
Liner material / minimum thickness	Compacted clay @ 1.0 m	Design Objectives for Wastewater Treatment Lagoons (Manitoba Sustainable Development)
Minimum top-of-berm width	3.0 m	Minimum width to allow vehicle access

2.4 TREATED EFFLUENT CRITERIA

Manitoba Conservation regulates the discharge of treated effluent in Manitoba, as legislated in the *Public Health Act* (P210). Based on current Provincial and Federal regulations, **Table 2-3** summarize the anticipated effluent requirements to the Moosehorn Lakes.

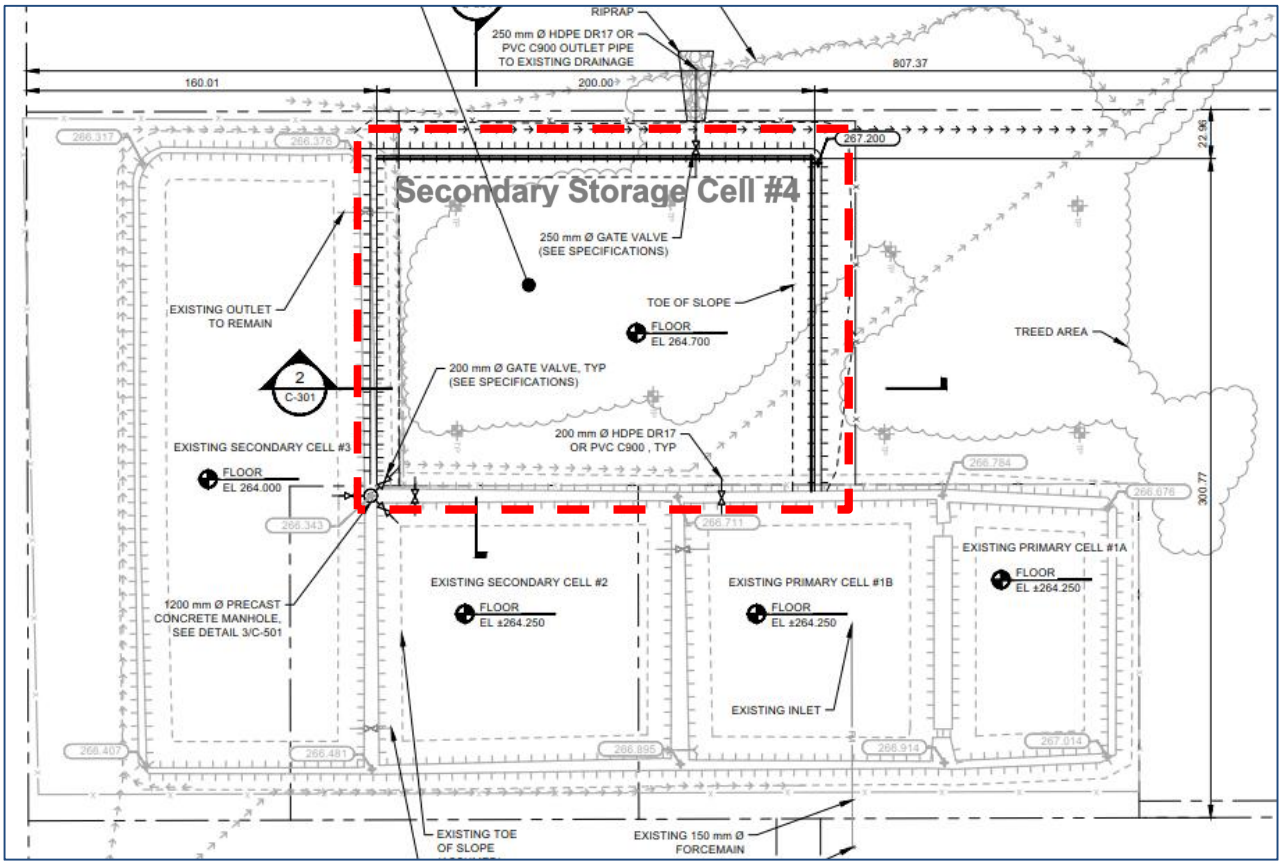
Table 2-3 – Anticipated Wastewater Effluent Requirements

$cBOD_5$, (mg/L)	**≤ 25 mg/L**	
TSS, (mg/L)	**≤ 25 mg/L**	
Total Phosphorus, TP, (mg/L)	**< 1.0 mg/L**	
Total coliform, (MPN/100 mL)	**< 1500**	
E. coli, (MPN/100 mL*)*	**< 200**	
Unionized Ammonia (mg/L)	**< 1.25 mg/L**	Env. Canada (WSER) Expressed as N, sample at T=15ºC +/- 1ºC
Total Residual Chlorine (mg/L)	**<0.02**	Env. Canada (WSER) If chlorine is used in the process.
Acute Lethality	**< 50% rainbow trout mortality after 96 hr.**	Env. Canada (WSER) Fish submerged in 100 percent effluent.

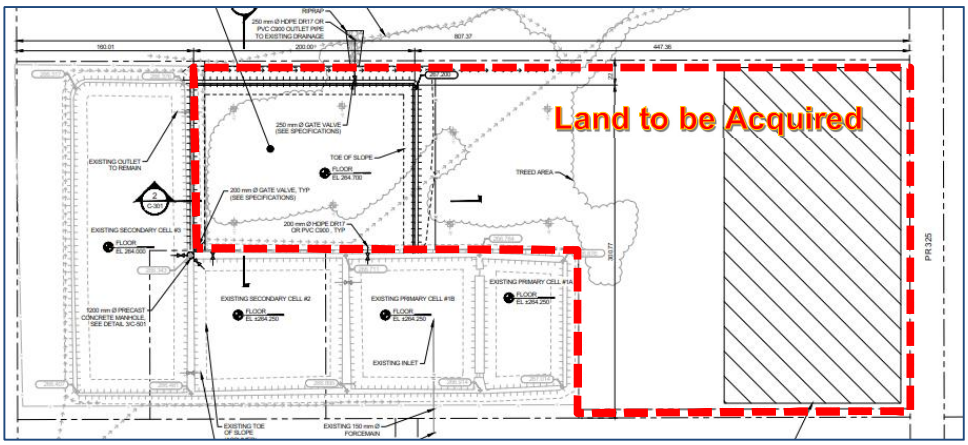
3 Civil Design

Figure 3-1 shows the existing Facility and the proposed expansion cell named **Secondary Storage Cell #4.**

Figure 3-1 – Proposed Lagoon Expansion Plan



The RM does not currently own the lands for the lagoon expansion cell. Negotiations are in process to begin acquisition from the current land owner.



3.1 TREATMENT CELL

The existing treatment and storage cells will remain relatively unchanged. New interconnection pipes from each cell into the new Cell #4 are proposed to allow more flexibility of operation. These new interconnections will allow Cell #2, Cell #3 and #4 to be taken off line in the future for any maintenance or cleaning.

3.2 STORAGE CELL

A new Storage Cell #4 is proposed to have a total capacity of 40,000 m^3 to meet the average wet year requirements for 227 days (November 1 to June 15) of storage for the 20-year design population. Available project funding may limit this cell size.

The new storage cell will be constructed adjacent to the treatment cells and settling ponds. The new storage cell will have an operating depth of 1.5 m plus 1.0 m freeboard.

3.3 LINERS

The new cell will be lined with re-worked in-situ material from floor to top-of-berm with clay sourced from Area #2 as per the attached geotechnical report. Liners will be 1.0 m thick, compacted to 100% SPD in 150 mm lifts.

3.4 TRUCK DUMP SPILLWAY

The existing truck dump spill way will remain as is.

3.5 GATES AND FENCING

The existing fencing will be extended around the new cell, and the existing gates will remain.

3.6 EROSION CONTROL

All cells will be constructed with interior and exterior slopes of 4 horizontal to 1 vertical. The interior slopes will be seeded with perennial type, low growing, shallow rooted grass above the water line for additional erosion protection. Funds at this time do not allow for any rip rap protection along the shoreline.

Exterior slopes will be seeded from toe to top-of-berm for erosion protection.

3.7 DISCHARGE SCHEDULES

Discharge schedules will be changed somewhat. Currently discharge from the third cell runs through a drainage ditch paoccurs through the proposed cell. The drain will need to be re-routed around the new cell and exit to the north.

4 Phosphorus Management Strategy

The current design shows a new central manhole between Cell #2 and Cell #3 that could be used for injection of alum (coagulant) for phosphorus settling in Cell #3. Or from Cell #3 into Cell #4.

At this time, this manhole and piping arrangement will exceed the available project budget. So we will show it as “future work” that the RM can install to assist with a phosphorus management strategy.

For the interim, the RM can maintain their current phosphorus strategy with broadcasting by boat as needed.

