Environment

Rural Municipality of Morris.

Lowe Farm Lagoon Expansion – Environment Act Proposal

Prepared by:

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

Project Number:

60447253

Date:

March, 2016

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("AECOM") for the benefit of the Client ("Client") in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents AECOM's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

AECOM shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. AECOM accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

AECOM agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but AECOM makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by AECOM represent AECOM's professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since AECOM has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, AECOM, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

Except (1) as agreed to in writing by AECOM and Client; (2) as required by-law; or (3) to the extent used by governmental reviewing agencies for the purpose of obtaining permits or approvals, the Report and the Information may be used and relied upon only by Client.

AECOM accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information ("improper use of the Report"), except to the extent those parties have obtained the prior written consent of AECOM to use and rely upon the Report and the Information. Any injury, loss or damages arising from improper use of the Report shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

AECOM: 2015-04-13

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

March 1, 2016

Ms. Tracey Braun, M.Sc.
Director, Environmental Assessment and Licensing
Manitoba Conservation and Water Stewardship
123 Main Street
Ste. 160 Union Station
Winnipeg, Manitoba R3C 1A5

Dear Ms. Braun:

Project No: 60447253

Regarding: Lowe Farm Lagoon Expansion – Environment Act Proposal

Please find enclosed four hard copies and one electronic copy of the *Environment Act* Proposal form and supporting information to obtain approval for Lowe Farm Lagoon Expansion. We understand that the proposed project is a Class 2 Development as per the *Classes of Development Regulation.* In accordance with the Classes of Development Regulation Fee, please find enclosed the *Environment Act* Proposal Form and a cheque for the application fee of $7,500. We trust that the information on the form and the attached supporting information are sufficient.

Should you have any questions regarding the project or the attached information, please do not hesitate to contact Somia Sadiq directly at 204-928-8494.

Sincerely,
AECOM Canada Ltd.

Paul Barsalou, M.Sc.,P.Eng.
Project Manager

AECOM Canada

KC:dh
Encl.
cc: RM of Morris

Distribution List

# of Hard Copies	PDF Required	Association / Company Name
4	1	Manitoba Conservation and Water Stewardship
2	1	RM of Morris

Revision Log

Revision #	Revised By	Date	Issue / Revision Description

AECOM Signatures

Report Prepared By:

Kristiina Cusitar, C.E.T., EP (SAR)
Environmental Assessor

Report Reviewed By:

Somia Sadiq, BEnv.Sc.,EP, MCIP RPP
Manitoba Lead, Impact Assessment & Permitting

Executive Summary

This *Environment Act* Proposal report contains the information described in Conservation and Water Stewardship's Information Bulletin "*Environment Act Proposal Report Guidelines*" and "*Alterations to Developments with Environment Act Licences*". The existing Lowe Farm lagoon requires an upgrade to meet future wastewater requirements.

AECOM completed a Wastewater Management Plan (WMP) in March 2014 for the RM of Morris. This work identified that the existing Lowe Farm lagoon has reached its hydraulic loading capacity and will reach the capacity for organic loading in the next few years. The population of the town has surpassed the design population of 400 and the hydraulic loading will exceed capacity. In order to meet the future projected loadings, an upgrade of the lagoon is required.

The proposed project includes the following components:

- Construction of a new secondary lagoon cell providing the required storage capacity to meet future hydraulic yearly loading of 66,000 m^3/year and population growth. The new cell will have a storage capacity of 31,027 m^3.
- Installation of a new interconnection pipe between the new secondary lagoon cell and the existing lagoon cell.
- Removal of the existing berm between the existing two lagoon cells to create one new primary lagoon cell.
- Installation of a new truck hauling dump.
- Installation of a new effluent discharge pipe.
- Abandonment of the existing effluent discharge pipe.
- Installation of a new influent pipe with connection to the existing influent pipe system.
- Abandonment of the existing influent pipe.

The results of the effects assessment can be summarized as follows:

Topography

Effects due to stockpiling, excavating, grading and leveling, and contouring are assessed to be negligible and temporary in nature, and therefore considered insignificant. There will be permanent changes in topography on the Project Site following construction of the new secondary lagoon cell; this is considered major change that is reversible during decommissioning depending on the end use of the land. The perimeter ditching of the new lagoon system will represent a permanent change in the topography; however, this change is not assessed to be adverse. Therefore, overall changes to topography during construction of the proposed project are anticipated to result in minor residual effects.

Air and Noise

Although dust is not anticipated to be a major concern at the Project Site, with the implementation of measures such as limiting material stockpile heights, keeping disturbed/exposed areas to a minimum, and using dust suppression if required, the effects of dust is assessed to be negligible.

During the site visit on September 22, 2015, no odour was noted at the existing lagoon (on the berm) or while on the access road.

With respect to exhaust emissions, it is anticipated that a maximum of 10 construction vehicles will access the Project Site via Municipal Road No. 5W. With the implementation of measures such as maintaining vehicles and equipment in proper working order and vehicle idling kept to a minimum, the effects of exhaust emissions is assessed to be negligible.

Noise levels at the Project Site during construction are not expected to be high enough to cause significant disturbance in the Project Area. With the implementation of measures such as providing hearing protection to workers as required and properly maintaining vehicles and equipment are expected to mitigate potential adverse effects. During operation, sources of noise include maintenance vehicles and general activities (anticipated to be typical of lawn equipment, trucks, and small hand-held tools) along with septage hauler trucks arriving to the site. It is anticipated that septage will be trucked to the lagoon approximately once per week. Septage trucks traveling to the lagoon will temporarily increase from approximately one septage truck per week to approximately three septage trucks per week for one month in duration every second year as a municipal cleaning program for residences.

Greenhouse Gas Emissions

With respect to greenhouse gas (GHG) emissions, the proposed primary and secondary cells will be 1.5 m in depth and therefore produce negligible quantities of methane. Also, vehicle emissions associated with sludge removal and maintenance are anticipated negligibly contribute to local GHG concentrations. Therefore, the effect of odour is assessed to be negligible.

Soil

With respect to soil compaction, mixing, and erosion during construction, the implementation of mitigation measures identified in this assessment is anticipated to mitigate any potential soil compaction/mixing and erosion effects. Therefore, it is anticipated that the residual effect on soil is assessed to be negligible.

Groundwater

The proposed project does not require undertaking of any activities that may affect groundwater in the area. In Manitoba, clay-lined lagoons are to provide a minimum 1 m thick clay seal having a hydraulic conductivity of 1×10^{-9} m/s lining the floor of the interior surfaces of the facility. The in-situ clays encountered in this area have a hydraulic conductivity range from 2.4×10^{-10} to 3.5×10^{-10} m/s. The clay was consistent and was found at depths up to 7.6 to 8.1 m, well beyond the requirement of 1 m. Based on the results of the geotechnical investigation (December 29, 2014), the existing natural clay meets and exceeds the criteria for a natural clay liner.

Surface Water and Aquatic Resources

The new lagoon system will meet the following effluent criteria (prescribed under Manitoba Water Quality Standards, Objectives, and Guidelines):

- $CBOD_5$ - 25 mg/L;
- Total Suspended Solids (TSS); excluding algae solids - 25 mg/L;
- Total Coliform - 1500 CFU per 100 mL;
- Fecal Coliform - 200 CFU per 100 mL; and
- Un-ionized ammonia - 1.25 mg/L expressed as nitrogen (N), at 15°C ± 1°C.

As the lagoon will be servicing a population of less than 2,000 people, Phosphorus reduction through natural attenuation methods will be used for the effluent from the Lowe Farm lagoon. Phosphorus absorption by the natural

grasses, reeds, and soil in the drainage ditches is possible due to the long route to the Morris River (approximately 14 km). The effluent discharges into the east ditch of Municipal Road 5W and flows north into the Anderson Drain (south ditch of Municipal Road 25N). The effluent then travels east for approximately 13 km to the Morris River, which drains into the Red River just north of the Town of Morris. In addition to this, the lagoon will utilize trickle discharge over a 2-3 week period to facilitate nutrient uptake.

With the above criteria as the target for key parameters, the quality of the effluent that will be discharged to the Morris River is anticipated to improve. The quantity of effluent is not anticipated to increase. Phosphorus reduction through natural attenuation methods will be used for the effluent from the Lowe Farm lagoon. Phosphorus absorption by the natural grasses, reeds, and soil in the drainage ditches is possible due to the long route to the Morris River (approximately 14 km).

With the implementation of the mitigation measures identified in this assessment, any adverse effects during the construction and operation phase are therefore assessed to be negligible.

Protected and Other Flora Species

There is the potential that the western ironweed, culver's root, Riddell's goldenrod, and western silvery aster may be found in the Project Region. Clearing and dust from construction activities are potential sources of effects on flora. The location of the new secondary lagoon cell was previously agricultural land used for the production of soy beans and is currently cleared. Some vegetation clearing and grading may also be required within the existing effluent drainage ditch.

With the implementation of the mitigation measures identified in this assessment, the effect of vegetation clearing is assessed to be minor.

Protected and Other Fauna Species

With respect to protected species, the listed wildlife species at risk are unlikely to occur in the local area of the Project Site due to the agricultural nature of the Project Site and surrounding area. The area of the existing lagoon has been previously disturbed therefore the likelihood of protected species in the area is anticipated to be low. Also, immediately east of the existing lagoon is the active Lowe Farm Landfill. Noise during construction will cause a short-term disturbance. With implementation of the mitigation measures identified in this report, the expected residual effects as a result of noise on wildlife are anticipated to be negligible at the Project Site.

Protected Areas

With respect to protected areas, the closest protected area is located approximately 47 km east from the Project Site therefore, no effects on protected areas are anticipated from the construction and operation of the proposed project.

Heritage Resources

AECOM submitted a screening request to Heritage Resources Branch (HRB) on October 28, 2015. HRB has no concerns with the proposed project.

Aesthetics

During construction, good housekeeping practices will be implemented at the Project Site including inspecting the Project Site on a regular basis for loose waste and debris and storing waste and debris in proper bins prior to removal from the site. The existing lagoon is located approximately 800 m east of the closest human receptors

through a treed shelter belt. The main traffic along Municipal Road No. 5W is to access either the existing lagoon or the Lowe Farm Landfill with some traffic to the homesteads located approximately 1.3 km north of the existing lagoon. The new the lagoon system will be fenced and will have a gate to limit public access. Therefore, the overall impact on aesthetics as a result of the proposed project is assessed to be reversible and insignificant.

Public Engagement

An information session was held at the Lowe Farm Community Centre on Monday December 14, 2015 from 2 pm until 7pm. Neighbouring property owners were contacted via mail and a follow-up phone call from AECOM inviting them out for the information session. Speaking with the landowners via phone call, no concerns were raised about the existing lagoon and proposed lagoon expansion.

Conclusion Summary

Considering the implementation of the proposed mitigation measures, design features, existing and proposed environmental licence conditions and the social and ecological context of each environmental component, the cumulative residual environmental effects of the proposed lagoon upgrade project are expected to negligible in magnitude. The measures described to mitigate the risk of occurrence of accidents and malfunctions are deemed to be appropriate in mitigating such risks. Therefore, it is our opinion that based on the available information and documented assumptions, the overall potential adverse effects of the proposed project will be negligible to minor and insignificant.

Table of Contents

List of Figures

List of Tables

Appendices

1. Introduction

1.1 Project Overview

AECOM completed a Wastewater Management Plan (WMP) in March 2014 for the RM of Morris. This work identified that the existing Lowe Farm lagoon has reached its hydraulic loading capacity and will reach the capacity for organic loading in the next few years. The population of the town has surpassed the design population of 400 and the hydraulic loading has reached capacity. In order to meet the future projected loadings, an upgrade of the lagoon is required.

Lowe Farm is located approximately 85 km south of Winnipeg, Manitoba and approximately 17 km west of Morris, Manitoba along Provincial Highway No. 23. The existing Lowe Farm Lagoon is located northeast of Lowe Farm along Disposal Site Road (Municipal Road 5W) and immediately west of the community solid waste disposal site. The location of the lagoon is shown in **Figure 01**.

The existing lagoon consists of two cells, which cover a total surface area of approximately 2.04 hectares. There is also a truck hauling dump located the primary cell. As part of the upgrade, the lagoon system has to demonstrate a nutrient reduction strategy instead of meeting Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG) stringent 1 mg/L phosphorus limit as this system discharges less than 820 kg of total phosphorus per year (population less than 2,000 people). Further, according to the Tier I Water Quality Standards, new or expanding facilities discharging less than 820 kg of total phosphorus per year are required to limit discharge to 1 mg/L or demonstrate a nutrient reduction strategy. A nutrient reduction strategy was thus accounted for in the proposed design for the new lagoon cell.

Figure 01 shows the general location of Lowe Farm in Manitoba and **Figure 02** shows the location and layout of the existing lagoon. **Figure 03** shows the proposed expansion in relation to the existing lagoon.

This Environment Act Proposal Report has been prepared by AECOM Canada Ltd. (AECOM) on behalf of the Rural Municipality (RM) of Morris in accordance with Manitoba Conservation and Water Stewardship's Information Bulletin, "*Environment Act Proposal Report Guidelines*", and AECOM's professional experience with other similar projects. The report documents the proposed upgrade and potential environmental effects and proposed mitigation measures and is submitted along with the *Environment Act* Proposal Form for consideration by Manitoba Conservation and Water Stewardship (MCSW).

1.2 Land Ownership and Property Rights

The proposed lagoon upgrade will be constructed on property purchased by the RM of Morris (NW ¼ 05-05-01 WPM). A copy of the Status of Title is provided in **Appendix A**.

1.3 Regulatory Framework

The existing lagoon operates according to the Clean Environment Commission (CEC) Order No. 1000 which was issued to the RM of Morris on August 29, 1983. The following conditions are outlined in the Order:

- "The lagoon will be operated in a manner to minimize odours;
- The organic loading of the primary cell five-day biochemical oxygen demand (BOD_5) will not exceed 56 kgs/hectare/day;
- Effluent limits include:

  - BOD_5 < 30 mg/L;
  - Fecal coliform < 200 per 100 mL of sample as indicated by the MPN index;
  - Total coliform < 1,500 per 100 mL of sample as indicated by the MPN index;
- No discharge if flooding from any cause is occurring in the drainage route;
- No discharge if the effluent will cause or contribute to flooding in or along the discharge route; and
- No discharge is permitted between November 1st and May 15th of the following year."

The proposed lagoon expansion is considered a Class 2 Development under the *Classes of Development Regulation* and as described in Section 11 of Manitoba's *Environment Act*. The proposed lagoon expansion is not listed on the *Regulations Designating Physical Activities* under the *Canadian Environmental Assessment Act*, *2012*, and as such, no federal environmental assessment requirements are anticipated. Since the project will not involve any disturbance to adjacent waterbodies, a Request for Review or subsequent permitting from the Department of Fisheries and Oceans is not required.

The *Water and Wastewater Facility Operators Regulation* addresses the classification of water and wastewater facilities and certification of operators in Manitoba. The completed Application for Wastewater Treatment Facility Classification is included in **Appendix B**.

2. Project Description

The proposed project includes the following components:

- Construction of a new secondary lagoon cell providing the required storage capacity to meet future hydraulic yearly loading of 66,000 m^3/year and population growth. The new cell will have a storage capacity of 31,027 m^3.
- Installation of a new interconnection pipe between the new secondary lagoon cell and the existing lagoon cell.
- Removal of the existing berm between the existing two lagoon cells to create one new primary lagoon cell.
- Installation of a new truck hauling dump.
- Installation of a new effluent discharge pipe.
- Abandonment of the existing effluent discharge pipe.
- Installation of a new influent pipe with connection to the existing influent pipe system.
- Abandonment of the existing influent pipe.

The physical components listed above are illustrated in **Figure 03**.

The following sections provide an overview of the existing site and the constructed Facility site. Additional design details are provided in the Functional Design Report located in **Appendix C**.