5 Construction Schedule

The proposed work program is currently funded by the **Clean Water and Wastewater Fund**. The two critical tasks that will delay start of these works will be the environmental approvals process (i.e. Draft EAL) and the acquisition of the lands for the expansion. Also, as previously noted, the funding is contingent on 100% completion by April 2019, but liner acceptance is required in 2018.

Table 5-1 – Project Timeline

	2018												2019			
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A
EAP Submission (January 29)	★															
EAP Approvals		▬	▬	▬	▬	▬										
Tendering Works					▬											
Draft EAL						★										
Award Contract						★										
Construction of Cell #4						▬	▬	▬	▬	▬						
Liner Approvals										▬						
Substantial Completion										★						
Funding Deadline															★	

6 Opinion of Probable Construction Costs

The following Table summarizes the probable construction costs for the construction of the new secondary storage Cell #4 and associated works.

Table 6-1 – Cell #4 OPC – Minimum Scope

Item	Unit	Qnty	Unit Price	Amount
Mobilization and Demobilization	LS	1	$20,000	**$20,000**
Clearing and grubbing	LS	1	$10,000	**$10,000**
Topsoil stripping	LS	1	$20,000	**$20,000**
Topsoil replacement	LS	1	$20,000	**$20,000**
Common Excavation Embankment	m^3	17,150	$4.50	**$77,175**
Common Excavation Embankment (borrow)	m^3	5,000	$4.50	**$22,500**
Compacted Clay Liner (borrow)	m^3	32,500	$6.00	**$195,000**
Intercell Piping (from Cell #3 to Cell #4)	m	1	$3,500	**$3,500**
Gate Valve (from Cell #3 to Cell #4)	each	1	$5,000	**$5,000**
Discharge Piping (from Cell #4)	m	1	$3,500	**$3,500**
Gate Valve (from Cell #4)	m	1	$5,000	**$5,000**
			SUB TOTAL:	***$381,675.00***
			Contingency (10%)	***$40,000***
** Known expense*			**Engineering & Testing**	***$67,150***
			TOTAL:	**$488,825**

Table 6-1 estimates a potential project cost of $488,825 for the new 40,000 m^3 Cell #4. With the available Funding of $343,250 from CWWF, this means that the RM will need to contribute a further $145,575 of additional funds (or seek more funding).

The following **Table 6-2** lists price additions for other features that can be added to the facility. The prices are assuming this work is completed with the main project. If these are delayed to the future under other contracts, the costs will likely increase.

Table 6-2 – OPC for Additional Works

Item	Unit	Qnty	Unit Price	Amount
ADDITIONAL INTERCELL PIPING				
Intercell Piping (from Cell #1 and #2 into Cell #4)	each	2	$10,000	**$20,000**
Gate Valves (from Cell #1 and #2 into Cell #4)	each	2	$5,000	**$10,000**
PHOSPHORUS DOSAGE MANHOLE				
Intercell Manhole	LS	25,000	$25,000	**$25,000**
Gate Valves	Each	3	$5,000	**$15,000**
Intercell Piping	LS	1	$15,000	**$15,000**
OTHER WORKS				
New Fencing Around Cell #4	LS	1	$5,500	**$5,500**
			TOTAL:	**$90,500.00**

7 Closure

This study has been prepared for the RM of West Interlake to provide a design summary complete with probable costs, for the described upgrades at the Ashern lagoon facility. The information provided herein is based on the information provided by the Municipality and our best understanding of the Municipality's intent.

Respectfully submitted,

Prepared by:

Ken Anderson., P.Eng.
Manger, Water

Appendix A - Geotechnical Investigation

GEOTECHNICAL INVESTIGATION
PROPOSED ASHERN LAGOON EXPANSION
NW 22-25-7W1M
ASHERN, MANITOBA

Submitted to:

Associated Engineering (Sask.) Ltd.

Winnipeg, Manitoba
R3T 0P4

Attention: Mr. Ken Anderson, Manager

Submitted by:

Amec Foster Wheeler Environment & Infrastructure
A division of Amec Foster Wheeler Americas Limited

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28 August 2017

WX18276

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Explanation of Terms and Symbols

1.0 INTRODUCTION

At the request and authorization of Mr. Ken Anderson, Manager for Associated Engineering (Sask) Ltd., Amec Foster Wheeler Environment & Infrastructure, a division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler), has completed a geotechnical investigation for the proposed expansion of the existing lagoon in Ashern, Manitoba. The purpose of the geotechnical investigation was to investigate subsurface soil and groundwater conditions in order to determine if soils at the site are suitable for liner and berm construction, and to provide recommendations for construction of a geosynthetic liner (if required).

The scope of work for the project was outlined in Amec Foster Wheeler proposal number WPG2017.129, dated 15 March 2017.

This report summarizes the field and laboratory testing programs, describes the subsurface conditions encountered at the test hole locations, provides evaluation of the suitability of local clay as clay liner material, and presents recommendations for subgrade preparation beneath geosynthetic liners.

2.0 PROJECT AND SITE DESCRIPTION

The location and current layout of the existing Ashern wastewater lagoon is illustrated in Figure 1. The facility is located at the west terminus of Main Street in Ashern, Manitoba, within legal subdivision 22-25-07W1M.

A plan view delineating the perimeter of the proposed cell expansion is overlain in Figure 1. Based on the information provided to our office, Amec Foster Wheeler understood that the project consists of the addition of a new overflow storage cell (Cell #4) to the existing lagoon cells. Specifically, it was understood that the new cell will be approximately 55,000 m^3 in volume, and that the cell floor will be located approximately 1.2 m below grade. New perimeter berms will extend approximately 1.2 m above grade, with an estimated volume of 5,000 m^3.

At the time of the investigation, the expansion area was relatively flat lying with topographic relief estimated as approximately 0.3 m or less. An elevation survey was not undertaken. Due to the combination of forested land, steep berms, and the perimeter drainage channel around the existing lagoon cells, test holes TH01 through TH03 south of the drainage channel were not accessible, and thus with approval from Associated Engineering, were deleted from the program at the time of drilling.

3.0 GEOTECHNICAL INVESTIGATION PROGRAM

Prior to initiating drilling, Amec Foster Wheeler notified public utility providers (i.e. Manitoba Hydro, MTS, etc.) of the intent to drill in order to clear public utilities, and where required, met with said representatives on-site. Prior to mobilizing to the field, Amec Foster Wheeler submitted proposed test hole locations to Associated Engineering for approval.

On 13 July 2017, Amec Foster Wheeler supervised the drilling of test holes TH04 through TH08 at the proposed locations illustrated in Figure 1. The test holes were drilled to auger refusal between approximately 1.1 and 3.7 m below grade using a track mounted Acker Renegade drill rig equipped with 125 mm diameter solid stem augers; operated by Maple Leaf Drilling Ltd. of

Winnipeg, Manitoba. Approximate UTM coordinates for each of the test holes were surveyed by Amec Foster Wheeler using a hand held GPS unit.

Due to the combination of forested land, steep berms, and the perimeter drainage channel around the existing lagoon cells, test holes TH01 through TH03 south of the drainage channel were not accessible, and thus with approval from Associated Engineering, were deleted from the program at the time of drilling.

During drilling, Amec Foster Wheeler field personnel visually classified the soil stratigraphy within the test holes in accordance with the Modified Unified Soil Classification System (MUSCS); as well as noted observed seepage and/or sloughing conditions. Grab samples were collected from each test hole at selected depths and retained in sealed plastic bags for shipping, review, and select testing in Amec Foster Wheeler's Winnipeg laboratory. The in-situ relative consistency of cohesive overburden was evaluated within each test hole during drilling using pocket penetrometer readings. The recorded pocket penetrometer readings are shown on the test hole logs.

Upon completion of drilling, the depths to slough and groundwater levels within each of the test holes were obtained after an elapsed time of about 10 minutes. Subsequently, the test holes were backfilled to grade with bentonite and auger cuttings.

Following completion of the field drilling program, a laboratory testing program was conducted on selected soil samples obtained from the test holes. The laboratory testing program completed consisted of moisture content determinations of select grab samples. Following review and selection of the samples for moisture content analysis, select clay and silt till samples from each of the test holes were combined to form a single bulk sample for Atterberg Limit testing, Particle Size Analysis by hydrometer method, Standard Proctor Analysis, and remolded Hydraulic Conductivity testing.

Detailed test hole logs summarizing the sampling, field testing, moisture content results, and subsurface conditions encountered at the test hole locations are presented in Appendix A. Actual depths noted on the test hole log may vary by ± 0.3 m from those recorded due to the method by which the soil cuttings are returned to the surface. Summaries of the terms and symbols used on the test hole logs and of the Modified Unified Soil Classification System are also presented in Appendix A.

4.0 SUBSURFACE CONDITIONS

4.1 Stratigraphy

Consistent with the regional geology and anticipated conditions, the stratigraphy at the test hole locations generally consisted of 125 to 200 mm of topsoil underlain by clay and silt till followed by sand. Brief description of each of the soil layers is presented below. The test hole logs presented in Appendix A should be consulted for detailed descriptions of the soil conditions at each test hole location.