2.1 Existing Wastewater Lagoon

When the existing lagoon was designed in 1982, the population of Lowe Farm was 359 and had a projected population of 400 for the year 2000 which was used for calculating the original design loadings. The existing lagoon is a facultative lagoon consisting of two cells; one primary treatment cell and one secondary storage cell, and includes a septic truck dumping spillway. The total area of the existing lagoon is approximately 2.04 hectares.

The primary lagoon cell has a bottom base area of 5,402 m^2 and a volume of 9,136 m^3. The secondary lagoon cell has a volume of 10,715 m^3 and was sized for a 200 day winter storage period (October 31 to May 15). Both cells have 3H:1V side slopes and 0.75 m of freeboard. The total 200 day storage volume of the lagoon system is 15,284 m^3.

Lagoon effluent discharges into the east ditch of Municipal Road 5W and flows north into the Anderson Drain (south ditch of Municipal Road 25N). The effluent then travels east for approximately 13 km to the Morris River, which drains into the Red River just north of the Town of Morris.

The existing lagoon operates according to the Clean Environment Commission (CEC) Order No. 1000 which was issued to the RM of Morris on August 29, 1983. Under this licence, the lagoon is not to be discharged when the organic loading (BOD_5) is in excess of 30 mg/L, fecal coliform is in excess of 200 MPN/100 mL, total coliform is in excess of 1,500 MPN/100 mL, if flooding is occurring anywhere along the discharge route, or if the effluent will cause or contribute to flooding in or along the discharge route. The lagoon must also never discharge between November 1 of any given year and May 15 of the following year (200 days). BOD_5 to the primary cell is not to exceed 56 kg/ha/day.

2.2 Design Criteria for the Proposed Lagoon Expansion

2.2.1 Population

AECOM prepared a *Detailed Development Plan* (DDP) for the RM of Morris, using a growth rate of 1.38% for the projected population growth for Lowe Farm. The projected population contributing to the lagoon in 2041 was estimated to be 685.

2.2.2 Wastewater Flows

According to the WMP (2014), the population of 685 with 240 L/person/day was used in the lagoon sizing calculations. Lowe Farm potable water is supplied by the Pembina Valley Water Cooperative Inc., therefore backwash flow from a water treatment plant was not included in the wastewater flow design.

Table 1. Lagoon Design Wastewater Flow

Population (Year 2041)	Storage (days)	Design Flow (lpcd)	Design Flow (L/d)	Storage Required (m^3/year)	Infiltration 10% (m^3/year)	Total Combined Hydraulic Storage Required (m^3/year)
685	230 [1]	240	164,400	37,812	3,781	41,593

Notes:
1. Based on current operating requirements issued by Manitoba Conservation and Water Stewardship.

2.2.3 Wastewater Effluent Criteria

In order to meet hydraulic loading, the existing lagoon system requires upgrading and new effluent requirements set forth by Manitoba Conservation and Water Stewardship will be met, including the implementation of phosphorus removal or a nutrient management strategy.

The upgrade lagoon system will meet the following effluent criteria (prescribed under Manitoba Water Quality Standards, Objectives, and Guidelines):

- $CBOD_5$ - 25 mg/L;
- Total Suspended Solids (TSS) - 25 mg/L;
- Total Coliform – 1,500 mg/L per 100 mL;
- Fecal Coliform - 200 mg/L per 100 mL;
- Un-ionized ammonia - 1.25 mg/L expressed as nitrogen (N), at 15°C ± 1°C;
- Total Phosphorus – Nutrient management strategy to reduce phosphorus (**Section 2.2.3.1**); and
- Discharge Period – June 15 to November 1 (~230 days of storage).

2.2.3.1 Nutrient Management Strategy

Lagoons servicing communities discharging less than 820 kg/year (population less than 2,000 people) have the option of implementing a demonstrated nutrient reduction strategy instead of meeting the more stringent 1 mg/L phosphorus limit.

Manitoba Conservation and Water Stewardship has been encouraging effluent irrigation, chemical dosing, constructed wetlands and trickling discharge as potential nutrient reduction practices.

The option of alum precipitation has been reviewed as part of the Functional Design as it is a process that is commonly used for phosphorus control. It is possible to add alum a week or two prior to testing and discharge. The precipitation process draws the phosphorus out of solution, forming a precipitate. A few disadvantages of this process is that it generates significantly more sludge, it permanently binds the phosphorus so that it does not have a phosphorus fertilizer value if it is ever land applied, and it increases operating costs significantly.

It is recommended in the Functional Design that the process of phosphorus reduction through natural attenuation methods will be used for the effluent from the Lowe Farm lagoon. Phosphorus absorption by natural grasses, reeds, and soil in the drainage ditches is possible due to the long route to the Morris River (approximately 14 km) as shown in **Figure 04**. The effluent discharges into the east ditch of Municipal Road 5W and flow north into the Anderson Drain (south ditch of Municipal Road 25N). The effluent then travels east for approximately 13 km to the Morris River, which drains into the Red River just north of the Town of Morris. In addition to this, the lagoon will utilize trickle discharge over a 2-3 week period to reduce the rate of discharge and facilitate nutrient uptake.

2.3 Lagoon Upgrade

The maximum organic loading permitted by the Province of Manitoba is 0.076 kg BOD/person/day. With a future population of 685 people, this yields an organic load of 52.06 kg BOD/day. The following table summarizes the organic loading.

Table 2. Lagoon Design Loadings

Description	Value
Organic Loading	0.076 kg/BOD/person/day
Population (Year 2041)	685
Estimated BOD Load	52.06 kg BOD/day
Influent Flow	66,000 m^3/year
Influent BOD	288 mg/L
Primary Treatment Area Required	9,296 m^2

2.3.1 Hydraulic Loading

The hydraulic load on the lagoon with a future population of 685 and a wastewater production rate of 240 L/person/day is 66,000 m^3/year. Based on the 230 days of storage, the required storage volume would be 41,593 m^3. It is calculated that there is 11,566 m^3 of storage in the existing cells resulting in a need for an additional 30,027 m^3 of storage from the new secondary cell. An additional 1,000 m^3 was included for contingency, giving the new secondary cell a storage volume of 31,027 m^3. The secondary cell requirements were determined using a liquid depth of 1.5 m, with the bottom 0.3 m of the cell containing the future sludge blanket, a freeboard of 1 m, and a side slope of 4:1.

2.3.2 Organic Loading

The organic loading of the lagoon needs to meet the Manitoba Conservation requirement of 56 kg BOD per hectare of surface area per day. The area of the existing primary and secondary cells is approximately 14,700 m^2, resulting

in more than enough surface area to meet the loading requirements for primary treatment. This will provide a treatment loading rate of 35 kg BOD/ha/d.

The secondary cell requirements were determined using a liquid depth of 1.5 m, with the bottom 0.3 m of the cell containing the sludge blanket, a freeboard of 1 m, and a dike slope of 4H:1V. Assuming twice a year discharge, the secondary cell volume and dimensions are provided in **Table 3**.

Table 3. Secondary Cell Size and Dimensions

Description	Value
Storage Time	230 days
Sludge Blanket Volume (volume below the pipes)	7,226 m^3
Storage Volume	31,192 m^3
Total Volume of the Secondary Cell (not including 1 m freeboard)	38,418 m^3
Water Surface Area (not including 1 m freeboard)	27,556 m^2
Cell Dimensions (Top of cell)	174 x 174 m
Cell Dimensions (Top of water)	166 x 166 m
Cell Dimensions (Base of cell)	154 x 154 m

2.4 Lagoon Construction

The two existing cells will be combined to make one new primary cell by removing part of the existing inter-cell berm. This opening will be 70 m at the top of the berm with slopes of 3H:1V. Some reconstruction of the existing berms will be required upon completion of the upgraded lagoon. A geotechnical assessment for the lagoon construction was completed on December 29, 2014. This assessment was also used to determine if a slope of 3:1 meets stability requirements. It was determined that the current slope does meet the requirements, however, it was determined that the existing lagoon cells will be constructed to a 3.5:1 slope with a 3 m wide compacted clay cut-off around the perimeter of the existing that will meet permeability requirements. Additional details of the geotechnical assessment of the existing lagoon slopes are provided in **Appendix D**.

The existing cells were originally designed with 0.75 m of freeboard but the majority of the berms have a 1.0 m freeboard. Freeboard will be raised to 1.0 m on the existing lagoon cells by addition of clay where required.

The new primary and secondary cells will be separated by a common berm with the existing 3.5H:1V slope to the south and a new 4H:1V to the north. It will be a common berm to reduce soil volumes and also to provide adequate cover for the interconnecting piping. The new primary cell will be connected to the new secondary cell by a 300 mm pipe through the common berm with the invert 0.3 m above the base of the cell. Based on the results of the geotechnical investigation, the existing natural clay in the area meets the criteria for a natural clay liner.

The berms of the lagoon will be grassed and will be accessible by one ton trucks. The crest of the berms will be 3 m wide to facilitate driving on surface. No gravel driving surface will be provided on top of the berms. The grass on the berms will be maintained by periodic cutting.

The provincial *Technical Reference Document for Liquid Manure Storage Structures, Compacted Clay Liner,* indicates that clay-lined lagoons are to provide a minimum 1 m thick clay seal having a hydraulic conductivity of 1×10^{-9} m/s lining the floor of the interior surfaces of the facility. The in-situ clays encountered in this area have a hydraulic conductivity range from 2.4×10^{-10} to 3.5×10^{-10} m/s. The clay was consistent and was found at depths up

to 7.6 to 8.1 m, well beyond the requirement of 1 m. Based on the results of the geotechnical investigation (December 29, 2014), the existing natural clay meets and exceeds the criteria for a natural clay liner.

The volume of clay excavated during the construction of the new secondary cell will be adequate for the construction of this cell with some material left over. If additional clay material is required, it may be borrowed from a location just east of the new secondary cell (**Figure 03**). The area of the borrowed clay material will then be filled with extra soil from the embankment reconstruction of the new primary lagoon cell. The site will be returned to its existing condition, complete with topsoil cover once work is complete.

Construction materials including; valves, interconnection pipes, etc., will stored in a temporarily fenced-off area immediately north of the new lagoon cell as shown in **Figure 03**. Construction equipment such as bulldozers, scrapers, and backhoes will be stored immediately north of the new lagoon cell.

New fencing will be installed around the new lagoon system.

2.4.1 Influent Forcemain

Part of the existing influent forcemain pipe will be removed and the new influent forcemain will be installed via a connection to the existing influent pipe system.

2.4.2 Effluent Discharge

Treated effluent from the lagoon will be discharged twice between June 15 and November 1 of any year through a new outfall ditch connecting to the existing lagoon outfall ditch once the system approaches design capacity (ie. when the population of Lowe Farm increases to more than 500 people). In the first 5 years of operation, it is anticipated that the lagoon will only discharge once per year during the fall. The lagoon effluent discharges into the east ditch of Municipal Road 5W and then flows into the Anderson Drain which flows east towards the Morris River. A section of the existing outfall pipe will be removed, plugged with concrete, packed with clay, and the valve closed.

Some ditch clearing and grading will be required.

2.4.3 Sludge

In order to determine the current sludge volume in the existing lagoon cells, AECOM completed a sludge survey on October 29, 2015. The sludge volume in the existing primary and secondary cells were 1,300 m^3 and 1,060 m^3 respectively. The average depth of sludge in the existing cells is 0.22 m. It is estimated that the sludge volume is 2,360 m^3 at 8% solids. This amount of sludge will remain in the existing lagoon cells and will be reassessed in the future.

2.4.4 Truck Hauling Dump

A new truck hauling dump will be constructed on the south berm and would be accessed from the landfill road. It will consist of a half corrugated metal pipe mounted on the clay berm with riprap at the base and around the pipe. It is anticipated that septage will be trucked to the lagoon approximately once per week. Currently, every second year the RM covers the cost of having all septic tanks in Lowe Farm to be emptied which increases the haul trucks from approximately once per week to approximately three times per week for one month in duration. This is the normal operation, which will not change in the future.

2.4.5 Access Road

A new lagoon access road will be constructed from the existing Lowe Farm Landfill access road. This will provide access to the new truck hauling dump location.

2.5 Wastewater Lagoon Operation

As indicated in **Section 1.3**, the Application for Wastewater Treatment Facility Classification is included in **Appendix B**.

2.6 Operation and Maintenance

The wastewater lagoon has been operated in Lowe Farm for over two decades successfully. Operation of the proposed upgrade will not alter operation substantially. Maintenance will include:

- Grass cutting around the site, in particular on the berm.
- Maintenance of the perimeter fence and gate.
- Check the berms for burrowing animals. If required, start a program with pest control for removal.
- Maintain the truck dump location and the secondary access location.
- Weekly check for mischief items that may occur.
- Perform road grading and add granular if required.

Testing and discharging lagoon will include:

- One week prior to the desire discharge, close the inter-cell pipe valve.
- Collect a representative sample of the secondary cell contents.
- Send sample for testing at commercial laboratory for the Licensed parameters.
- If the secondary cell meets effluent licence, open the discharge valve partially for a 2 week discharge period.
- Retain the sample results for records and submit as required to regulatory bodies.
- Once the discharge to 0.3 m depth is complete, close the discharge valve.
- Open the interconnection valve and allow the liquid levels to equalize.
- This discharge procedure can be followed in the spring and fall as the population and flow rate requires, provided it is within the Licence discharge date requirements.

2.7 Schedule

A brief outline of the expected sequence of events throughout the design and construction of the new lagoon is provided below.

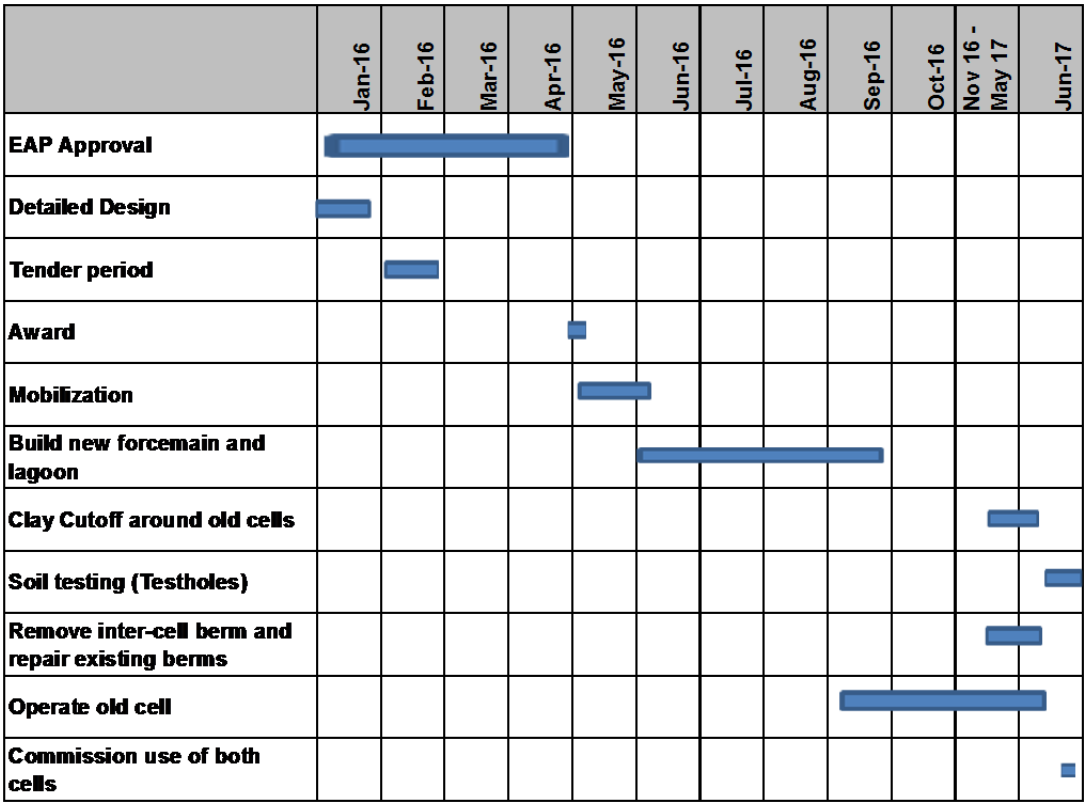


Table 4. Preliminary Schedule

2.8 Funding

The project funding will be provided by the Canada – Manitoba Infrastructure Program.