Topsoil

Approximately 125 to 200 mm of topsoil was encountered at the surface of each of the test holes. The topsoil generally consisted of organic clay described as silty, high plastic, moist, and soft. It

should be noted that the thickness of topsoil across the site could vary from that encountered at the test hole locations.

It should also be noted that Amec Foster Wheeler has evaluated topsoil thickness using the basic A-B-C soil horizon classification system to identify the O and A soil horizons in which weathering and humus (i.e. organic matter and roots) are most concentrated. Evaluation of topsoil was not undertaken based on any minimum nutrient requirement for end-use in landscaping and/or planting. Nutrient analysis of the topsoil was outside of the scope of work for this project.

Clay and Silt till

Consistent with typical soil and groundwater conditions in the region, medium plastic clay and silt till was encountered beneath the topsoil at all test hole locations. The thickness of the clay and silt till layer at the test hole locations ranged from about 0.9 to 1.7 m (average 1.3 m), and extended to the underlying sand layer at TH04 through TH07 between approximately 1.5 and 1.8 m below grade. At TH08, the till layer extended to auger refusal approximately 1.1 m below grade. The clay and silt till was generally described as sandy with trace to some gravel, damp to moist, very stiff, and brown. General overview of averaged in-situ moisture content results indicated near surface values ranging from about 13 to 18 percent, decreasing to between about 11 and 13 percent below 0.6 m below grade. Standard Proctor analysis of a bulk sample indicated an optimum moisture content of about 12.4 percent.

Hydraulic Conductivity testing of a bulk sample comprised of grab samples from all test holes and remoulded to a target 95 percent of Standard Proctor maximum Dry Density (SPMDD) was undertaken. The hydraulic conductivity test result and Standard Proctor value are summarized in Table 1.

Table 1: Standard Proctor and Hydraulic Conductivity Results

Sample ID and Depth	Standard Proctor Result		Hydraulic Conductivity	
	Maximum Dry Density (kg/m^3)	Optimum Moisture Content (%)	Sample Density (% of SPMDD)	Hydraulic Conductivity (cm/sec)
Bulk Sample TH04 through TH08	1969	12.4	95.4	1.0×10^{-8}

Atterberg Limit and Particle Size Analysis results of the same bulk sample are presented in Table 2.

Table 2: Atterberg Limit Results and Estimated Optimum Moisture Contents

Sample ID and Depth	Atterberg Results			Particle Size Analysis Results			
	Liquid Limit	Plastic Limit	Plasticity Index	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
Bulk Sample TH04 through TH08	32.3	12.2	20.1	3.7	27.4	39.9	29.0

4.2 Groundwater and Sloughing Conditions

All test holes were monitored for seepage and sloughing throughout drilling, and were left open for approximately 10 minutes *upon* completion to monitor short term slough and groundwater accumulation levels prior to backfilling. Recorded observations are summarized in Table 3.

Table 3: Observed Slough and Groundwater Conditions During Drilling

Test Hole ID	Test Hole Depth (m)	During Drilling		Upon Completion	
		Sloughing Zone (m)	Seepage Zone (m)	Depth of open hole (m)	Depth to Groundwater (m)
TH04	3.5	None observed	None observed	3.5	None observed
TH05	3.7	None observed	None observed	3.7	None observed
TH06	3.7	None observed	Seepage on auger cuttings below 3.0 m	3.0	None above slough level
TH07	3.4	None observed	None observed	3.4	None observed
TH08	1.1	None observed	None observed	1.1	None observed

In addition to monitoring groundwater within the open bore during drilling and upon drilling completion, TH06 was instrumented with a slotted standpipe piezometer. Installation details are illustrated on the test hole log in Appendix A. Groundwater within the standpipe was measured approximately 1.28 m below grade on 19 July 2017; approximately 6 days after installation.

It should be noted that only short-term seepage and sloughing conditions were observed and that groundwater levels can fluctuate annually, seasonally, or as a result of construction activity.

5.0 GEOTECHNICAL RECOMMENDATIONS

5.1 General Evaluation

Generally, the stratigraphy and soil conditions at the Site are typical of conditions within the region of Ashern, Manitoba. Based on soil conditions observed at the borehole locations, Amec Foster Wheeler anticipates common fill resulting from excavation of the lagoon will consist of organic clay topsoil underlain by clay and silt till with frequent silt and sand lenses, followed by poorly graded, fine grained sand.

The following sections provide discussion and recommendations as they pertain to the suitability of the clay and silt till as liner material, and recommendations for geomembrane liner construction.

5.2 Suitability of Clay and Silt till as Liner Material

Feasibility for the utilization of the various materials as a low permeable liner meeting the requirements of Manitoba Environment for the proposed lagoon will largely depend on the quality and amount of the clay available. Typical engineering practice is to specify materials that comply with the following minimum parameters:

- Liquid Limit of 30% or greater ;
- Plastic Index of 10% or greater;
- 30% or more passing a number 200 mesh sieve; and
- 20% or more of clay particles (2-µm particle size)

In general, materials meeting the combination of characteristics noted above would typically provide a re-compacted liner having a hydraulic conductivity not exceeding the maximum allowable value of $1x10^{-7}$ cm/sec. Where the characteristics of materials tested exceed one or more of these criteria, the required hydraulic conductivity may not be achieved.

Based on the laboratory test results outlined in Table 1 and Table 2, clay and silt till at the site is expected to meet the maximum conductivity value specified by Manitoba Conservation when *re-worked* and compacted to a minimum specification of 95% of Standard Proctor Maximum Dry Density (SPMDD). Due to the presence of abundant sand and silt lenses (or seams) within the natural till deposit, Amec Foster Wheeler considers there to be a high risk that the permeability of the natural (i.e. unworked) till deposit could exceed Manitoba Environment's criteria of $1x10^{-7}$ cm/sec. Removal of silt and sand seams through sub excavation, mixing, and re-compaction of the entire liner thickness is recommended

The underlying fine grained sand will not meet the performance criteria for liner material; however subject to implementing erosions protection measures to mitigate surface erosion due to run-off, could be used as berm material overlying a clay core, or as berm material overlain with a suitable geosynthetic liner. The sand could also be considered for reuse as cover material for geosynthetic liners.

5.3 Geomembrane Liners

When suitable in-situ or local borrow material is not available, synthetic liners may be used to line the cells of waste water lagoons. Acceptable liners come in a variety of material types including, but not limited to, geosynthetic clay, poly vinyl chloride (PVC), and High-Density Polyethylene (HDPE) liners. From a geotechnical standpoint, all of these liner materials are adequate, provided they meet Manitoba Environment design objectives.

The satisfactory performance of PVC and HDPE liners is dependent on smooth contact with the underlying soil and the absence of perforations, tears, and breaks in the seams. If a liner is used, both PVC and HDPE liners should be placed following liner manufacturer and installation recommendations, as well as the following general guidelines:

1. HDPE and PVC liners must not be less than 60 mils or 30 mils thick, respectively.
2. Initial subgrade preparation for both HDPE and PVC liners should include removal of materials which could cause punctures of the membrane, such as large stones with sharp edges.
3. In the case of smooth HDPE liners, an underlying, nonwoven geotextile (i.e., Geotex® 1001 or similar) is strongly recommended to improve sliding resistance between the liner and the slopes and to help cushion the liner against perforation. Alternatively, textured HDPE liners may be acceptable and eliminate the need of a geotextile to reduce slippage between the subgrade and the HPDE liner.

4. Following completion of excavation, the finished grade should be scarified to a minimum depth of 200 mm and compacted to 95% of standard Proctor maximum dry density (SPMDD) within two (2) percent of optimum moisture content (OMC).
5. The ground surface to be lined should be free of irregularities, stones or other protrusions, loose soil, and abrupt changes in grade as per manufacturer specifications.
6. Excessively softened or disturbed soils should be removed and replaced with properly compacted fill consisting of native or imported granular or fine grained soils of similar properties to the in-situ sand or in-situ clay and silt till, respectively. All fill should be placed in horizontal lifts not exceeding 150 mm in compacted thickness and uniformly compacted per the recommendations in Item 4 above.
7. The ground surface should be examined and approved by a geotechnical representative of the Owner and then covered with an approved non-woven geofabric as soon as possible.
8. The prepared subgrade should be protected against desiccation and freeze/thaw prior to placing the liner.
9. Geomembrane panels should be placed individually above the geofabric and each field panel should be seamed immediately after its placement in order to minimize the number of unseamed field panels exposed to wind. Both the geomembrane and the underlying geotextile must be in complete, smooth contact with the subgrade. At the end of each working day it should be adequately restrained in this position, without excessive tension.
10. The exposed edges of the geomembrane should be kept clean and protected;
11. The liner should be provided with suitable anchorage both as a temporary measure during construction, as well as in the long term using an anchor trench or similar located at the crest of the berms which meets the manufacturer's recommendations for the final berm side slope configurations;
12. Edge-roll overlaps should be a minimum of 150mm;
13. End-roll overlaps should be a minimum of 600mm;
14. Overlaps should be seamed per the manufacturer recommendations;
15. Liners should be placed by rolling down from the top of the berm slope (i.e. downslope) and carefully secured to minimize wrinkles in the panels, especially differential wrinkles between adjacent panels. Overlapping should also be done in the downstream direction to minimize resistance to flow. That is, downstream sections of the liner should be placed under the adjacent upstream liner sections. It is also usually beneficial to proceed downslope and in the direction of (with) prevailing winds. Scheduling decisions must be made during installation, in accordance with varying environmental conditions. In any event, the liner Installer/Contractor should be fully responsible for the decisions made regarding placement procedures.
16. Geomembrane placement should not proceed in ambient air temperatures or adverse weather conditions that would jeopardize the integrity of the liner. The Installer must

demonstrate that acceptable seaming can be performed by completing trial seams/welds under the current air ambient conditions under the supervision of the Engineer.

17. Use equipment that does not damage the geomembrane as a result of handling, traffic, excessive heat, leakage of hydrocarbons, etc.
18. Personnel working on the geomembrane should not smoke, wear hard-soled shoes and engage in activities which could otherwise damage the geomembrane;
19. Upon completion of the installation, the liner should be checked for tears, breaks or holes and the seams should be properly tested to confirm continuity of the welded seams as per manufacturer recommendations.
20. Both HDPE and PVC liners should be covered with a minimum 300 mm thick cover of common fine grained sand for ultraviolet protection and protection from puncture.
21. Riprap will be required to provide erosion protection, particularly at the location of cell inlets and outlets, and should consist of well-graded, rounded, durable, sound material, that is resistant to the action of water and frost, and material that varies in size between 100 and 350 mm and is placed over a non-woven geotextile.

6.0 CLOSURE

The findings and recommendations presented in this report were based on geotechnical evaluation of the subsurface conditions observed during the site investigation described in this report. If conditions other than those presented in this report are noted during subsequent phases of the project, or if the assumptions stated herein are not in keeping with the design, this office should be notified immediately in order that the recommendations can be verified and revised as required. Recommendations presented herein may not be valid if an adequate level of inspection is not provided during construction, or if relevant code requirements are not met.

The site investigation conducted and described in this report was for the sole purpose of identifying geotechnical conditions at the project site. Although no environmental issues were identified during the fieldwork, this does not indicate that no such issues exist. If the owner or other parties have any concern regarding the presence of environmental issues, then an appropriate level environmental assessment should be conducted.

Soil conditions, by their nature, can be highly variable across a site. The placement of fill and prior construction activities on a site can contribute to the variability especially in near surface soil conditions. A contingency should always be included in any construction budget to allow for the possibility of variation in soil conditions, which may result in modification of the design and construction procedures.

This report has been prepared for the exclusive use of Associated Engineering (Sask.) Ltd., and their agents, for specific application to the project described in this report. The data and recommendations provided herein should not be used for any other purpose, or by any other parties, without review and written advice from Amec Foster Wheeler. Any use that a third party makes of this report, or any reliance or decisions made based on this report, are the responsibility of those parties. Amec Foster Wheeler accepts no responsibility for damages suffered by a third party as a result of decisions made or actions based on this report.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, either expressed or implied, is made.

Respectfully submitted,

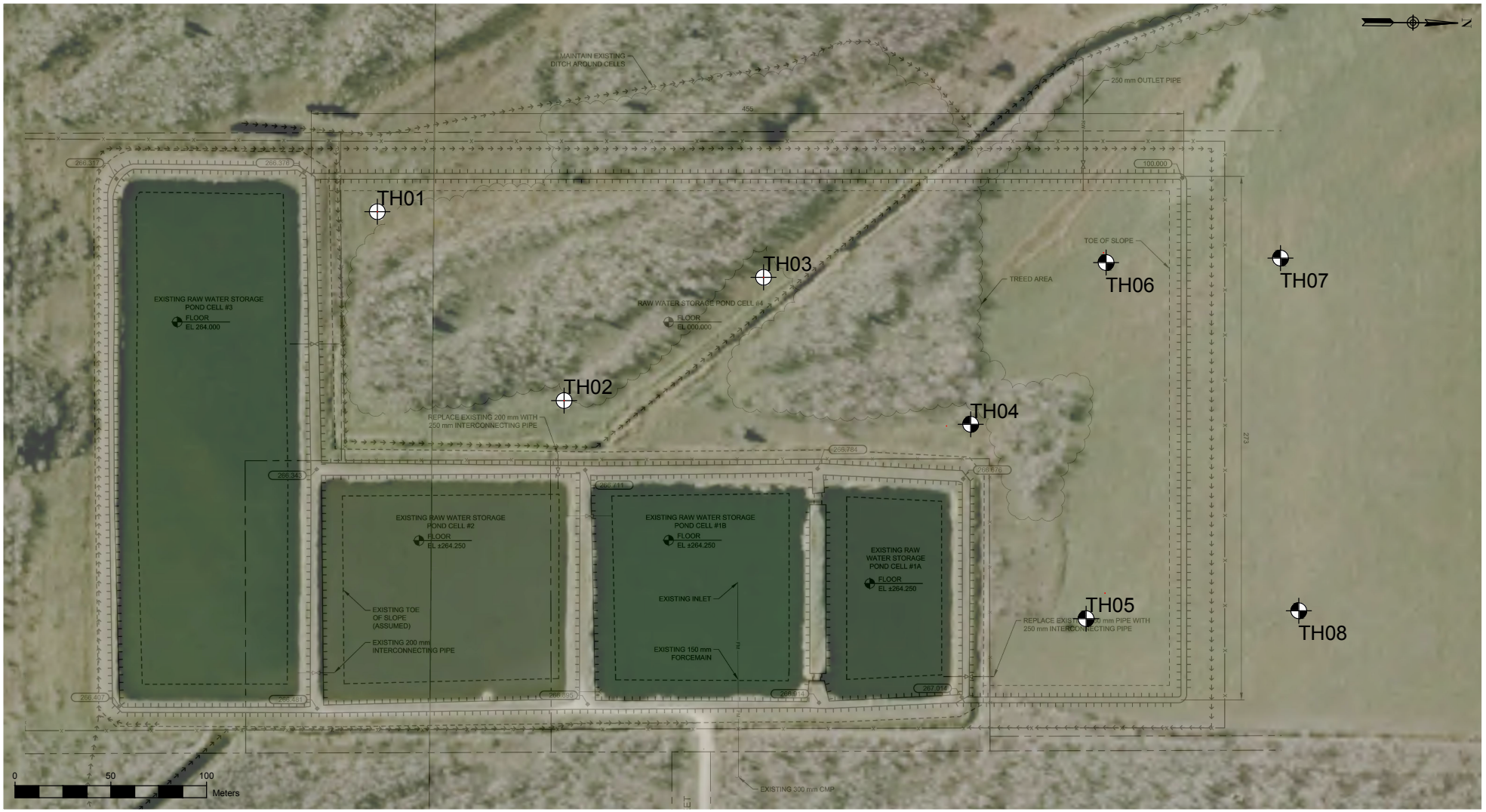
Amec Foster Wheeler Environment & Infrastructure,
A Division of Amec Foster Wheeler Americas Limited

Kelly Johnson, P. Eng.
Senior Geotechnical Engineer

Reviewed By:

Brad Wiebe, M.Sc., P.Eng.
Senior Associate Geotechnical Engineer
Manager of Geotechnical Services, Winnipeg

FIGURES



P:_JOBS\18200's\18270\18276 - ASHERN LAGOON EXPANSION\5 DRAWINGS\WX18276.DWG

LEGEND:

TEST HOLE (NOT DRILLED/ACCESSIBLE)

TEST HOLE

REVISION	BY	DATE
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CLIENT:

ASSOCIATED ENGINEERING LTD.