3. Scope of the Assessment

To assess the potential environmental impact of the lagoon upgrade, spatial and temporal boundaries were defined as follows:

3.1 Temporal Boundaries

The temporal boundaries of the assessment are divided as follows:

- **Construction Phase**: Construction April 2016 to June 2017.
- **Operation Phase**: June 2017 for the operation of the new lagoon system into the future.
- **Decommissioning Phase**: This refers to the eventual decommissioning of the Facility site, and all associated infrastructure that is being proposed in this document. There are currently no plans to decommission the Facility in the foreseeable future. However, when the Project Site needs to be decommissioned at some point in the future, a site decommissioning plan will be filed with appropriate regulators prior to decommissioning. Therefore, effects associated with decommissioning have not been assessed as a part of this environmental assessment.

3.2 Spatial Boundaries

Spatial boundaries used for the assessment are described below. However, where specifically noted, the boundaries may be adjusted to suit the Environmental Component (EC) or Social Component (SC) affected.

- **Project Site**: includes all areas subject to direct disturbance as a result of the project.
- **Project Area**: is a 3 km radius surrounding the Project Site, intended to account for the potential effects of the Project immediately outside of the Project Site. The majority of the information used to describe the existing environment is focused on the Project Area.
- **Project Region**: is a 10 km radius beyond the Project Site, intended to account for the maximum spatial extent of potential impacts of the Project.

The Project Area and Project Region are shown in **Figure 05** and **Figure 06**, respectively.

3.3 Environmental and Social Components

This environmental assessment considers changes to the environment caused by the project, as well as any consequential socio-economic implications. The Environmental Components (ECs) and Social Components (SCs) were selected following the guidance provided in Manitoba Conservation's Information Bulletin, "*Environment Act* Proposal Report Guidelines". SCs include components of the socio-economic environment that may be affected by a change in the environment as a result of the project.

The potential interaction between project components and ECs and SCs are identified in **Table 5**. Potential interactions were identified based on the professional judgement of the assessor combined with assumed implementation of standard environmentally responsible construction techniques and operating procedures in the course of project construction, operation and closure. Potential interactions identified in **Table 5** are assessed in **Section 5**. Mitigation measures and residual effects are also described in **Section 5**.

Table 5: Identification of Potential Environmental/Social Component Interactions with the Project

	Environmental Components								Social Components [1]		
	Topography	Air and Noise	Climate	Soil	Surface Water & Aquatic Resources	Groundwater	Vegetation	Wildlife	Protected Areas (Land Use)	Heritage Resources	Aesthetics
Construction Phase											
Clearing and grubbing		X	X	X			X	X			X
Transportation and stockpiling of materials and equipment	X	X	X	X				X			X
New lagoon construction (primary and secondary cells), including truck dump	X	X	X	X			X	X			X
Construction of new access road to new lagoon	X	X	X	X			X	X			X
Sludge removal and dewatering from existing lagoon		X	X	X							
Waste disposal		X	X	X							X
Site restoration		X	X	X							X
Operation Phase											
Maintenance		X	X								
Discharging effluent					X						

Notes:
X = identified interaction
1. only indirect interactions with SCs as a result of an direct project/EC interactions were considered

4. Existing Environment

Lowe Farm is located approximately 85 km south of Winnipeg, Manitoba and approximately 17 km west of Morris, Manitoba along Provincial Highway No. 23. The existing Lowe Farm Lagoon is located northeast of Lowe Farm along Disposal Site Road (Road 5W) and immediately west of the communities waste disposal site. Site photographs from a site visit conducted on September 22, 2015 are provided in **Appendix E**.

The following sections provide information regarding the existing environment within the study area. Information was gathered via desktop review and a site visit.

4.1 Physical Environment

4.1.1 Climate

The closest meteorological station to the Project Site is the Morris 2 meteorological station that measures precipitation (rainfall and snowfall). The Morden CDA meteorological station is the next closest station that measures temperature. **Table 6** shows the monthly precipitation data relevant to the Project Area.

Table 6. Climate Data for Morris 2, Manitoba (1971-2000)
Latitude 49°26'N, Longitude 97°29'W, Elevation 237.7 m

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Precipitation (mm)	24.1	17.7	22.6	30.4	61.8	88.7	77.7	76.4	50.5	41.6	26.5	23.6	541.4	A
Rainfall (mm)	0	2.4	8.5	23.6	60.9	88.7	77.7	76.4	50.5	36.3	6.2	1.3	432.4	A
Snowfall (cm)	24	15.3	14.1	6.9	0.9	0	0	0	0.1	5.3	20.3	22.2	109	A

Notes:
Data obtained from Environment Canada, Morris 2 meteorological station (2015a).
``A":World Meteorological Organization (WMO) "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for either temperature or precipitation) between 1971 and 2000.

Table 7 shows the monthly temperature data relevant to the Project Area.

Table 7. Climate Data for Morden CDA, Manitoba (1971-2000)
Latitude 49°11'N, Longitude 98°05'W, Elevation 297.5 m

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average Temperature (°C)	-15.6	-11.7	-4.9	4.7	12.9	17.7	20.1	19.1	13.3	6.2	-4.3	-12.5	3.8	A

Notes:
Data obtained from Environment Canada, Morden CDA meteorological station (2015b).
``A":World Meteorological Organization (WMO) "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for either temperature or precipitation) between 1971 and 2000.

The Project Area falls within the Lake Manitoba Plain Ecoregion. Climate in the Lake Manitoba Plain Ecoregion is characterized by short, warm summers and long, cold winters. The mean annual temperature ranges between 1.8 and 3.1°C with an average growing season ranging from 177 to 187 growing days. The mean annual precipitation for the ecoregion is ranges from approximately 485 to 540 mm. The average yearly soil moisture deficit is ranges from approximately 100 to 210 mm. (Smith *et al*., 1998) The general area receives 541.4 mm of precipitation per year, with 432.4 mm as rainfall and 109 mm as snow (Environment Canada, 2015a). The annual daily average

temperature at the Morden CDA meteorological station was 3.8°C, ranging from -15.6°C (January) to 20.1°C (July). Extreme temperatures range from -42°C to 43.9°C (**Table 8**). (Environment Canada, 2015b)

Table 8: Other Weather Parameters for Lowe Farm, Manitoba

Parameter	Value
Extreme Maximum Temperature (°C) [1]	43.9 (July 11, 1936)
Extreme Minimum Temperature (°C) [1]	-42 (January 16, 1993)
Extreme Daily Rainfall (mm) [2]	93.4 (August 18, 1995)
Extreme Daily Snowfall (cm) [2]	25.4 (March 4, 1966)

Notes:
1 - Data obtained from Environment Canada, Morden CDA meteorological station (2015b).
2 - Data obtained from Environment Canada, Morris 2 meteorological station (2015a).

4.1.2 Topography

The Project Region is located within the Winnipeg Ecodistrict. The topography of this region can be generally described as smooth, level to very gently sloping clayey glaciolacustrine plain (Smith, *et al.*, 1998). The topography of the Project Area varies from approximately 244 m above sea level (masl) and 240 masl (Department of Energy, Mines and Resources, 1984).

4.1.3 Geology

The Lake Manitoba Plain Ecoregion is underlain by low-relief, flat-lying Paleozoic limestone bedrock and covered by glacial till, silts, and clays deposited by glacial Lake Agassiz (Smith *et al*, 1998).

The underlying geology in the Project Area is of the Ordovician Stony Mountain Formation and generally consists of calcareous shale, thin limestone beds, and argillaceous dolomite. It is also part of the Gunton and Williams Members consisting of dolomite and sandy argillaceous dolomite. (Geological Survey of Canada, 1987).

4.1.4 Soils

In general, the soils of the Winnipeg Ecodistrict "…*predominantly are imperfectly drained Gleyed Humic Vertisols and Gleyed Vertic Black Chernozems, and poorly drained Gleysolic Humic Vertisols and Humic Gleysols which have developed on calcareous, clayey glaciolacustrien sediments"* (Smith *et al.*, 1998).

Soil in the Project Site is considered to have a combination of moderate limitations that restrict the range of crops and have moderately severe limitations that restrict the range or crops or require special conservation (Class 2w3w). The soil limitations include excess water (other than from flooding) due to poor drainage, high water table, seepage and/or runoff from surrounding areas. (CLI, 1966)

AECOM conducted a geotechnical investigation at the Project Site on December 29, 2014. The Project Site generally consisted of topsoil that had a considerable amount of sand which ranged in thickness from 100 m to 200 mm. This was underlain by a thick deposit of silty clay which extended to the termination depth in all the geotechnical test holes at depths ranging from 7.6 to 8.1 m below the ground surface.

4.1.5 Groundwater

According to the aquifer maps of southern Manitoba, groundwater is found in the limestone and dolomite of the Paleozoic Carbonate rock formations. The domestic wells generally yields more than 1.0 L/s and the water quality ranges from good to very salty. The groundwater within the Lowe Farm area is classified as having salty water with a total dissolved solids concentration of 5,000 mg/L to 100,000 mg/L. (Rutulis, 1986a)

Shallow groundwater aquifers may also be found in the vicinity of the Project Region, within lenses of sand and gravel. The depth of the shallow groundwater aquifers ranges from a few meters to more than 100 m and typically produce well yields between 0.1 L/s and 10 L/s. Generally, groundwater quality within the shallow groundwater aquifers ranges from very poor to excellent. The groundwater within the Lowe Farm area is classified as salty to very salty with a total dissolved solids concentration ranging from 5,000 mg/L to 25,000mg/L. (Rutulis, 1986b)

4.1.5.1 Extent of Groundwater Use

A review of the Groundwater Information Network (2014) online mapping service was completed to determine the registered wells within a 1.6 km radius of the Project Site. The search found a total of two registered wells as shown in **Figure 07**. Of the two wells, one was registered as a production well and the other was registered as a test well. One registered well indicated that the groundwater level is at 3.05 m below the ground surface.

Potable water is supplied to the community of Lowe Farm via the Pembina Valley Water Cooperative Inc. This cooperative was developed to supply potable water in an area which lacked a wide distribution of water resources but shows the highest rate of economic growth in Manitoba. (PVWC, 2015)

4.2 Hydrology

The Project Site is located within the Red River Basin and is part of the Morris River Watershed. The Morris River generally flows to the southeast/east which then flows into the Red River just north of Morris. The Project Site is located approximately 14 km west of the Morris River.

4.2.1 Flooding

The Project Site is located near the Red River Valley which is prone to spring flooding. However, according to the Red River Valley Designated Flood Area Map, the Project Site is located outside of the Red River Valley Designated Flood Area. Lowe Farm is also located outside of the 1997 flood event (Manitoba Natural Resources, 1997). No flooding has been noted by residents in the area during the 1997 and 2007 flood events.

4.3 Aquatic Environment

The existing lagoon effluent discharges into the east ditch of Municipal Road 5W and then into the Anderson Drain. The effluent then travels east approximately 13 km to the Morris River, which drains into the Red River just north of the Town of Morris. The Red River valley is prone to spring flood and many of the waterways in the area are construction drains to assist with flood mitigation.

There are 57 reported species native to the Red River watershed (Stewart and Watkinson, 2004). The Morris River, as a tributary of the Red River has the potential for numerous fish species, particularly in the lower reaches near the mouth of the river. The Anderson Drain is a constructed waterway, which enters the Morris River approximately 5 km west of its confluence with the Red River. Past fishery investigations (Milani, 2013) in Anderson Drain have captured only Fathead Minnow (Pimephales promelas) and Brook Stickleback (Culaea inconstans). Near where

Anderson Drain enters it, Fathead Minnow, Quillback (Carpiodes cyprinus), River Shiner (Notropis blennius), Sand Shiner (Notropis stramineus) and Troutperch (Percopsis omiscomaycus) have been reported in Morris River. During times of high water levels, many species may travel up the Morris River and into Anderson Drain. Year-round habitat is likely only available for small-bodied fish near the Project Site.

Habitat in the Anderson Drain itself is generally characterized as a Class D habitat (Milani, 2013), where forage fish and simple habitat are present. The Morris River is classified as a Class A habitat, which provides complex habitat for indicator species (i.e., recreational, commercial or at risk).

4.4 Terrestrial Environment

4.4.1 Flora

The Project Area lies within the Lake Manitoba Plain Ecoregion. The native vegetation of the Lake Manitoba Plain Ecoregion includes trembling aspen and shrubs located on moist sites and bur oak and grassland communities at drier sites. The main grasses found in the ecoregion include fescue grasses, wheat grasses, June grass, and Kentucky bluegrass. (Smith *et al*. 1998)

A site visit was conducted by AECOM on September 22, 2015. The existing Lagoon site consists of mowed grass and some weeds. Some taller grasses were observed along the shore of the lagoon cells. Taller grasses were also observed along the effluent ditch west of the existing lagoon and along a berm/hill separating the existing lagoon and the active Lowe Farm landfill. West of the existing lagoon was the location of the former Lowe Farm landfill, which was capped approximately 25 years ago which is currently storing farm equipment on mowed grass.

The area for the proposed secondary lagoon cell, located north of the existing lagoon is cultivated agriculture land which has been purchased by the RM of Morris.

Site photographs are provided in **Appendix E**.

4.4.2 Fauna

Wildlife in the Lake Manitoba Plain Ecoregion include white-tailed deer, coyote, rabbits, ground squirrels, and waterfowl (Smith *et al*. 1998).

During the site visit, a couple of ducks were observed in the existing lagoon. No other wildlife was observed.

4.5 Protected Areas

The closest protected area to the Project Site is St. Malo Wildlife Management Area (WMA), located approximately 47 km east of the Project Site. There are two units to the St. Malo WMA; the east unit is adjacent to the west side of Provincial Highway No. 59 and the west unit can be accessed on the Trans Canada Trail. This WMA protects habitat for deer, ruffed grouse, and neo-tropical birds. Other wildlife that may be found in the WMA includes black bears, raccoons, beavers, hares, and jackrabbits. Some rare plants are also found in the WMA including the western silvery aster, whorled milkwort, false spikenard, and Riddell's goldenrod. (MCWS, Wildlife Branch, 2015a)

The closest provincial park to the Project Site is St. Malo Provincial Park also located approximately 47 km east of the Project Site. This park is a recreational park and includes a serviced campground and picnic areas, provides a beach and swimming areas, and is capable of accommodating large groups. (MCWS, Parks and Protected Spaces, 2004)

4.6 Protected Species

To identify species at risk that have the potential to occur in the Project Region, the Manitoba Conservation Data Centre (MB CDC), Occurrence of Species by Ecoregion was examined (MB CDC, 2013). The species listed on the MB CDC were cross-referenced with Schedule 1 of the Federal *Species at Risk Act* (SARA) (Government of Canada, 2015) and the *Manitoba Endangered Species Act* (MESA) (MCWS, Wildlife Branch, 2015b) to determine the provincially listed rare or sensitive species with the ecoregion. Distribution maps and habitat requirements were examined to determine the likelihood of occurrence of federally and/or provincially listed species in the Project Region.

Based on this search, there is potential for 33 listed species to occur in the Project Region (**Table 9**).