Amec Foster Wheeler
Environment & Infrastructure
440 DOVERCOURT DRIVE
WINNIPEG, MANITOBA R3Y 1N4
PHONE: 204.488.2997 FAX:204.489.8261

amec foster wheeler

DWN BY:	MD
CHK'D BY:	KJ
DATUM:	NAD83
PROJECTION:	UTM Zone 14 U
SCALE:	AS SHOWN

GEOTECHNICAL INVESTIGATION
PROPOSED LAGOON EXPANSION
ASHERN, MANITOBA

TEST HOLE LOCATION PLAN

DATE:	AUGUST 2017
PROJECT NO:	WX18276
REV. NO.:	---
FIGURE NO:	FIGURE 1

APPENDIX A

PROJECT: Ashern Lagoon Expansion	DRILLED BY: Maple Leaf Drilling Ltd.	BORE HOLE NO: **TH04**
CLIENT: Associated Enginering (Saks) Ltd.		PROJECT NO: WX18276
LOCATION: NAD83, 14U N5670281 E544435	DRILL METHOD: 125 mm diam. Solid Stem Augers	ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

■ POCKET PENETROMETER (kPa) ■ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	Depth (m)
0		PT	TOPSOIL (200mm)					0
			CLAY & SILT TILL - clayey, some sand, trace gravel, medium plastic, moist, very stiff		1			
					2			
1		ML	- below 0.9m, some gravel					1
					3			
			SAND - and silt, trace clay, poorly graded, fine grained, loose to compact (inferred), damp, brown					
2								2
			- below 2.1m, some gravel, loose		4			
		SM						
3					5			3
					6			
			AUGER REFUSAL AT 3.5m BELOW GRADE - no sloughing observed during drilling. - no seepage during drilling. - test hole open to 3.5m 10 minutes after drilling completion. - no groundwater accumulation above slough level. - test hole backfilled with auger cuttings and bentonite.					
4								4
5								

WX18276 - ASHERN LAGOON EXPANSION.GPJ 17/08/28 10:02 AM (GEOTECHNICAL REVISED WITH UTM INPUTS)

Amec Foster Wheeler Environment & Infrastructure
Winnipeg, Manitoba

LOGGED BY: AF	COMPLETION DEPTH: 3.5 m
REVIEWED BY: KJ	COMPLETION DATE: 13 July 2017
Figure No. A1	Page 1 of 1

PROJECT: Ashern Lagoon Expansion	DRILLED BY: Maple Leaf Drilling Ltd.	BORE HOLE NO: **TH05**
CLIENT: Associated Enginering (Saks) Ltd.		PROJECT NO: WX18276
LOCATION: NAD83, 14U N5670342 E544536	DRILL METHOD: 125 mm diam. Solid Stem Augers	ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

■ POCKET PENETROMETER (kPa) ■ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	Depth (m)
0		PT	TOPSOIL (150mm)					0
			CLAY & SILT TILL - clayey, some sand, trace gravel, medium plastic, damp, very stiff, brown		1			
			- below 0.6m, some gravel		2			
1		ML						1
					3			
			SAND - and silt, trace clay, poorly graded, fine grained, loose to compact (inferred), damp, brown					
2					4			2
			- below 2.4m, some gravel, coarse grained, very loose					
		SM						
3					5			3
					6			
			AUGER REFUSAL AT 3.7m BELOW GRADE - no sloughing observed during drilling. - no seepage during drilling. - test hole open to 3.7m 10 minutes after drilling completion. - no groundwater accumulation above slough level. - test hole backfilled with auger cuttings and bentonite.					
4								4
5								

WX18276 - ASHERN LAGOON EXPANSION.GPJ 17/08/28 10:02 AM (GEOTECHNICAL REVISED WITH UTM INPUTS)

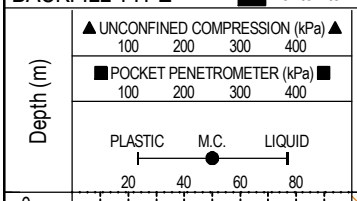
Amec Foster Wheeler Environment & Infrastructure
Winnipeg, Manitoba

LOGGED BY: AF	COMPLETION DEPTH: 3.7 m
REVIEWED BY: KJ	COMPLETION DATE: 13 July 2017
Figure No. A2	Page 1 of 1

PROJECT: Ashern Lagoon Expansion	DRILLED BY: Maple Leaf Drilling Ltd.	BORE HOLE NO: **TH06**
CLIENT: Associated Enginering (Saks) Ltd.		PROJECT NO: WX18276
LOCATION: NAD83, 14U N5670351 E544350	DRILL METHOD: 125 mm diam. Solid Stem Augers	ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand



Depth (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	Depth (m)
0		PT	TOPSOIL (150mm) - organic clay, silty, high plastic, moist, soft					
			CLAY & SILT TILL - clayey, some sand, trace gravel, medium plastic, damp, very stiff, brown		1			
					2			
					3			
			- below 0.8m, some gravel					
1		ML			4			1
					5		Groundwater level on 19 July 2017	
					6			
			SAND - and silt, trace clay, poorly graded, fine grained, loose to compact (inferred), damp, brown					
2					7			2
		SM						
					8			
3			- below 3.0m, some gravel, wet, free water on surface of auger cuttings					3
					9			
			AUGER REFUSAL AT 3.7m BELOW GRADE - no sloughing observed during drilling. - seepage on auger cutting below 3.0m during drilling. - test hole open to 3.0m 10 minutes after drilling completion. - no groundwater accumulation above slough level. - test hole instrumented with slotted standpipe piezometer, screened below 2.1m below grade.					
4								4
5								

WX18276 - ASHERN LAGOON EXPANSION.GPJ 17/08/28 10:02 AM (GEOTECHNICAL REVISED WITH UTM INPUTS)

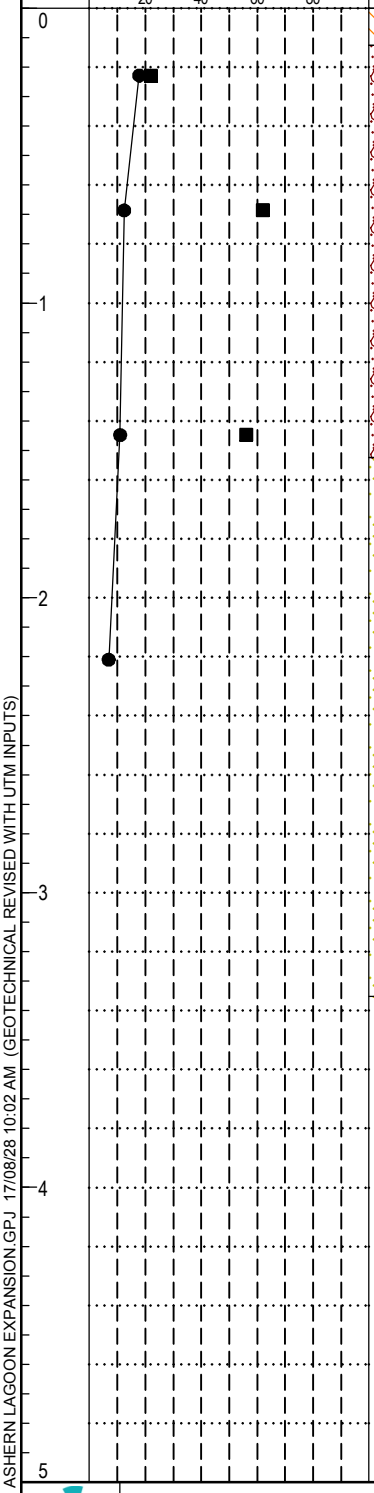
Amec Foster Wheeler Environment & Infrastructure
Winnipeg, Manitoba

LOGGED BY: AF	COMPLETION DEPTH: 3.7 m
REVIEWED BY: KJ	COMPLETION DATE: 13 July 2017
Figure No. A3	Page 1 of 1

PROJECT: Ashern Lagoon Expansion	DRILLED BY: Maple Leaf Drilling Ltd.	BORE HOLE NO: **TH07**
CLIENT: Associated Enginering (Saks) Ltd.		PROJECT NO: WX18276
LOCATION: NAD83, 14U N5670442 E544347	DRILL METHOD: 125 mm diam. Solid Stem Augers	ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand



Depth (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	Depth (m)
0		PT	TOPSOIL (125mm)					0
			SILT TILL - clayey, some sand, trace gravel, medium to highly plastic, moist, stiff to very stiff, greyish brown		1			
			- below 0.5m, some gravel, medium plastic, damp, brown		2			
1		ML			3			1
			SAND - and gravel, some silt, trace clay, poorly graded, fine to coarse grained, loose to compact (inferred), damp, brown		4			
2		SM						2
					5			
3					6			3
			AUGER REFUSAL AT 3.4m BELOW GRADE - no sloughing observed during drilling. - no seepage during drilling. - test hole open to 3.4m 10 minutes after drilling completion. - no groundwater accumulation above slough level. - test hole backfilled with auger cuttings and bentonite.					
4								4
5								

WX18276 - ASHERN LAGOON EXPANSION.GPJ 17/08/28 10:02 AM (GEOTECHNICAL REVISED WITH UTM INPUTS)

Amec Foster Wheeler Environment & Infrastructure
Winnipeg, Manitoba

LOGGED BY: AF	COMPLETION DEPTH: 3.4 m
REVIEWED BY: KJ	COMPLETION DATE: 13 July 2017
Figure No. A4	Page 1 of 1

PROJECT: Ashern Lagoon Expansion	DRILLED BY: Maple Leaf Drilling Ltd.	BORE HOLE NO: **TH08**
CLIENT: Associated Enginering (Saks) Ltd.		PROJECT NO: WX18276
LOCATION: NAD83, 14U N5670453 E544531	DRILL METHOD: 125 mm diam. Solid Stem Augers	ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

■ POCKET PENETROMETER (kPa) ■ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	Depth (m)
0		PT	TOPSOIL (125mm)					0
		ML	SILT TILL - clayey, some sand, trace gravel, medium to highly plastic, moist, stiff to very stiff, greyish brown		1			
1					2			1
			AUGER REFUSAL AT 1.1m BELOW GRADE - no sloughing observed during drilling. - no seepage during drilling. - test hole open to 1.1m 10 minutes after drilling completion. - no groundwater accumulation above slough level. - test hole backfilled with auger cuttings and bentonite.					
2								2
3								3
4								4
5								

WX18276 - ASHERN LAGOON EXPANSION.GPJ 17/08/28 10:02 AM (GEOTECHNICAL REVISED WITH UTM INPUTS)

Amec Foster Wheeler Environment & Infrastructure
Winnipeg, Manitoba

LOGGED BY: AF	COMPLETION DEPTH: 1.1 m
REVIEWED BY: KJ	COMPLETION DATE: 13 July 2017
Figure No. A5	Page 1 of 1

EXPLANATION OF TERMS AND SYMBOLS

The terms and symbols used on the borehole logs to summarize the results of field investigation and subsequent laboratory testing are described in these pages.