Table 9. Federally and Provincially Listed Species that May Occur in the Project Region

Species	SARA Status	MESA Status	Environmental Considerations
Vertebrate Animal			
Whip-poor-will *Caprimulgus vociferus*	Threatened	Threatened	• Breeding preference in pine and oak based semi-open forests with clearings or forests that are regenerating. [1] • May feed in shrubby pastures or wetlands with perches.[1] • Overwinters in mixed coniferous-broadleaved forests. [1]
Common Snapping Turtle *Chelydra serpentina serpentina*	Special Concern	Not Ranked	• Generally found in dry, open grasslands and breed primarily in temporary wetlands or edges of some permanent or semi-permanent wetlands. [1] • These shallow, clear pools are often found in imperfectly drained, sandy areas in grasslands, pastures, ditches or agricultural fields and range in size from large wetlands to small puddles. [1]
Common Nighthawk *Chordeiles minor*	Threatened	Threatened	• In Manitoba, found south of the treeline and inhabits mixed and coniferous forests. [1] • Nests in a wide range of open, vegetation-free habitats including dunes, beaches, recently harvested forests, burnt-over areas, logged areas, rocky outcrops, rocky barrens, grasslands, pastures, peat bogs, marshes, lakeshores and river banks. [1]
Yellow Rail *Coturnicops noveboracensis*	Special Concern	Not Ranked	• Found in marshes dominated by sedges, true grasses and rushes with little to no standing water. [1] • Also found in damp fields and meadows, on floodplains of rivers and streams. [1]
Northern Leopard Frog *Lithobates pipiens*	Special Concern	Not Ranked	• Overwinter in well-oxygenated water bodies that do not freeze to the bottom, including streams, creeks, rivers, deep lakes and ponds. [1] • Breeds in pools, ponds, marshes, lakes and slow-moving streams and creeks that are typically located in an open area with abundant vegetation and no fish. [1] • Summer in moist upland meadows and native prairie, riparian areas and ponds. [1]
Red-headed Woodpecker *Melanerpes erythrocephalus*	Threatened	Threatened	• Found in a variety of habitat including open oak and beech forests, grasslands, forest edges, orchards, pastures, riparian forests, roadsides, urban parks, golf courses, cemeteries, along beaver ponds and brooks. [1] • Nests are usually found in dead or dying trees but can also make nests in dead branches of live trees. [1]
Golden-winged Warbler *Vermivora chrysoptera*	Threatened	Threatened	• Found in regeneration zones where young shrubs grow, surrounded by mature forest. [1] • Prefer public utility right-of-ways, the edges of fields, areas where logging has recently occurred, beaver ponds and burned-out or intermittently cultivated areas. [1] • Nests are built on the ground in areas of herbaceous plants and low bushes. [1]
Baird's Sparrow *Ammodramus bairdii*	Not Ranked	Endangered	• Found primarily in mixed grass prairies or in lightly grazed pastures. [6]
Canada Warbler *Wilsonia canadensis*	Threatened	Endangered	• Found in a variety of forest types but is most abundant in wet, mixed deciduous-coniferous forest with a well-developed shrub layer. [1] • They are also found in riparian shrub forests on slopes, ravines and in old-growth forests with a high density of shrubs. [1] • Nests are built on or very close to the ground in dense ferns or fallen logs. [1]

Species	SARA Status	MESA Status	Environmental Considerations
Piping Plover *Charadrius melodus*	Endangered	Endangered	• Prefer nesting above the high-water mark on exposed sandy or gravelly beaches. [1] • On the prairies, nesting occurs on gravel shores of shallow, saline lakes and on sandy shores of larger prairie lakes and seeps provide foraging habitat. [1]
Trumpeter Swan *Cygnus buccinator*	Not Ranked	Endangered	• Prefer beaver ponds for nesting sites and habitats such as freshwater and coastal estuarine wetlands and flooded agricultural land. [1]
Caribou *Rangifer tarandus caribou*	Threatened	Threatened	• Prefers mature and old growth coniferous forests that contain lichens during the winter months. [1] • These forested areas are generally associated with marshes, bogs, lakes and rivers. [1] • During the summer months, they occasionally feed in young stands, after fire or logging. [1]
Silver Chub *Macrhybopsis storeriana*	Special Concern	Not Ranked	• In Manitoba, found in large, moderate flowing rivers with a substrate of silt or sand. [1]
Burrowing Owl Athene cunicularia	Endangered	Endangered	• In Manitoba, pasture lands are the most commonly used habitat but they have also been found nesting in ditches, croplands, golf courses, and manicured lawns. [2]
Chestnut-collared Longspur Calcarius ornatus	Threatened	Endangered	• Found in native prairie grasslands and typically breeds in recently grazed or mowed, arid, short or mixed-grass prairie. [3]
Eskimo Curlew Numerius borealis	Endangered	Endangered	• Breeding habitat consisted of treeless upland tundra with dwarf shrubs and grassy tundra meadows. [1]
Least Bittern Ixobrychus exilis	Threatened	Endangered	• Breeds in marshes dominated by emergent vegetation surrounded by areas of open water. [1] • Nests are almost always within 10 m of open water which is needed for foraging. [1]
Loggerhead Shrike Lanius ludovicianus	Endangered	Endangered	• Found in relatively open, grassy sites; pastured or hayed areas are preferred; often nest in the vicinity of hedgerows or farm shelterbelts. [2]
Mapleleaf Mussel Quadrula quadrula	Endangered	Endangered	• Populations documented in the Red River and the lower reaches of the Assiniboine and Roseau Rivers. [1] • Found in medium to large river with slow to moderate currents and firmly packed substrate of sand, coarse gravel or clay/mud. [1]
Peregrine Falcon Falco peregrinus anatum	Special Concern	Endangered	• Prefer open habitats such as tundra, grassland and marshes but will also hunt in open forest. [2] • Nests are found on ledges of steep cliffs or embankments and are near wetlands frequented by shorebirds and waterfowl. [2] • In urban areas, they often nest on tall buildings with ledges. [2]
Prairie Skink Eumeces septentrionalis	Endangered	Endangered	• Found in mixed-grass prairies with sandy soils. [1] • They require sandy soils for nesting and constructing burrows during the summer. [1]
Chimney Swift Chaetura pelagic	Threatened	Threatened	• Mainly associated with urban and rural areas where the birds can find chimneys to use as nesting and resting sties. [1] • A small portion of the population is likely to still use hollow trees for nesting. [1]

Species	SARA Status	MESA Status	Environmental Considerations
Dakota Skipper Hesperia dacotae	Threatened	Threatened	• Found in native tall-grass prairies that feature bluestem grasses and plants such as smooth camas, hareball, black-eyed Susan, and wood lily (nectar sources). [1]
Sprague's Pipit Anthus spragueii	Threatened	Threatened	• Prefer native vegetation of intermediate height and density in areas where habitats are lightly to moderately grazed or where fires periodically remove vegetation. [1]
Short-eared Owl Asio flammeus	Special Concern	Threatened	• Found in a variety of open habitats including grasslands, peat bogs, marshes, sand-sage concentrations, and old pastures. [1] • Occasionally breeds in agriculture fields. [1] • Prefers nesting sites in dense grasslands. [1]
Vascular Plant			
Cliff-brake Pellaea glabella ssp. occidentalis	Not Ranked	Endangered	• Found in drier calcareous and limestone outcrop habitats including limestone, sandstone, dolomite cliff edges, boulders, and rocky places. [4]
Gattinger's Agalinis Agalinis gattingeri	Endangered	Endangered	• Preference for dry prairie, open wetlands, roadsides, glades, bluffs, and alvars. [1]
Small White Lady's-slipper Cypripedium candidum	Endangered	Endangered	• Found in calcareous prairie openings in wooded grasslands, or on open, south-facing slopes. [2] • Often found in relatively undisturbed grasslands but can also be found in disturbed areas such as roadside ditches. [2]
Western Ironweed Vernonia fasciculata ssp. corymbosa	Not Ranked	Endangered	• Is currently confined to a small area in south central Manitoba. [5] • Can also be found on field margins near the Rat River and west of Morris. [5]
Culver's-root Veronicastrum virginicum	Not Ranked	Threatened	• Found in partially shaded, small wooded areas and in small tall-grass prairie openings. [2] • Prefer moist, calcium-rich, sandy loam soil. [2] • Many remaining populations are found along roads and fence lines in areas dominated by intensive agriculture. [2]
Hackberry Celtis occidentalis	Not Ranked	Threatened	• Found in dry prairie habitats with sandy soils. [2]
Riddell's Goldenrod Solidago riddellii	Special Concern	Threatened	• Grows in open tall-grass prairie and shrubby fen-like habitats. [2] • Prefers moist to wet, calcium rich soils. [2] • Manitoba's remaining populations occur along roads. [2]
Western Silvery Aster Symphyotrichum sericeum	Threatened	Threatened	• Found in dry prairies, fields and openings in bur oak/trembling aspen woodlands. [2] • Found often in gravelly and/or sandy soils, calcareous and well to moderately well-drained soils. [2] • Can be found in roadside ditches and adjacent to gravel pits. [2]

Sources:
1. Species at Risk Public Registry (Government of Canada, 2015).
2. Species listed under the Manitoba Endangered Species and Ecosystems Act (MCWS, Wildlife Branch, 2015b).
3. COSEWIC Assessment and Status Report on the Chestnut-collard Longspur in Canada (COSEWIC, 2010).
4. SKCDC Status Assessment: Wester Smooth Cliff-brake in Saskatchewan (Enns, A., 2011)
5. Manitoba Conservation Data Centre Surveys and Stewardship Activities, 2014 (Murray, C. and C. Church, 2015).
6. Species listed under the Manitoba Endangered Species and Ecosystems Act (MCWS, Wildlife Branch, 2015c).

It is anticipated that these listed wildlife species are unlikely to occur in the local area of the Project Site due to the agricultural nature of the Project Site and surrounding area. Potential listed vegetation species that may be in the Project Region include the western ironweed as it may be found along field margins west of Morris; culver's root (in areas dominated by intensive agriculture); Riddell's goldenrod (remaining population in Manitoba occur along roads); and western silvery aster (found in roadside ditches). It is also possible that species of concern among migratory waterfowl may pass through the Project Area in the spring and fall but it is but it is unlikely that these species would nest in the area due to the lack of suitable habitat.

4.6.1 Migratory Birds

In the Lake Manitoba Plain Ecoregion, waterfowl are common and are protected under Article I of the *Migratory Birds Convention Act*. The SARA bird species (longspurs, bitterns, shrikes, swifts, sparrows, plovers, swans, woodpeckers, and warblers) identified above are identified as long distance migrants.

4.7 Heritage Resources

A screening request to the Heritage Resources Branch (HRB) was sent on October 28, 2015 to determine if there are any potential heritage resources that may be affected by the proposed development and if a Heritage Resources Impact Assessment (HRIA) is required. HRB has no concerns with the propose project and a copy of the correspondence is included in **Appendix F**.

4.8 Socio-Economic Environment

4.8.1 Land Use

The location of the proposed secondary lagoon cell was previously agricultural land used for the production of soy beans.

4.8.2 Municipal Use

Emergency services are provided by the fire department and the Royal Canadian Mounted Police (RCMP) serving the Town of Morris and surrounding communities. Other emergency services include the Morris fire department, Morris Hospital, and the area has 9-1-1 emergency. Within the RM, the communities of Lowe Farm, Rosenort, and Sperling have local fire departments.

Potable water is supplied to the community of Lowe Farm via the Pembina Valley Water Cooperative Inc. This cooperative was developed to supply potable water in an area which lacked a wide distribution of water resources but shows the highest rate of economic growth in Manitoba. (PVWC, 2015)

Within the Lake Manitoba Plains Ecoregion, spring wheat and other cereal grains are dominant agricultural products in the ecoregion while oilseeds and hay are dominant in the northern section of the ecoregion (Smith *et al*. 1998).

4.8.3 Population Census and Economy

According to the 2011 census, Lowe Farm is part of the RM of Morris census which had a population of 2,999; an 11.3% increase over the reported population of 2,662 in 2006. The median age of the residents is 33.4 with 74.3% of the population aged 15 years or older. (Statistics Canada, 2015) According to the Functional Design Report, the population of Lowe Farm was 359 people in 1982 and was estimated to be 460 in 2012.

The RM of Morris is a growing agricultural, commercial, and industrial community. Other businesses within the RM include manufacturing, trades and services, construction, and retail. (Rural Municipality of Morris, 2012)

4.8.4 Transportation

Lowe Farm is serviced by Provincial Highway No.23 and Provincial Road No. 332. According to the 2014 Traffic Flow Map available from the Manitoba Infrastructure and Transportation Traffic Engineering Branch, the annual average daily traffic (AADT) along Provincial Highway No. 23 is 1,640 east of Provincial Road No. 332 and 1,640 west of Provincial Road No. 332 along Provincial Highway No. 23.

It is anticipated that a maximum of 10 construction vehicles will access the Project Site via the Provincial Highway No. 23, therefore it is anticipated that the addition of approximately 10 vehicles will not significantly affect the local traffic.

4.8.5 First Nations

The nearest First Nation Community to the Project Site is Roseau River First Nation located approximately 60 km southeast of the Project Site.

5. Environmental Effects Assessment and Mitigation Measures

5.1 Effects Assessment Methodology

This section contains the results of the environmental assessment.

Applying professional judgement and a thorough understanding of the components of the proposed project (outlined in **Section 2** of this application) and the existing environment (as described in **Section 4**); AECOM determined the potential for physical and biological components to interact with project components as presented in **Table 5** (in **Section 3** of this application). The assessment includes any effects on social components resulting from residual adverse environmental effects. Mitigation measures that have been incorporated into the proponent's proposed plan are taken into account, as well as the environmental protection practices included in the proponent's operation.

Environmental effects that may be caused as a result of accidents and malfunctions are discussed separately in **Section 5.14**. Definitions of the terms used to guide the effects assessment are provided in **Table 10**.

Table 10. Factors and Definitions Considered in Assessing Environmental Effects

Project Phase:	Refers to the phase of the project as construction, operation or decommissioning.				
Potential Effect:	Classification of the type of effects possible during a specific project phase.				
Magnitude of Effect:	Refers to the estimated percentage of population or resource that may be affected by activities associated with the construction, operation and decommissioning of the proposed project. Where possible and practical, the population or resource base has been defined in quantitative or ordinal terms (e.g., hectares of soil types, units of habitat). Magnitude of effect has been classified as either less than (<) 1%, 1% to 10%, or greater than (>) 10% of the population or resource base. Where the magnitude of an effect has been defined as virtually immeasurable and represents a non-significant change from background in the population or resource, the effect is considered negligible. An exception to this is in terms of potential human health effects where, for example health issues due to water-borne diseases amounting to 1% of the population being affected would still be considered major.				
Direction of Effect:	Refers to whether an effect on a population or a resource is considered to have a positive, adverse or neutral effect.				
Duration of Effect:	Refers to the time it takes a population or resource to recover from the effect. If quantitative information was lacking, duration was identified as short-term (<1 year), moderate term (1 to 10 years) and long term (>10 years).				
Frequency of Activity:	Refers to the number of times an activity occurs over the project phase, and is identified as once, rare, intermittent, or continuous.				
Scope of Effect:	Refers to the geographical area potentially affected by the effect and was rated as Project Site, Project Area or Project Region as defined in **Section 4**. Where possible, quantitative estimates of the resource affected by the effect were provided.				
Degree of Reversibility:	Refers to the extent an adverse effect is reversible or irreversible over a 10-year period.				
Residual Effect:	A qualitative assessment of the residual effect remaining after employing mitigation measures in reducing the magnitude and/or the duration of the identified effect on the environment.				
Magnitude of Effect	**Direction of Effect**	**Duration of Effect**	**Frequency of Effect**	**Scope of Effect**	**Degree of Reversibility of Effect**
Negligible (immeasurable)	Positive	Short term (< 1 year)	Once	Project Site	Reversible
Minor (<1%)	Adverse	Moderate (1 to 10 years)	Rare	Project Area	Irreversible
Moderate (1 to 10%)	Neutral	Long term (>10 years)	Intermittent	Project Region	
Major (>10%)			Continuous		

5.2 Topography

Sources of changes to site topography include activities such as clearing, grading, excavating or stockpiling materials. Restoration of the site topography will be conducted to match the surrounding area and provide proper surface water flow away from the new secondary lagoon cell.

Effects due to stockpiling, excavating, grading and leveling, and contouring are assessed to be negligible and temporary in nature, and therefore considered insignificant.

There will be permanent changes in topography on the Project Site following construction of the new secondary lagoon cell; this is considered a major change that is reversible during decommissioning depending on the end use of the land. When the Project Site needs to be decommissioned at some point in the future, a site decommissioning plan will be developed focusing on returning the site to pre-project conditions to the extent possible. The plan will be filed with appropriate regulators prior to decommissioning.