It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site.

TEST DATA

Data obtained during the field investigation and from laboratory testing are shown at the appropriate depth interval.

Abbreviations, graphic symbols, and relevant test method designations are as follows:

*C	Consolidation test	*ST	Swelling test
D_R	Relative density	TV	Torvane shear strength
*k	Permeability coefficient	VS	Vane shear strength
*MA	Mechanical grain size analysis	w	Natural Moisture Content (ASTM D2216)
	and hydrometer test	w_l	Liquid limit (ASTM D 423)
N	Standard Penetration Test (CSA A119.1-60)	w_p	Plastic Limit (ASTM D 424)
N_d	Dynamic cone penetration test	E_f	Unit strain at failure
NP	Non plastic soil	γ	Unit weight of soil or rock
pp	Pocket penetrometer strength	γ_d	Dry unit weight of soil or rock
*q	Triaxial compression test	ρ	Density of soil or rock
q_u	Unconfined compressive strength	ρ_d	Dry Density of soil or rock
*SB	Shearbox test	C_u	Undrained shear strength
SO_4	Concentration of water-soluble sulphate	→	Seepage
		▼	Observed water level

* The results of these tests are usually reported separately

Soils are classified and described according to their engineering properties and behaviour.

The soil of each stratum is described using the Unified Soil Classification System[1] modified slightly so that an inorganic clay of "medium plasticity" is recognized.

The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual[2].

Relative Density and Consistency:

Cohesionless Soils

Relative Density	SPT (N) Value
Very Loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Cohesive Soils

Consistency	Undrained Shear Strength c_u (kPa)	Approximate SPT (N) Value
Very Soft	0-12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

Standard Penetration Resistance ("N" value)
The number of blows by a 63.6kg hammer dropped 760 mm to drive a 50 mm diameter open sampler attached to "A" drill rods for a distance of 300 mm after an initial penetration of 150 mm.

[1] "Unified Soil Classification System", Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S. Army. Vol. 1 March 1953.

[2] "Canadian Foundation Engineering Manual", 3rd Edition, Canadian Geotechnical Society, 1992.

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISIONS			SYMBOLS: USCS	SYMBOLS: GRAPH	SYMBOLS: COLOUR	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75um)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW		RED	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u=D_{60}/D_{10}$ >4; $C_c=(D_{30})^2/(D_{10}xD_{60})$ = 1 to 3
			GP		RED	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY GRAVELS (WITH SOME OR MORE FINES)	GM		YELLOW	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR PI LESS THAN 4
			GC		YELLOW	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE AND PI MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW		RED	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u=D_{60}/D_{10}$ >6; $C_c=(D_{30})^2/(D_{10}xD_{60})$ = 1 to 3
			SP		RED	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM		YELLOW	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR PI LESS THAN 4
			SC		YELLOW	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE AND PI MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75um)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 50%	ML		GREEN	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		W_L > 50%	MH		BLUE	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SAND OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 30%	CL		GREEN	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		30% < W_L < 50%	CI		GREEN-BLUE	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		W_L > 50%	CH		BLUE	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	W_L < 50%	OL		GREEN	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G. SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		W_L > 50%	OH		BLUE	ORGANIC CLAYS OF HIGH PLASTICITY	
HIGHLY ORGANIC SOILS			PT		ORANGE	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

SPECIAL SYMBOLS

LIMESTONE		OILSAND	
SANDSTONE		SHALE	
SILTSTONE		FILL (UNDIFFERENTIATED)	

SOIL COMPONENTS

FRACTION	U.S. STANDARD METRIC SIEVE SIZE		DEFINING RANGES OF PERCENT BY WEIGHT OF MINOR COMPONENTS	
GRAVEL	PASSING	RETAINED	PERCENT	DESCRIPTOR
COARSE	76mm	19mm		
FINE	19mm	4.75mm	35 - 50	AND
SAND				
COARSE	4.75mm	2.00mm	30 - 35	Y / EY
MEDIUM	2.00mm	425µm	10 - 20	SOME
FINE	425µm	75µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)	75µm		1 - 10	TRACE

OVERSIZED MATERIAL

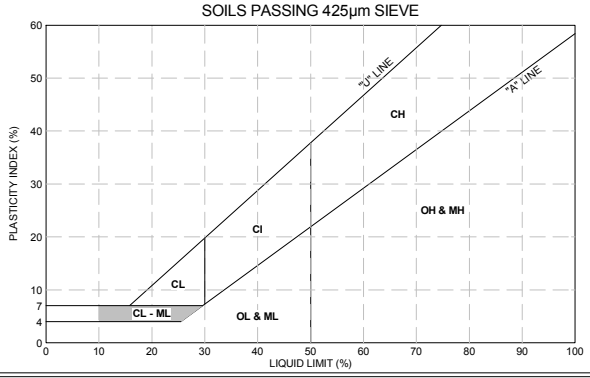
ROUNDED OR SUBROUNDED:

COBBLES 76mm to 200mm
BOULDERS > 200mm

NOT ROUNDED:

ROCK FRAGMENTS ? 76mm
ROCKS > 0.76 CUBIC METRE IN VOLUME

PLASTICITY CHART FOR SOILS PASSING 425µm SIEVE



NOTES:

1. ALL SIEVE SIZES MENTIONED ARE U.S. STANDARD ASTM E.11.
2. COARSE GRAINED SOILS WITH TRACE TO SOME FINES GIVEN COMBINED GROUP SYMBOLS, E.G. GW-GC IS A WELL GRADED GRAVEL SAND MIXTURE WITH TRACE TO SOME CLAY.
3. DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

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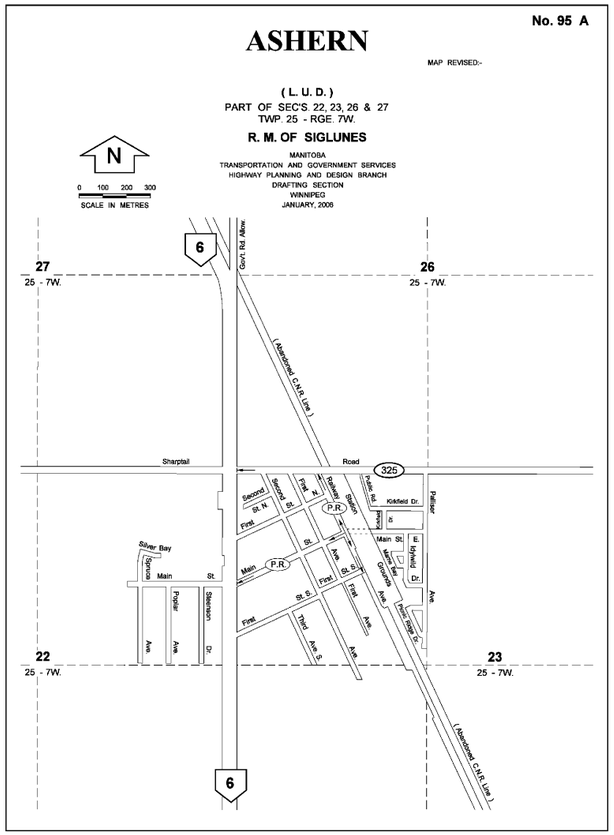
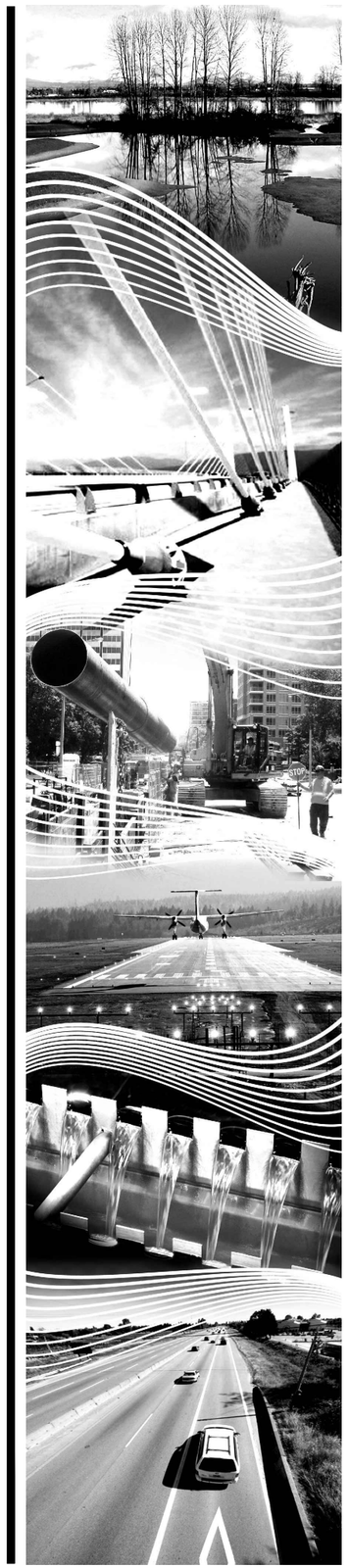
Appendix D – Drawings