The perimeter ditching of the new lagoon system will represent a permanent change in the topography; however, this change is not assessed to be adverse. Therefore, overall changes to topography during construction of the proposed project are anticipated to result in minor residual effects.

5.3 Air Quality and Noise

5.3.1 Dust

Sources of dust include activities such as clearing, grading, excavating, vehicle movement, the reconstruction of the existing lagoon cells, and stockpiling of materials on-site. Air quality may be affected by dust and particulates with subsequent effects on human health (including respiratory issues) and vegetation (dust deposition). Dust occurs primarily during summer and fall, with greater likelihood for an increase in dust during dry and windy conditions.

Vehicles commuting to and from the Project Site will utilize the paved Provincial Highway No. 23 followed by the gravel Municipal Road No. 5W. The nearest residence is approximately 800 m west of the Project Site. Given that the area where the new secondary cell is proposed to be located was already cleared, minimal additional grubbing will be required, minimizing the use of equipment for this component.

Although dust is not anticipated to be a major concern, to further manage potential effects due to dust, the following mitigation measures will be implemented:

- Material stockpile heights will be limited;
- The disturbed/exposed areas will be kept to a minimum; and
- If required, dust suppression activities such as the use of approved dust control agents and/or water will be undertaken.

In our opinion, the mitigation measures proposed above are sufficient to mitigate any adverse effects due to dust during the construction and operation phases. Residual effects on air quality due to dust emissions are therefore assessed to be negligible.

5.3.2 Noise

An increase in noise levels at the Project Site could potentially affect people and wildlife in the surrounding area. Potential effects of noise on wildlife are discussed in **Section 5.9**.

Sources of noise during construction would be typical of heavy equipment such as graders, excavators, loaders, compactors, and haulage trucks. Construction activities are anticipated to generate intermittent noise over the construction period (approximately eight months of construction). The closest residential receptors to the Project Site would be residents of Lowe Farm, located approximately 800 m west of the Project Site through a treed shelter belt.

During the operation phase, sources of noise include maintenance vehicles and general activities (anticipated to be typical of lawn equipment, trucks, and small hand-held tools) along with the septage haulers trucks. It is anticipated

that septage will be trucked to the lagoon approximately once per week. As indicated in **Section 2.4.4**, septage trucks traveling to the lagoon will temporarily increase from approximately one septage truck per week to approximately three septage trucks per week for one month in duration every second year. This is the normal operation, which will not change in the future.

Some additional measures to mitigate noise are:

- Vehicle and equipment will be properly maintained.
- Provide hearing protection to workers as required.

The mitigation measures listed above are judged to be sufficient to mitigate any potential noise related effects at the Project Site. Therefore, residual effects from noise are assessed to be negligible.

5.3.3 Odour

During the site visit on September 22, 2015, no odour was noted at the existing lagoon (on the berm) or while on the access road.

During the operation phase, odour may be generated during the spring thaw and during windy days. For the remainder of the year, odours are anticipated to be minimal as the lagoon will be aerobic and substantial methane generation is not anticipated.

The existing lagoon is located approximately 800 m east of the closest human receptors through a treed shelter belt. Due to this separation distance, the residual effects due to odour are anticipated to be negligible at the Project Site and in the Project Area. If during construction or operation, odour becomes an issue for the neighbouring properties, the RM of Morris will work with individuals to try to alleviate the concerns. Based on the separation distance between the Project Site and the closest receptors, any residual impact due to odour is anticipated to be minor.

5.3.4 Exhaust Emissions

During construction, exhaust emissions will be generated during the delivery of materials (i.e. interconnection pipes, valves, etc.) to the Project Site, construction equipment movement at the Project Site, and septage truck deliveries during operation. These emissions could decrease the quality of the air by increasing the local concentration of carbon monoxide, carbon dioxide, particulate matter, and nitrogen oxides in the air with potential for subsequent effects on human health. During construction, a maximum of 10 construction vehicles will access the Project Site via the Municipal Road No. 5W, which will be temporary. During operation, it is anticipated that septage will be trucked to the lagoon approximately once per week. Currently, every second year the RM covers the cost of having all septic tanks in Lowe Farm to be emptied which increases the haul trucks from approximately once per week to approximately three times per week for one month in duration. This is the normal operation, which will not change in the future.

The following mitigation measures will be implemented to manage these construction-related exhaust emissions:

- Vehicles and equipment will be properly maintained; and
- Vehicle idling will be kept to a minimum.

With the implementation of the mitigation measures proposed above, any adverse residual impact due to exhaust emissions are anticipated to be negligible.

5.4 Climate

5.4.1 Greenhouse Gas Emissions

Wastewater treatment can generate methane; a potent greenhouse gas (GHG). GHGs trap heat in the atmosphere and are the leading cause of climate change. Methane is the second most abundant GHG emitted by human activities after carbon dioxide.

According to the Intergovernmental Panel on Climate Change (IPCC), lagoons less than 1 m in depth generally provide aerobic conditions and negligible quantities of methane are generated. Lagoons deeper than 2-3 m, however, can produce significant amounts of methane. (IPCC, 2006) As the lagoon will be less than 2 m in depth, significant methane emissions are not anticipated.

The vehicle emissions associated with sludge removal and maintenance are anticipated negligibly contribute to local GHG concentrations.

5.5 Soil

5.5.1 Soil Compaction and Mixing

As a result of incidental vehicle and equipment movement, along with grading, excavations, and stockpiling of materials at the Project Site during construction, there is the potential to cause soil compaction and mixing of soil horizons which may change the soil structure. Soil compaction also has the potential to change surface drainage patterns and reduce flora growth.

To reduce potential soil compaction and mixing of soil horizons at the Project Site, the following mitigation measures will be implemented:

- Construction equipment and vehicle movements will be limited to designated roads/pathways within and around work areas;
- Construction activities during periods of extensive precipitation/runoff will be limited;
- Disturbed/exposed areas will be kept to a minimum with site restoration occurring as soon as practical;
- Topsoil will be stripped and stockpiled on the Project Site for use in site restoration; and
- The contractor will be responsible for the appropriate repair of any areas where equipment has compacted soils with the repairs including appropriate grading and site restoration.

In our opinion, the mitigation measures proposed above are sufficient to mitigate potential adverse effects due to soil compaction and mixing during the construction and operation phases. Residual effects on soils are therefore assessed to be negligible.

5.5.2 Soil Erosion

Soil may be lost during the construction phase due to erosion as runoff from wind and precipitation. Conditions favourable for erosion have the potential to occur during clearing, grading, excavation, stockpiling, site restoration, and movement of equipment at the Project Site. Erosion of soil and material stockpiles due to wind has the potential to cause subsequent effects on air quality (dust and particular matter) and vegetation (dust deposition).

To mitigate potential soil erosion effects, mitigation measures described in **Section 5.3.1** will be implemented. In our opinion, the mitigation measures proposed are sufficient to mitigate any adverse effects due to soil erosion during

the construction and operation phases. Residual effects on air quality due to soil erosion are therefore assessed to be negligible.

5.6 Groundwater

As indicated in **Section 4.1.5.1**, a review of the Groundwater Information Network (2014) online mapping tool was completed and two registered groundwater wells were found to be within a 1.6 km radius of the Project Site. Also, Potable water is supplied to the community of Lowe Farm via the Pembina Valley Water Cooperative Inc.
The proposed project does not require undertaking any activities that may affect groundwater in the area. As indicated in **Section 2.4**, clay-lined lagoons in Manitoba are to provide a minimum 1 m thick clay seal having a hydraulic conductivity of 1×10^{-9} m/s lining the floor of the interior surfaces of the facility. The in-situ clays encountered in this area have a hydraulic conductivity range from 2.4×10^{-10} to 3.5×10^{-10} m/s. The clay was consistent and was found at depths up to 7.6 to 8.1 m, well beyond the requirement of 1 m. Based on the results of the geotechnical investigation (December 29, 2014), the existing natural clay meets and exceeds the criteria for a natural clay liner.

5.7 Surface Water and Aquatic Resources

The existing lagoon currently operates under the Clean Environment Commission (CEC) Order No. 1000 (issued August 29, 1983).

With the proposed replacement of the existing Lagoon, the new Lagoon system will meet the following effluent criteria (prescribed under Manitoba Water Quality Standards, Objectives, and Guidelines):

- $CBOD_5$ - 25 mg/L;
- Total Suspended Solids (TSS); excluding algae solids - 25 mg/L;
- Total Coliform – 1,500 CFU per 100 mL;
- Fecal Coliform - 200 CFU per 100 mL; and
- Un-ionized ammonia - 1.25 mg/L expressed as nitrogen (N), at 15°C ± 1°C.

With the above criteria as the target for key parameters, the quality of the effluent that will be discharged to the Morris River is anticipated to improve. The quantity of effluent is not anticipated to increase. Phosphorus reduction through natural attenuation methods will be used for the effluent from the Lowe Farm lagoon. Phosphorus absorption by the natural grasses, reeds, and soil in the drainage ditches is possible due to the long route to the Morris River (approximately 14 km). The effluent discharges into the east ditch of Municipal Road 5W and flow north into the Anderson Drain (south ditch of Municipal Road 25N). The effluent then travels east for approximately 13 km to the Morris River, which drains into the Red River just north of the Town of Morris (**Figure 04**). In addition to this, the lagoon will utilize trickle discharge over a 2-3 week period to facilitate nutrient uptake.

Therefore, effluent from the new lagoon is not anticipated to have a significant adverse effect on water quality in the Morris River.

In our opinion, the mitigation measures proposed are sufficient to mitigate any adverse effects during the construction and operation phase. Residual effects on surface water and aquatic resources are therefore assessed to be negligible.

5.8 Protected and Other Flora Species

As described in **Section 4.6**, there is the potential that the western ironweed, culver's root, Riddell's goldenrod, and western silvery aster may be found in the Project Region.

Clearing and dust from construction activities are potential sources of effects on flora. The location of the new secondary lagoon cell was previously agricultural land used for the production of soy beans and is currently cleared. Some vegetation clearing and grading may also be required within the existing effluent drainage ditch.

To minimize the amount of disturbance to vegetation at the Project Site, the disturbed/exposed areas will be kept to a minimum with site restoration occurring as soon as practical following construction. With these measures implemented, the residual effects on flora are assessed to be minor.

5.9 Protected and Other Fauna Species

Noise (disturbance) is a potential source of effects on fauna.

As described in **Section 4.6**, the listed wildlife species at risk are unlikely to occur in the local area of the Project Site due to the agricultural nature of the Project Site and surrounding area. Also, the SARA bird species (longspurs, bitterns, shrikes, swifts, sparrows, plovers, swans, woodpeckers, and warblers) listed in **Section 4.6** are included in Article I of the *Migratory Birds Convention Act* as long distance migrants.

During the site visit, a couple of ducks were observed in the existing lagoon. No other wildlife was observed. The area of the existing lagoon has been previously disturbed therefore the likelihood of protected species in the area is anticipated to be low. Also, immediately east of the existing lagoon is an active Lowe Farm Landfill. Noise during construction will a short-term disturbance and will subside thereafter. Effects due to noise during construction will be mitigated with the implementation of the mitigation measures identified in **Section 5.3.2**.

With the implementation of the mitigation measures identified above, the expected residual effects as a result of noise on wildlife is anticipated to be negligible at the Project Site.

5.10 Protected Areas

The construction and operation of the proposed project is not anticipated to affect nearby protected areas. Based on the distance to the Project Site as indicated in **Section 4.5**, no effects on protected areas are anticipated from the construction and operation of the proposed project.

5.11 Heritage Resources

As part of this assessment, a screening request was submitted to the Heritage Resources Branch (HRB) to determine if there are any potential heritage resources that may be affected by the proposed project. HRB has no concerns about the proposed project. Correspondence with HRB is provided in **Appendix F**.

If artifacts, historical features or skeletal remains are encountered during construction, work activities will stop immediately around the affected area with the find reported to the site supervisor. A qualified archaeologist may investigate and assess the find prior to the continuation of work. If skeletal remains are encountered during construction activities, the find will be immediately reported to the site supervisor and the RCMP.

5.12 Aesthetics

The aesthetics of the Project Site are anticipated to temporarily change during the construction phase due to the presence of construction equipment and related general disturbances (noise, dust, and construction wastes).

The existing lagoon is not gated, however, the new the lagoon system will be fenced and gated to limit public access.

The existing lagoon is located approximately 800 m east of the closest human receptors through a treed shelter belt. The main traffic along Municipal Road No. 5W is to access either the existing lagoon or the Lowe Farm Landfill with some traffic to the homesteads located approximately 1.3 km north of the existing lagoon.

To maintain a clean, aesthetically pleasing Project Site, the following mitigation measures will be implemented:

- The Project Site will be inspected for loose waste and debris in order to maintain a clean Project Site on a regular basis; and
- Waste and debris will be stored in bins and removed on a regular basis from the Project Site.

With the implementation of the above mitigation measures, the overall impact on aesthetics as a result of the proposed project is assessed to be reversible and insignificant.

5.13 Health and Safety

During construction and operation, there is potential for negative effects to worker and Project Site employee safety. Exposure to fuels, moving vehicles, construction equipment and pinch points could all negatively impact worker safety. In Manitoba, worker protection is provided through legislated standards, procedures and training under the *Workplace Safety and Health Act*. All contractors will be subject to site specific environmental, health and safety orientation for the construction phase of the proposed project.

The health and safety program will include the following;

- All construction will be carried out in accordance with the *Workplace Safety and Health Act* to minimize health and safety effects;
- Contractors will adhere to the requirements of applicable health and safety legislation and the site specific safety plan developed by the prime contractor or contractor as appropriate; and
- All workers will wear appropriate PPE at all times, including hearing protection as required.

Construction signage will be in place for the safety of the community. The public will not be permitted access to the Project Site as it will be fenced and gated during both construction and operation.

The new lagoon system will be completely fenced to prevent public access and signage will be posted.

With the above provisions in place, we expect risks to health and safety as a result of the proposed upgrade, to be appropriately mitigated for.

5.14 Accidents and Malfunctions

To prevent accidents and malfunctions, all phases of the proposed project will be conducted in accordance with applicable regulatory requirements. The following sections provide additional details on precautionary measures that are proposed to minimize the risk of occurrence for accidents and malfunctions.

5.14.1 Spills

During construction and operation, there is potential for environmental effects due to fuel spills and/or leaks. Accidents (including transportation accidents) could also result in the accidental release of hazardous materials and/or equipment/vehicle fluids and fuels. A number of potential environmental concerns are also associated with the accidental release of chemicals and fuels resulting from improper storage and handling procedures. Spills can affect soil, vegetation, groundwater quality, air quality, and can potentially threaten human health and safety. Activities that may cause a spill are anticipated to occur rarely over the short term during the construction phase of the proposed project. Spills are expected to be predominantly contained to the Project Site. The magnitude of the spill effects are anticipated to range from negligible to moderate depending on the severity of a spill.

To prevent spills from occurring during project activities, the following procedures will be employed:

- All potentially hazardous products (if required on-site) will be stored in a pre-designated, safe and secure product storage area(s) in accordance with applicable legislation within the construction material laydown area (**Figure 03**).
- Storage and disposal of liquid wastes and filters from equipment maintenance, and any residual material from spill clean-up will be contained in an environmentally safe manner and in accordance with any existing regulations.
- Storage sites (equipment storage, hazardous product storage, etc.) will be inspected periodically for compliance with requirements.
- Service and minor repairs of equipment performed on-site will be performed by trained personnel in appropriate areas.
- Vehicles and equipment will be maintained to minimize leaks. Regular inspections of hydraulic and fuel systems on equipment/machinery will be completed on a routine basis. When detected, leaks will be repaired immediately by trained personnel.
- Any used oils or other hazardous liquids will be collected and disposed of according to provincial requirements.
- Appropriate type and size of spill kits are available on-site.
- On-site construction staff will be trained in how to deal with spills and clean-up procedures, including review of applicable Spill Response Plans and knowledge of how to properly deploy site spill kit materials; which will be readily accessible at the site at all times.

Adherence to standard environmental management practices will minimize the risks of accidental spills and adverse effects. This includes regular equipment inspection and maintenance to minimize the risk of fuel spills. In the event of an accidental spill, a regulatory report will be made to Environment Canada and Manitoba Conservation and Water Stewardship. Following a spill, measures will be taken immediately with a spill kit or suitable alternative to prevent migration of the spilled material. Recovery measures will be implemented as necessary in consultation with the appropriate provincial authorities. Following initial response, a remediation program will be undertaken if necessary with contaminated material appropriately managed (in accordance with federal and provincial regulations).

With the implementation of the above mitigation measures as necessary and assuming the implementation of safe work practices, the risk of spills is considered to be appropriately mitigated.

5.14.2 Fire/Explosions

During construction and operation there exists the potential for fires at the Project Site involving mechanical equipment and fuels. Effects related to fires include, but are not limited to, harm to on-site personnel, equipment, and the potential release of contaminants and hazardous materials.

All precautions necessary will be taken to prevent fire hazards at the Project Site; these include, but are not limited to:

- All flammable waste will be removed on a regular basis and disposed of at an appropriate disposal site.
- Appropriate fire extinguisher(s) are available on the Project Site. Such equipment will comply with and be maintained to, the manufacturers' standards.
- All on-site fire prevention/response equipment is checked on a routine basis, in accordance with local fire safety regulations, to ensure the equipment is in proper working order at all times.
- Greasy or oily rags or materials subject to spontaneous combustion are deposited and stored in appropriate receptacles. This material will be removed from the Project Site on a regular basis and be disposed of at an appropriate waste disposal facility.

With these mitigation measures employed and assuming the implementation of typical safe work practices, the risk of fires and explosions is considered to be appropriately mitigated.

6. Public Engagement

Public consultation is an integral part of the environmental assessment process. It provides the opportunity for interested stakeholders to receive information from project planners and, in return, it allows proponents to gain an understanding of public concerns. Public consultation can also provide an opportunity to actively involve stakeholders in the early stages of a project, which, in turn, delivers a sense of transparency in the assessment and planning process.

An information session was held at the Lowe Farm Community Centre on Monday December 14, 2015 from 2 pm until 7pm. Neighbouring property owners we contacted via mail and a follow-up phone call from AECOM inviting them out for the information session. Speaking with the landowners via phone call, no concerns were raised about the existing lagoon and/or the proposed lagoon expansion.

A total of seven people attended the information session, of which five were representatives from the RM of Morris. The RM confirmed that they would like to keep the existing landfill gate in place and also have a separate gate for the truck hauling dump location at the lagoon. The option of a freeze-thaw cell was brought up by one of the RM representatives for the temporary sludge storage. This would involve creating a clay-lined cell with a berm for the storage of sludge. After one freeze-thaw cycle, the liquid from the cell could be pumped via a pump truck and the solids (ie. sludge) could be transported to an approved solid waste disposal site. This has idea has been partially incorporated into the Functional Design Report as outlined in **Section 2.4.3**.

7. Conclusions

The results of the effects assessment can be summarized as follows:

Topography

Effects due to stockpiling, excavating, grading and leveling, and contouring are assessed to be negligible and temporary in nature, and therefore considered insignificant. There will be permanent changes in topography on the Project Site following construction of the new secondary lagoon cell; this is considered major change that is reversible during decommissioning depending on the end use of the land. The perimeter ditching of the new lagoon system will represent a permanent change in the topography; however, this change is not assessed to be adverse. Therefore, overall changes to topography during construction of the proposed project are anticipated to result in minor residual effects.

Air and Noise

Although dust is not anticipated to be a major concern at the Project Site, with the implementation of measures such as limiting material stockpile heights, keeping disturbed/exposed areas to a minimum, and using dust suppression if required, the effects of dust is assessed to be negligible.

During the site visit on September 22, 2015, no odour was noted at the existing lagoon (on the berm) or while on the access road.

With respect to exhaust emissions, it is anticipated that a maximum of 10 construction vehicles will access the Project Site via Municipal Road No. 5W. With the implementation of measures such as maintaining vehicles and equipment in proper working order and vehicle idling kept to a minimum, the effects of exhaust emissions is assessed to be negligible.

Noise levels at the Project Site during construction are not expected to be high enough to cause significant disturbance in the Project Area. With the implementation of measures such as providing hearing protection to workers as required and properly maintaining vehicles and equipment are expected to mitigate potential adverse effects. During operation, sources of noise include maintenance vehicles and general activities (anticipated to be typical of lawn equipment, trucks, and small hand-held tools) along with septage hauler trucks arriving to the site. It is anticipated that septage will be trucked to the lagoon approximately once per week. Septage trucks traveling to the lagoon will temporarily increase from approximately one septage truck per week to approximately three septage trucks per week for one month in duration every second year as a municipal cleaning program for residences.

Greenhouse Gas Emissions

With respect to greenhouse gas (GHG) emissions, the proposed primary and secondary cells will be 1.5 m in depth and therefore produce negligible quantities of methane. Also, vehicle emissions associated with sludge removal and maintenance are anticipated negligibly contribute to local GHG concentrations. Therefore, the effect of odour is assessed to be negligible.

Soil

With respect to soil compaction, mixing, and erosion during construction, the implementation of mitigation measures identified in this assessment is anticipated to mitigate any potential soil compaction/mixing and erosion effects. Therefore, it is anticipated that the residual effect on soil is assessed to be negligible.

Groundwater

The proposed project does not require undertaking of any activities that may affect groundwater in the area. In Manitoba, clay-lined lagoons are to provide a minimum 1 m thick clay seal having a hydraulic conductivity of 1×10^{-9} m/s lining the floor of the interior surfaces of the facility. The in-situ clays encountered in this area have a hydraulic conductivity range from 2.4×10^{-10} to 3.5×10^{-10} m/s. The clay was consistent and was found at depths up to 7.6 to 8.1 m, well beyond the requirement of 1 m. Based on the results of the geotechnical investigation (December 29, 2014), the existing natural clay meets and exceeds the criteria for a natural clay liner.

Surface Water and Aquatic Resources

The new lagoon system will meet the following effluent criteria (prescribed under Manitoba Water Quality Standards, Objectives, and Guidelines):

- $CBOD_5$ - 25 mg/L;
- Total Suspended Solids (TSS); excluding algae solids - 25 mg/L;
- Total Coliform - 1500 CFU per 100 mL;
- Fecal Coliform - 200 CFU per 100 mL; and
- Un-ionized ammonia - 1.25 mg/L expressed as nitrogen (N), at 15°C ± 1°C.

As the lagoon will be servicing a population of less than 2,000 people, Phosphorus reduction through natural attenuation methods will be used for the effluent from the Lowe Farm lagoon. Phosphorus absorption by the natural grasses, reeds, and soil in the drainage ditches is possible due to the long route to the Morris River (approximately 14 km). The effluent discharges into the east ditch of Municipal Road 5W and flow north into the Anderson Drain (south ditch of Municipal Road 25N). The effluent then travels east for approximately 13 km to the Morris River, which drains into the Red River just north of the Town of Morris. In addition to this, the lagoon will utilize trickle discharge over a 2-3 week period to facilitate nutrient uptake.

With the above criteria as the target for key parameters, the quality of the effluent that will be discharged to the Morris River is anticipated to improve. The quantity of effluent is not anticipated to increase. Phosphorus reduction through natural attenuation methods will be used for the effluent from the Lowe Farm lagoon. Phosphorus absorption by the natural grasses, reeds, and soil in the drainage ditches is possible due to the long route to the Morris River (approximately 14 km).

With the implementation of the mitigation measures identified in this assessment, any adverse effects during the construction and operation phase are therefore assessed to be negligible.

Protected and Other Flora Species

There is the potential that the western ironweed, culver's root, Riddell's goldenrod, and western silvery aster may be found in the Project Region. Clearing and dust from construction activities are potential sources of effects on flora. The location of the new secondary lagoon cell was previously agricultural land used for the production of soy beans and is currently cleared. Some vegetation clearing and grading may also be required within the existing effluent drainage ditch.

With the implementation of the mitigation measures identified in this assessment, the effect of vegetation clearing is assessed to be minor.

Protected and Other Fauna Species

With respect to protected species, the listed wildlife species at risk are unlikely to occur in the local area of the Project Site due to the agricultural nature of the Project Site and surrounding area. The area of the existing lagoon has been previously disturbed therefore the likelihood of protected species in the area is anticipated to be low. Also, immediately east of the existing lagoon is the active Lowe Farm Landfill. Noise during construction will a short-term disturbance and will subside thereafter. With implementation of the mitigation measures identified in this report, the expected residual effects as a result of noise on wildlife are anticipated to be negligible at the Project Site.

Protected Areas

With respect to protected areas, the closest protected area is located approximately 47 km east from the Project Site therefore, no effects on protected areas are anticipated from the construction and operation of the proposed project.

Heritage Resources

AECOM submitted a screening request to Heritage Resources Branch (HRB) on October 28, 2015. HRB has no concerns with the proposed project.

Aesthetics

During construction, good housekeeping practices will be implemented at the Project Site including inspecting the Project Site on a regular basis for loose waste and debris and storing waste and debris in proper bins prior to removal from the site. The existing lagoon is located approximately 800 m east of the closest human receptors through a treed shelter belt. The main traffic along Municipal Road No. 5W is to access either the existing lagoon or the Lowe Farm Landfill with some traffic to the homesteads located approximately 1.3 km north of the existing lagoon. The new the lagoon system will be fenced and will have a gate to limit public access. Therefore, the overall impact on aesthetics as a result of the proposed project is assessed to be reversible and insignificant.

Public Engagement

An information session was held at the Lowe Farm Community Centre on Monday December 14, 2015 from 2 pm until 7pm. Neighbouring property owners were contacted via mail and a follow-up phone call from AECOM inviting them out for the information session. Speaking with the landowners via phone call, no concerns were raised about the existing lagoon and proposed lagoon expansion.

Conclusion Summary

Considering the implementation of the proposed mitigation measures, design features, existing and proposed environmental licence conditions and the social and ecological context of each environmental component, the cumulative residual environmental effects of the proposed lagoon upgrade project are expected to negligible in magnitude. The measures described to mitigate the risk of occurrence of accidents and malfunctions are deemed to be appropriate in mitigating such risks. Therefore, it is our opinion that based on the available information and documented assumptions, the overall potential adverse effects of the proposed project will be negligible to minor and insignificant.

8. References

AECOM. November 2015. Lowe Farm Lagoon Functional Design Report.

Canada Land Inventory (CLI). 1966. Soil Capability for Agriculture (Winnipeg 62H). Agriculture and Agri-Food Canada Website: http://sis.agr.gc.ca/cansis/publications/maps/cli/250k/agr/index.html (accessed November 10, 2015).

Clean Environment Act, August 29, 1983. An Order of the Clean Environment Commission under the Clean Environment Act, Clean Environment Act Order No. 1000.

COSEWIC. 2010. COSEWIC Assessment and Status Report on the Chestnut-collard Longspur in Canada. Government of Canada Website: http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Chestnut-collared%20Longspur_0810_e1.pdf

Department of Energy, Mines and Resources, Surveys and Mapping Branch. 1984. Roland, Manitoba. Etopo, 62H05, Edition 3, UTM Zone 14.

Enns, A. 2011. SKCDC Status Assessment: Western Smooth Cliff-brake (Pellaea glabella ssp. occidentalis) in Saskatchewan. Saskatchewan Conservation Data Centre, Fish and Wildlife Branch, 3211 Albert Street, Regina, Saskatchewan, Canada, S4S 5W6.

Environment Canada. September 22, 2015a. Canadian Climate Normals (1971-2000) – Morris 2. Government of Canada Website: http://climate.weather.gc.ca/climate_normals/index_e.html (accessed November 3, 2015)

Environment Canada. September 22, 2015b. Canadian Climate Normals (1971-2000) – Morden CDA. Government of Canada Website: http://climate.weather.gc.ca/climate_normals/index_e.html (accessed November 3, 2015)

Geological Survey of Canada, Manitoba Minerals Division. 1987. Geological Highway Map of Manitoba.

Government of Canada. August 14, 2015. Species at Risk Public Registry. Government of Canada Website: http://www.sararegistry.gc.ca (accessed November 16, 2015)

Groundwater Information Network (GIN). 2014. GIN Basic Map Viewer. GIN Website: http://gin.gw-info.net/service/api_ngwds:gin2/en/wmc/standard.html%3bjsessionid=204C40CF22DE3F55EF5FB9E75994BB17

International Panel on Climate Change (IPCC). 2006. IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 6 – Wastewater Treatment and Discharge.

Manitoba Conservation Data Centre (MB CDC). January 1, 2013. Occurrence of Species by Ecoregion – Lake Manitoba Plain. Manitoba Conservation Website: http://www.gov.mb.ca/conservation/cdc/ecoreg/lakembplain.html (accessed November 16, 2015).

Manitoba Conservation and Water Stewardship (MCWS), Parks and Protected Spaces. May 2004. Eastern Parks, St. Malo Provincial Park. Manitoba Conservation and Water Stewardship Website: https://www.gov.mb.ca/conservation/parks/popular_parks/eastern/malo_info.html (accessed November 16, 2015).

Manitoba Conservation and Water Stewardship (MCWS), Wildlife Branch. 2015a. Wildlife Management Areas. Manitoba Conservation and Water Stewardship Website: http://www.gov.mb.ca/conservation/wildlife/habcons/wmas/gMap/ (copyright 2015; accessed November 16, 2015).

Manitoba Conservation and Water Stewardship (MCWS), Wildlife Branch. 2015b. Species at Risk, Species Listed Under the *Manitoba Endangered Species and Ecosystems Act*. Manitoba Conservation and Water Stewardship Website: http://www.gov.mb.ca/conservation/wildlife/sar/sarlist.html (accessed November 16, 2015).

Manitoba Conservation and Water Stewardship (MCWS), Wildlife Branch. 2015c. Species at Risk, Baird's Sparrow Fact Sheet. Manitoba Conservation and Water Stewardship Website: http://www.gov.mb.ca/conservation/wildlife/sar/fs/bairdssp.html (accessed November 16, 2015)

Manitoba Infrastructure and Transportation (MIT), Traffic Engineering Branch. 2014. Annual Average Daily Traffic on Provincial Trunk Highways and Provincial Roads. MIT Website: http://umtig.eng.umanitoba.ca/mhtis/flowmap2014.pdf (accessed November 18, 2015).

Manitoba Municipal Government. Site Assessment, Red River Valley Designated Flood Area Map. Manitoba Municipal Government Website: http://www.gov.mb.ca/ia/livestock/red_river_map.html (accessed February 25, 2016).

Manitoba Natural Resources, Water Resources. July 15, 1997. Red River Valley: Areas Flooded by the Red River in 1950, 1979, 1996 and 1997 (map).

Milani, D.W. 2013. Fish Community and Fish Habitat Inventory of Streams and Constructed Drains Throughout Agricultural Areas of Manitoba (2002-2006). Canadian Data Report of Fisheries and Aquatic Sciences 1247: xvi + 6, 153 pp.

Murray, C. and C. Church. 2015. Manitoba Conservation Data Centre Surveys and Stewardship Activities, 2014. Report No. 2015-01. Manitoba Conservation Data Centre, Winnipeg, Manitoba. v+47 pp.

Pembina Valley Water Cooperative Inc. (PVWC) March 2015. Annual Report 2014. Pembina Valley Water Cooperative Inc. Website: http://pvwc.ca/ (accessed November 16, 2015).

Rural Municipality of Morris. 2012. Where Agriculture and Industry Meet. Rural Municipality of Morris Website: http://www.rmofmorris.com/ (accessed November 18, 2015)

Rutulis, M. 1986a. Province of Manitoba, Department of Natural Resources, Water Resources Branch, Aquifer Maps of Southern Manitoba, Map 1 of 2, Bedrock Aquifers.

Rutulis, M. 1986b. Province of Manitoba, Department of Natural Resources, Water Resources Branch, Aquifer Maps of Southern Manitoba, Map 2 of 2, Sand Aquifers.