DRAWING INDEX

SHEET	DRAWING NAME	REVISION	DRAWING TITLE	DRAWING DESCRIPTION
GENERAL				
1	4981-00-G-001	0	COVER	
CIVIL				
2	4981-00-C-001	0	OVERALL SITE PLAN	NOTES AND LEGEND
3	4981-00-C-101	0	SITE PLAN	
4	4981-00-C-301	0	SECTIONS	
5	4981-00-C-501	0	TYPICAL DETAILS	



Associated Engineering

WESTMAN BEST MANAGED COMPANIES

West Interlake RURAL MUNICIPALITY

ASHERN

RM OF WEST INTERLAKE
VILLAGE OF ASHERN
WASTEWATER LAGOON EXPANSION

20174981-00

RM OF WEST INTERLAKE
VILLAGE OF ASHERN
WASTEWATER LAGOON EXPASION

20174981-00

Issued for 60% Review - December 2017

PRELIMINARY/
FOR DISCUSSION
NOT FOR CONSTRUCTION

DRAFT

REV	DATE	DESIGN	DRAWN	DESCRIPTION
0	2017DEC08	K. ANDERSON	T. DYCHKO	ISSUED FOR 60% REVIEW

DRAWING	REVISION	SHEET
4981-00-G-001	0	1 / 5

Y:\20174981\00_Ashern_Lagoon\Working_Dwgs\900_Project_Standards\4981-00-g-001.dwg
DATE: 2017-12-18, Chelsey Archer

1 - PLAN 1:5000

OVERALL SITE

NOTES:

1. ALL MATERIALS AND INSTALLATION PRACTICES SHALL CONFORM TO M.W.S.B. STANDARD CONSTRUCTION SPECIFICATIONS.
2. DECIMALIZED NUMBERS INDICATE METERS AND WHOLE NUMBERS INDICATE MILLIMETERS.
3. LOCATION OF UNDERGROUND SERVICES AS SHOWN ARE BASED ON THE BEST INFORMATION AVAILABLE, BUT NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT.
4. CONTRACTOR MUST CONFIRM WITH THE INDIVIDUAL UTILITIES FOR EXISTENCE AND EXACT LOCATIONS OF ALL THE SERVICES PRIOR TO CONSTRUCTION.
5. CONTRACTOR MUST EXPOSE EXISTING INFRASTRUCTURE AT THE PROPOSED TIE-IN LOCATIONS TO ALLOW SITE ENGINEER TO VERIFY SIZE, MATERIAL AND INVERTS PRIOR TO CONSTRUCTION OF TIE-INS.
6. ALL SITE LAYDOWN AREAS SHALL BE AS NOTED IN THE SPECIFICATIONS AND APPROVED BY THE OWNER AND ENGINEER.
7. ALL AREAS SUBJECT TO CONSTRUCTION OPERATIONS SHALL BE RESTORED TO THE CONDITION IN WHICH THEY EXISTED PRIOR TO CONSTRUCTION. THIS INCLUDES, BUT IS NOT LIMITED TO, PAVEMENT REPAIRS, RE-GRAVELLING, TRENCH SETTLEMENT CORRECTION AND RE-SEEDING OF GRASSED AREAS. RESTORATION SHALL CONFORM TO M.W.S.B. AND MUNICIPAL STANDARDS.
8. CONTRACTOR SHALL MAINTAIN THE FOLLOWING INSTALLATION DISTANCES:
   - 8.1. SEPARATION BETWEEN POTABLE WATER AND RAW WATER OR WASTE WATER:
     - 8.1.1. HORIZONTAL = 3.0 m
     - 8.1.2. VERTICAL = 0.45 M, POTABLE WATER ABOVE.
   - 8.2. MINIMUM BURY DEPTH:
     - 8.2.1. WITHIN CITY, TOWN AND VILLAGE LIMITS = 2.75 m
     - 8.2.2. RURAL AREAS = 2.4 m
     - 8.2.3. CROSSINGS (ROAD, DRAIN, ETC.) = 3.0 m
     - 8.2.4. INSTALLATIONS WITH LESS THAN MINIMUM COVER SHALL BE INSULATED AS PER M.W.S.B. SPECIFICATIONS.
9. WHERE THE PROPOSED ALIGNMENT CROSSES PTH'S, PR'S, DEVELOPED ROAD ALLOWANCES, PRIVATE LANES, WATER RUNS AND WETLANDS, A TRENCHLESS METHOD OF INSTALLATION SHALL BE USED.

LINETYPES

	EXISTING	PROPOSED
FENCE	X X	x x
BOTTOM OF BANK		
TOP OF BANK		
HEDGE		
BUILDING		
PARCEL / LOT LINE		
EASEMENT		
ROAD ROW		
GAS	G	G
WATER MAIN	W	W
RAW WATER	RW	RW

SYMBOLS

	EXISTING	PROPOSED
FIRE HYDRANT	FH	FH
MANHOLE	M	M
TEE FLANGE		
END CAP / PLUG		
GATE VALVE		
WATER LEVEL		
REDUCER		
BORE HOLE	BH	BH
SPOT ELEVATION	EL1000	100.000
SLOPE	% 2 1	% 2 1

HATCH PATTERNS

CONCRETE | RIP-RAP / DRAIN ROCK | EARTH / NATIVE MATERIAL

X YYYYMMMDD E. ENGINEER D. DRAFTER ISSUED FOR XXXXXX

2016XXXX-XX

AS SHOWN

CIVIL

4981-00-C-001 X 2 XX

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DATE: 2017-12-08, Chelsey Archer

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NW 22-25-07W

NEW SECONDARY CELL #4
FSL VOL = XXX m3
FSL DEPTH = XXX m
MIN LIQUID DEPTH = XXX m
FREEBOARD = XXX m
EFFECTIVE VOL. = XXX m3

1 C-301

MAINTAIN EXISTING DITCH AROUND CELLS

RIPRAP

250 mm Ø HDPE DR17 OR PVC C900 OUTLET PIPE TO EXISTING DRAINAGE

160.01 | 200.00 | 807.37 | 447.36

266.317 | 266.376 | 267.200

22.96

250 mm Ø GATE VALVE (SEE SPECIFICATIONS)

EXISTING OUTLET TO REMAIN

TOE OF SLOPE

FLOOR EL 264.700

TREED AREA

2 C-301

200 mm Ø GATE VALVE, TYP (SEE SPECIFICATIONS)

EXISTING SECONDARY CELL #3

FLOOR EL 264.000

200 mm Ø HDPE DR17 OR PVC C900 , TYP

266.784 | 266.676

300.77

266.343 | 266.711

EXISTING PRIMARY CELL #1A

FLOOR EL ±264.250

EXISTING SECONDARY CELL #2

FLOOR EL ±264.250

EXISTING PRIMARY CELL #1B

FLOOR EL ±264.250

1200 mm Ø PRECAST CONCRETE MANHOLE, SEE DETAIL 3/C-501

EXISTING INLET

266.407 | 266.481 | 266.895 | 266.914 | 267.014

EXISTING TOE OF SLOPE (ASSUMED)

EXISTING 150 mm Ø FORCEMAIN

EXISTING 300 mm Ø CMP

EXISTING 200 mm Ø INTERCONNECTING PIPE

BORROW AREA

MAIN STREET

PR 325

1 - PLAN 1:1500

Associated Engineering

BEST MANAGED COMPANIES

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REV	DATE	DESIGN	DRAWN	DESCRIPTION
0	2017DEC08	K. ANDERSON	T. DYCHKO	ISSUED FOR 60% REVIEW

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RM OF WEST INTERLAKE
VILLAGE OF ASHERN