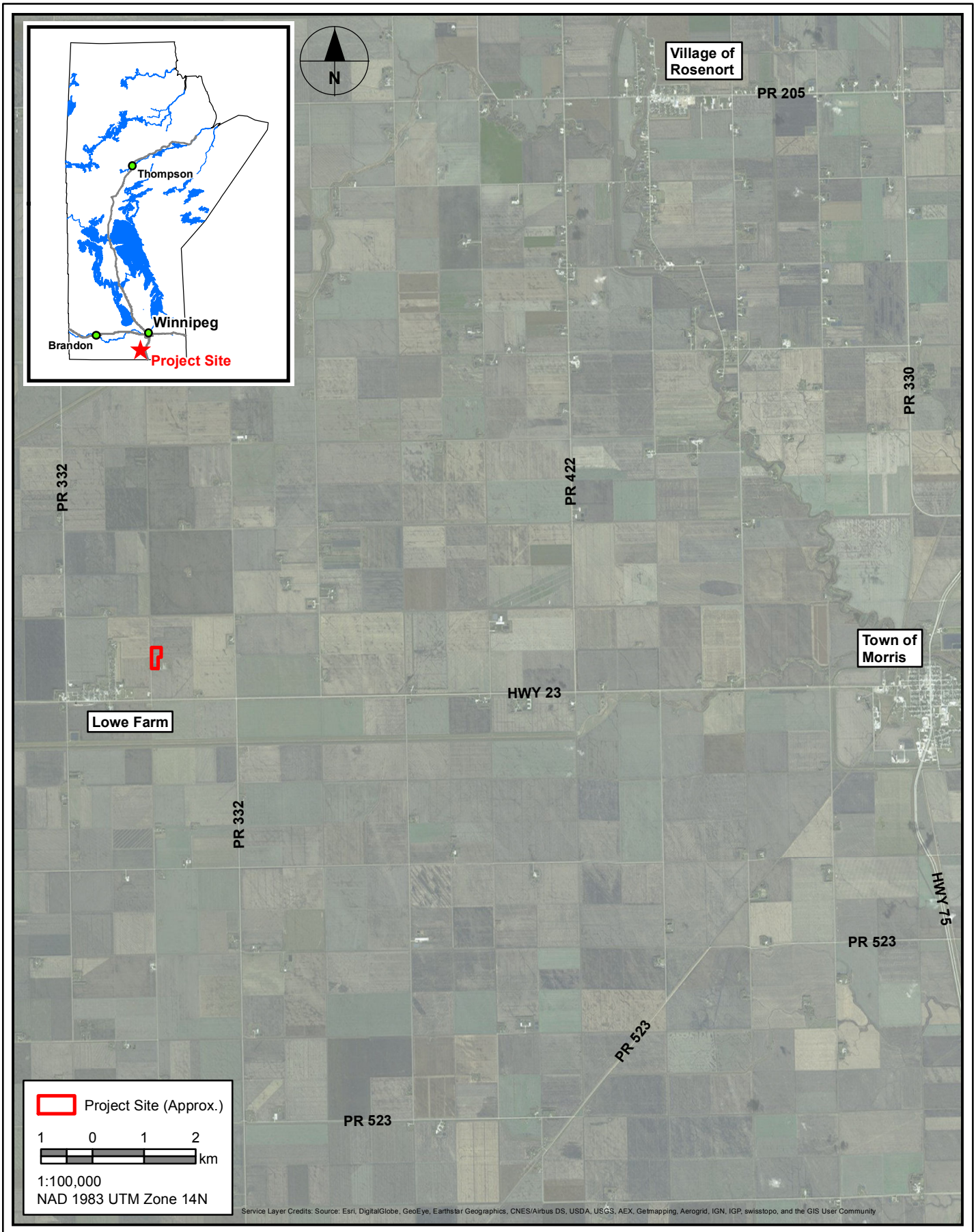
Smith, R.E., H. Veldhuis, G.F. Mills, R.G. Eilers, W.R. Fraser, and G.W. Lelyk. 1998. Terrestrial Ecozones, Ecoregions, and Ecodistricts, An Ecological Stratification of Manitoba's Natural Landscapes. Technical Bulletin 98-9E. Land resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agi-Food Canada, Winnipeg, Manitoba.

Statistics Canada. February 9, 2015. 2011 Census Profile, RM of Morris, Manitoba. Statistics Canada Website: http://www12.statcan.gc.ca/census-recensement/2011/dp-

pd/prof/details/Page.cfm?Lang=E&Geo1=CSD&Code1=4603065&Geo2=PR&Code2=46&Data=Count&SearchText=lowe%20farm&SearchType=Begins&SearchPR=46&B1=All&Custom= (accessed November 16, 2015).

Stewart, K.W. and Watkinson, D.A. 2004. The Freshwater Fishes of Manitoba. University of Manitoba Press, Winnipeg MB. 276 pp.

Figures



ANSI A 215.9mm x 279.4mm

Project Management Initials: Designer: Checked: Approved:

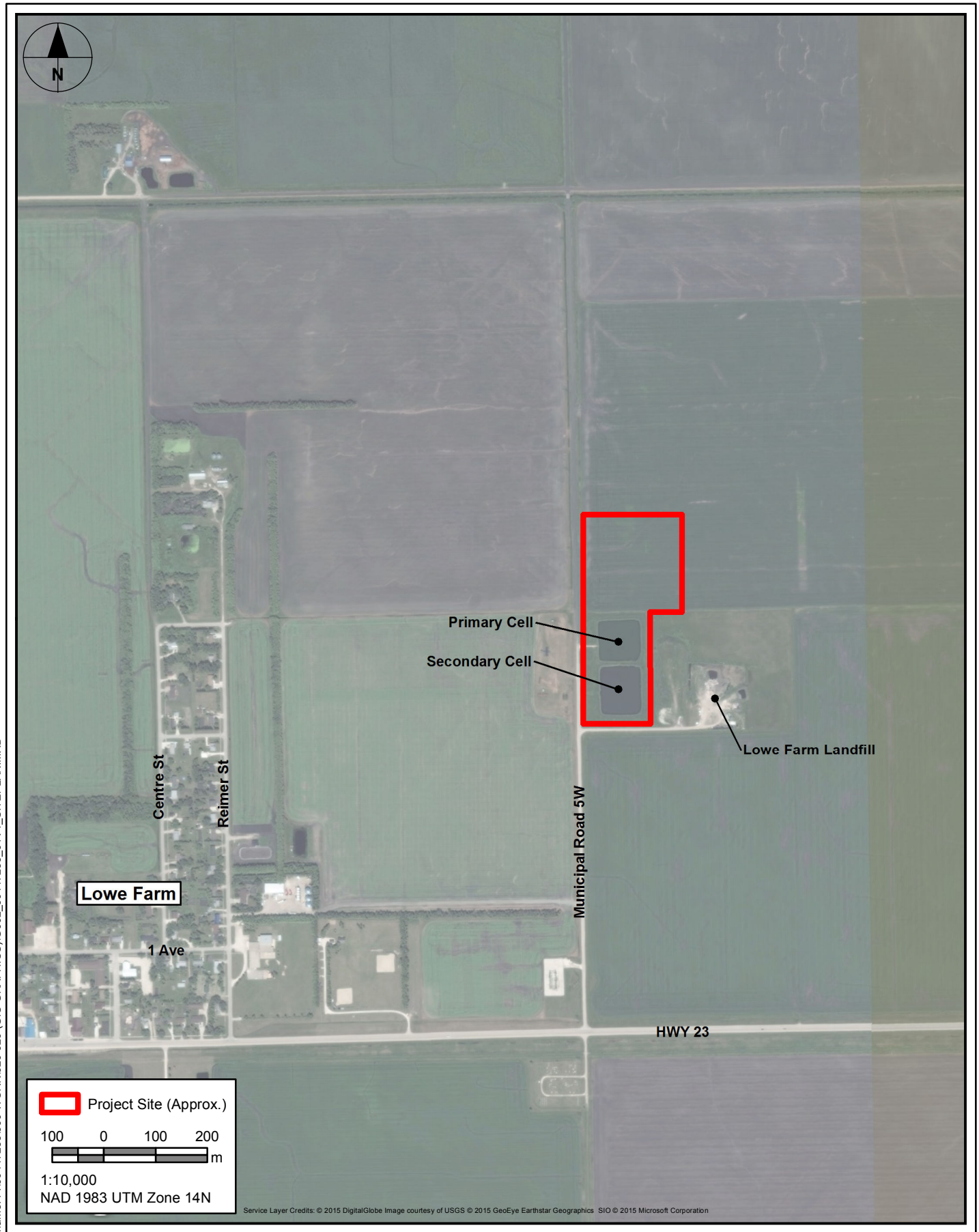
Last saved by: MAHEC (2015-12-22) Last Plotted: 2013-02-21
Filename: P:\60447253\900-WORK\920-929 (GIS-GRAPHICS)\G001_60447253_01V1_LOCATIONPLAN.MXD

Lowe Farm Lagoon Expansion - Environment Act Proposal
Rural Municipality of Morris
Lowe Farm, MB

Location Plan

AECOM

Figure: 01



ANSI A 215.9mm x 279.4mm

Project Management Initials: Designer: Checked: Approved:

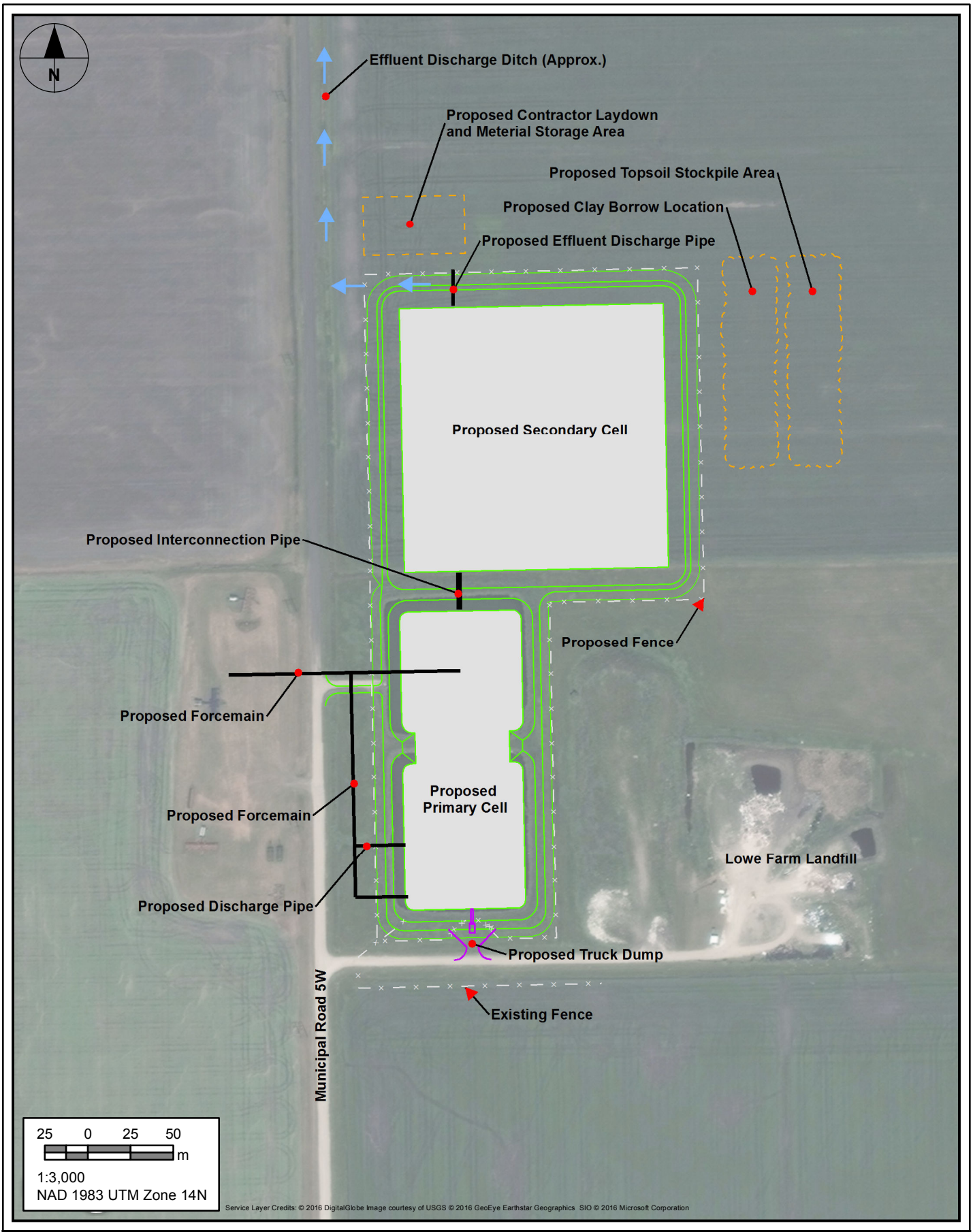
Last saved by: MAHEC (2015-12-22) Last Plotted: 2013-02-21
Filename: P:\60447253\900-WORK\920-929 (GIS-GRAPHICS)\G002_60447253_01V1_SITEPLAN.MXD

Lowe Farm Lagoon Expansion - Environment Act Proposal
Rural Municipality of Morris
Lowe Farm, MB

Existing Site Plan

AECOM

Figure: 02



ANSI A 215.9mm x 279.4mm

Project Management Initials: Designer: Checked: Approved:

Last saved by: MAHEC (2016-03-01) Last Plotted: 2013-02-21
Filename: P:\60447253\900-WORK\920-929 (GIS-GRAPHICS)\HG003_60447253_01V1_PROPOSEDSITEPLAN.MXD

Lowe Farm Lagoon Expansion - Environmental Act Proposal
Rural Municipality of Morris
Lowe Farm, MB

Proposed Site Plan

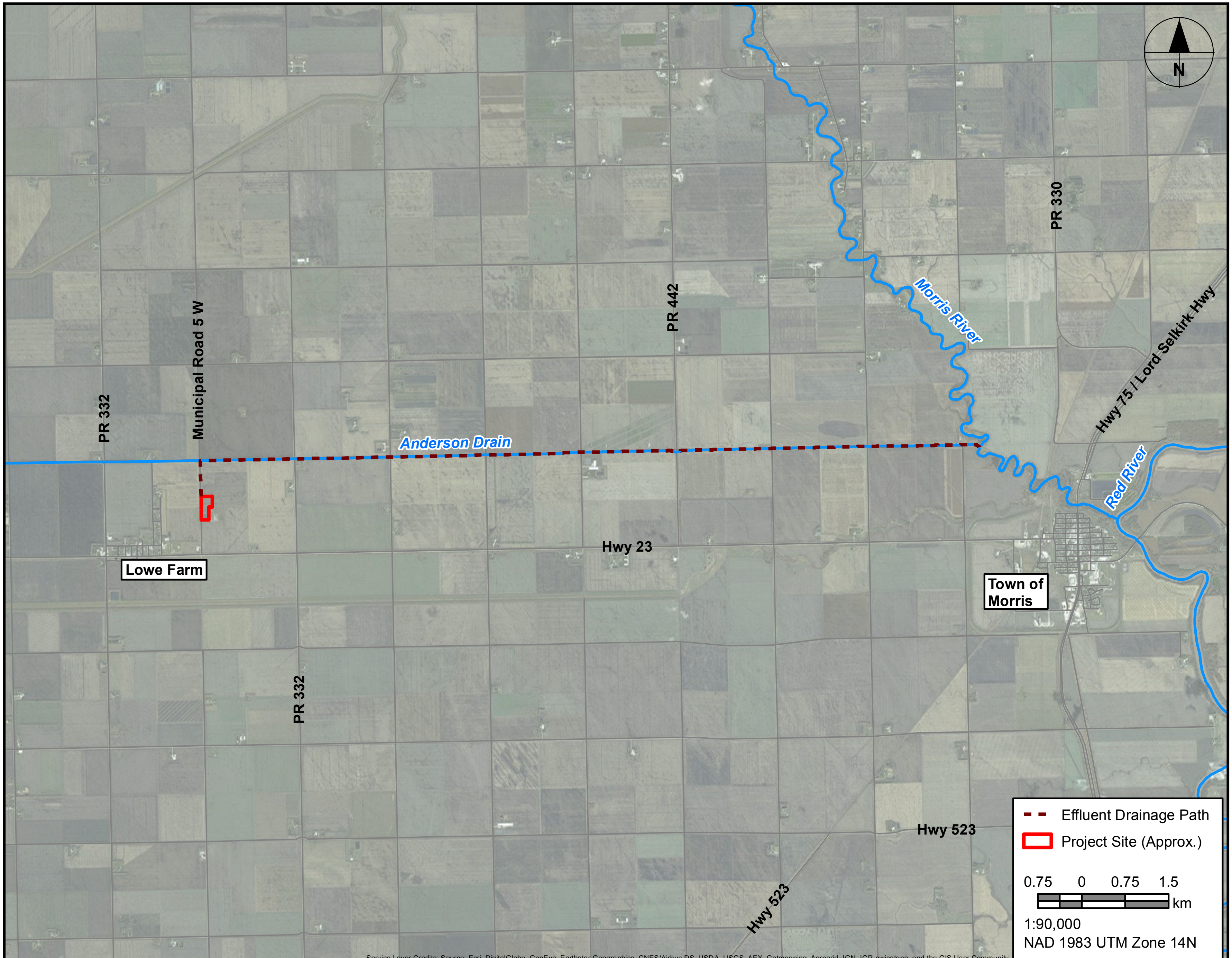
AECOM

Figure: 03

Last saved by: MAHEC (2015-12-22) Last Plotted: 2013-04-22
Filename: P:\60447253\900-WORK\920-929 (GIS-GRAPHICS)\G004_60447253_01V1_EFFLUENTDRAINAGEDITCHLANDSCAPE.MXD