WASTEWATER LAGOON EXPANSION

20174981-00

SCALE: AS SHOWN

CIVIL
SITE PLAN

DRAWING	REVISION	SHEET
4981-00-C-101	0	3 / 5

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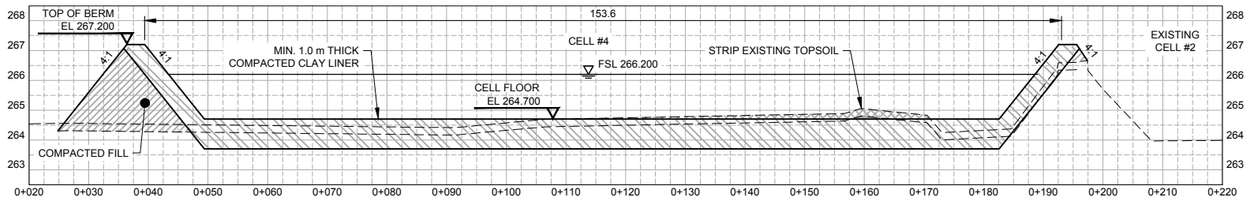
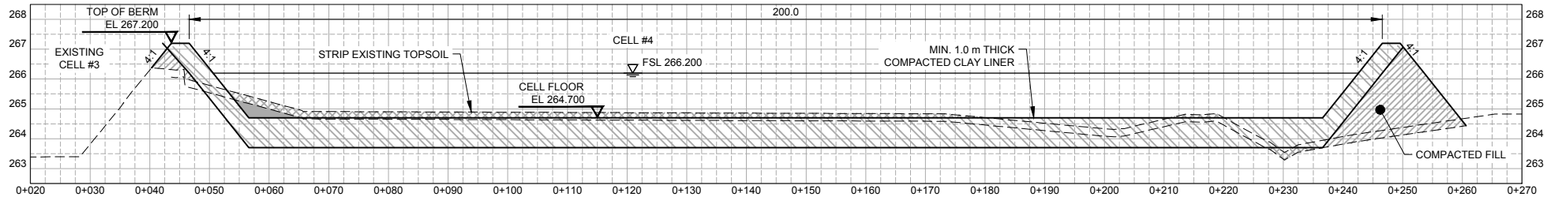


1 C-102 SECTION H1:500 V1:100



2 C-102 SECTION H1:500 V1:100

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WEST INTERLAKE RURAL MUNICIPALITY

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ASHERN WELCOMES YOU

RM OF WEST INTERLAKE
VILLAGE OF ASHERN

WASTEWATER LAGOON
EXPANSION

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SCALE: AS SHOWN

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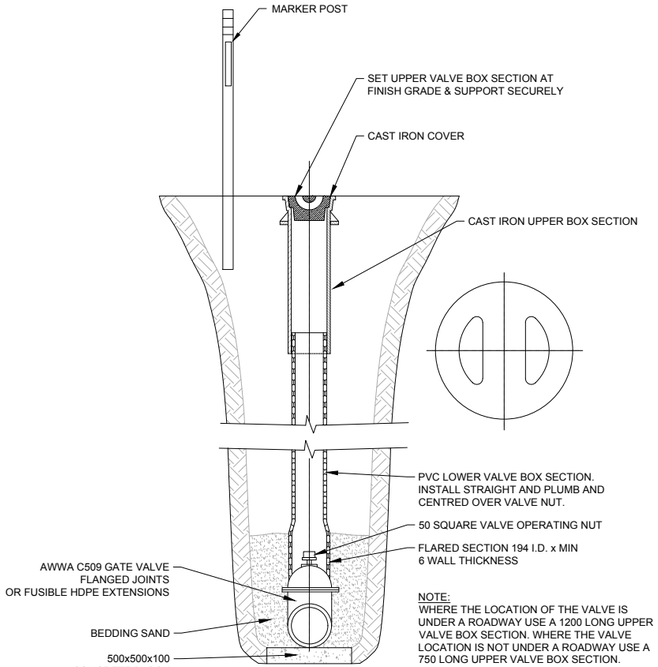
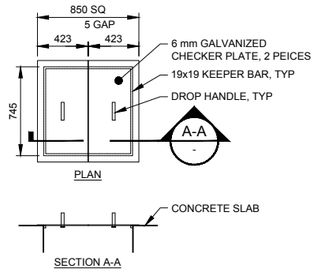
SECTIONS

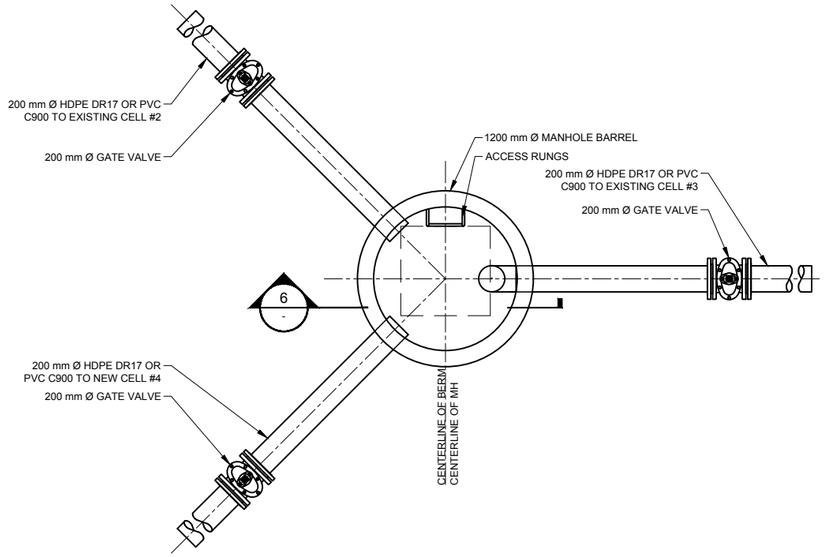
DRAWING	REVISION	SHEET
4981-00-C-301	0	4 / 5



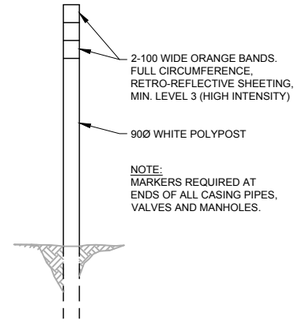
1 TYPICAL DETAIL NTS
GATE VALVE



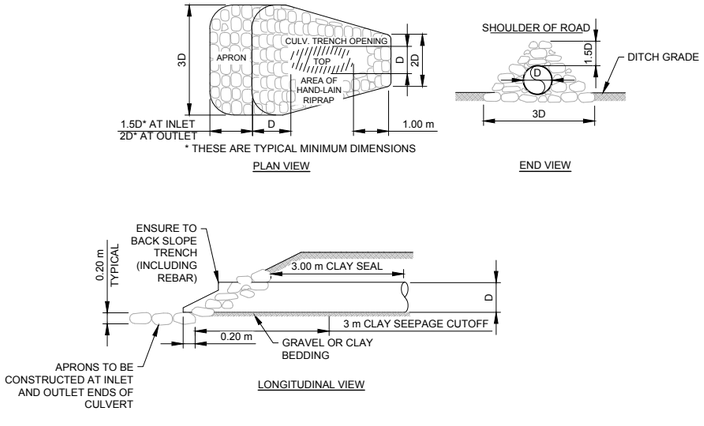
2 - DETAIL 1:25
MANHOLE HATCH



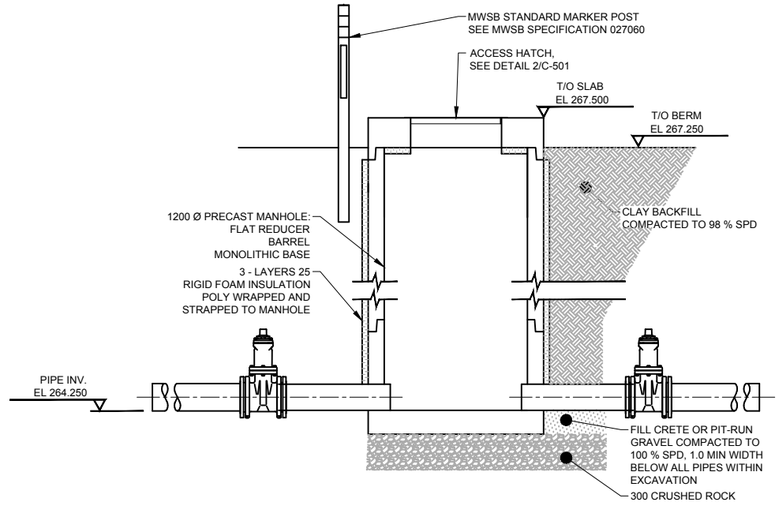
3 C-101 DETAIL 1:25
MANHOLE



4 - TYPICAL DETAIL NTS
MARKER POST



5 TYPICAL DETAIL NTS
LAGOON OUTLET



6 - DETAIL 1:25
MANHOLE

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TYPICAL DETAILS

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