Project Management Initials: Designer: Checked: Approved:

ANSI A 215.9mm x 279.4mm



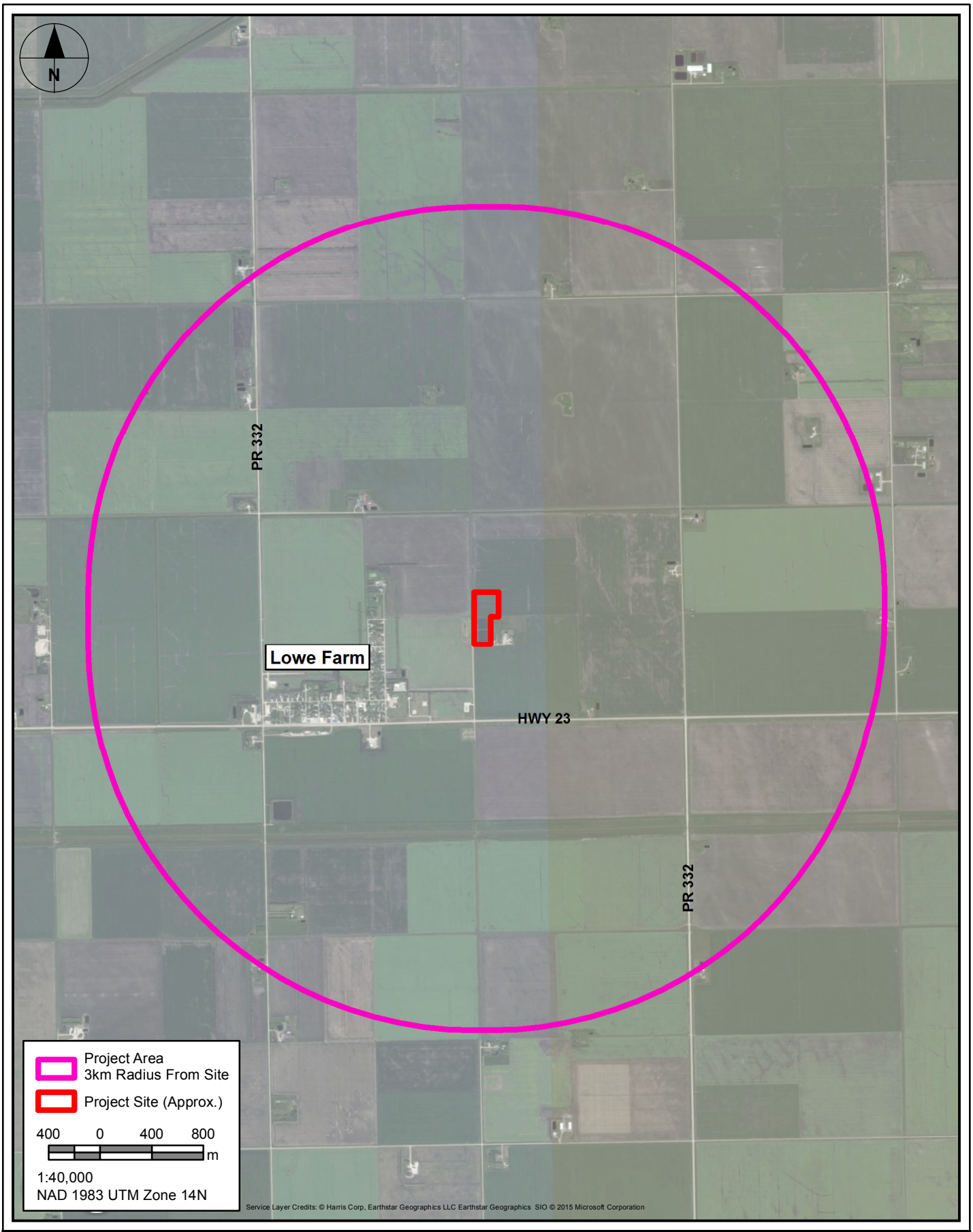
Lowe Farm Lagoon Expansion - Environment Act Proposal

Rural Municipality of Morris

Effluent Drainage Ditch

AECOM

Figure: 04



ANSI A 215.9mm x 279.4mm

Project Management Initials: Designer: Checked: Approved:

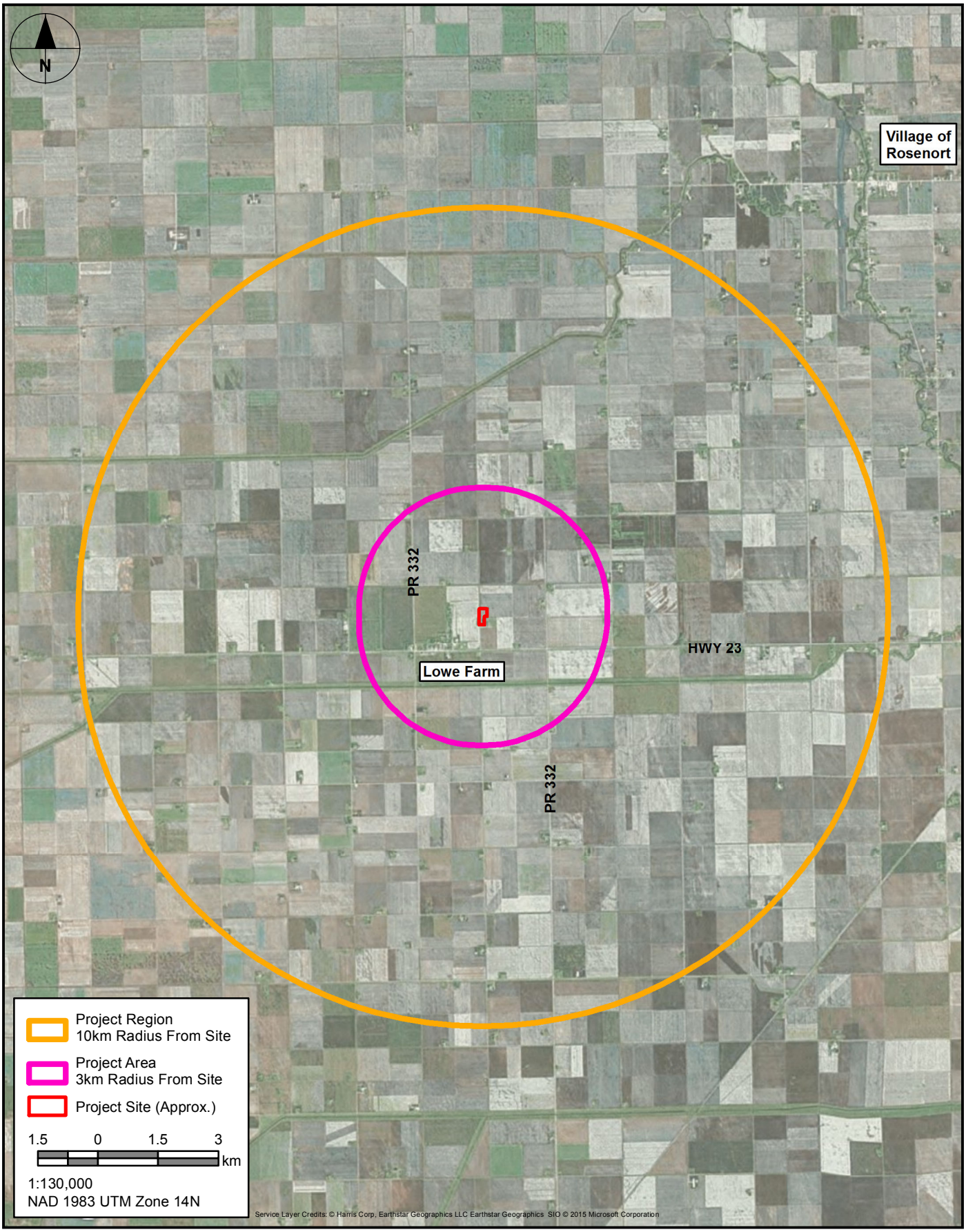
Last saved by: MAHEC (2015-12-22) Last Plotted: 2013-02-21
Filename: P:\60447253\900-WORK\920-929 (GIS-GRAPHICS)\G005_60447253_01V1_PROJECTAREA.MXD

Lowe Farm Lagoon Expansion - Environment Act Proposal
Rural Municipality of Morris
Lowe Farm, MB

Project Area - 3km Radius

AECOM

Figure: 05



ANSI A 215.9mm x 279.4mm

Project Management Initials: Designer: Checked: Approved:

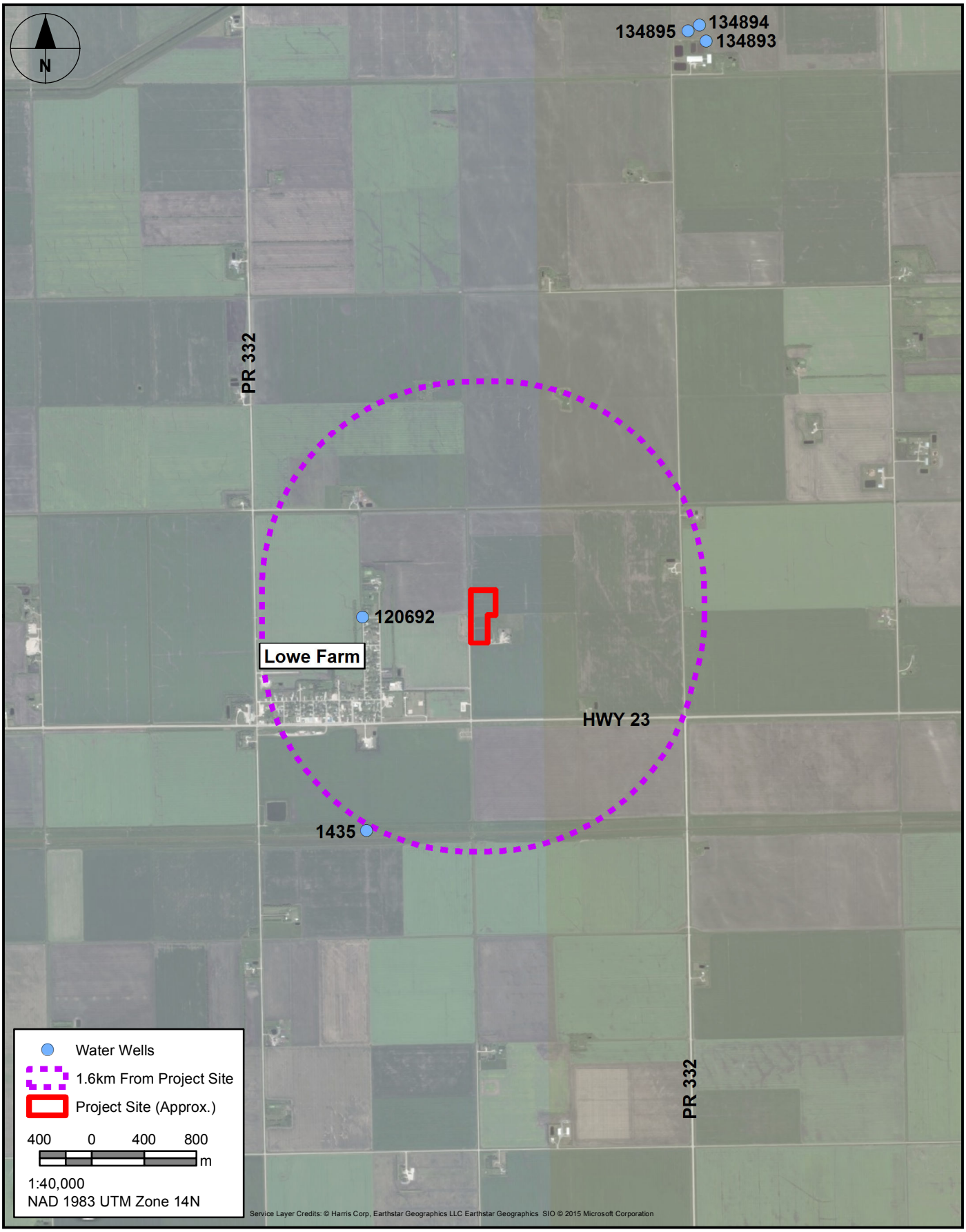
Last saved by: MAHEC (2015-12-22) Last Plotted: 2013-02-21
Filename: P:\60447253\900-WORK\920-929 (GIS-GRAPHICS)\G006_60447253_01V1_PROJECTREGION.MXD

Lowe Farm Lagoon Expansion - Environment Act Proposal
Rural Municipality of Morris
Lowe Farm, MB

Project Region - 10km Radius

AECOM

Figure: 06



ANSI A 215.9mm x 279.4mm

Project Management Initials: Designer: Checked: Approved:

Last saved by: MAHEC (2015-12-22) Last Plotted: 2013-02-21
Filename: P:\60447253\900-WORK\920-929 (GIS-GRAPHICS)\G007_60447253_01V1_WATERWELLS1.6KM.MXD

Lowe Farm Lagoon Expansion - Environment Act Proposal
Rural Municipality of Morris
Lowe Farm, MB

Registered Groundwater Wells Within 1.6km of the Project Site

AECOM

Figure: 07

Appendix A

Status of Title

Water & Wastewater Facility Operators Certification Program

Manitoba Conservation

Application for Wastewater Treatment Facility Classification

also available online at http://www.manitoba.ca/certification

Please print clearly or type and follow the instructions on the application form.
NOTE: If using Adobe Reader text can be inserted into form and tab between fields.

This application is pursuant to the Water and Wastewater Facility Operators Regulation issued under The Environment Act.

Name of Facility:	Lowe Farm Lagoon
Name of Facility Owner: (Municipality/Commission/ Company/Individual/etc)	Rural Municipality of Morris
Civic Address of Facility:	Northwest corner of SW 1/4 of 5-5-1W
Mailing Address of Owner:	RM of Morris, Box 518, 207 Main Street, Morris, Manitoba

Postal Code:	R0G 1K0	Telephone:	(204) 746-7300
Contact Person:	Larry Driedger, CMMA	Position:	Chief Administrative Officer
Cell or Pager:		Fax: (204) 746-8801	Email: larry@rmofmorris.ca

Is this a REAPPLICATION? (●) Yes ( ) No

Please complete the following. The information provided will be used to classify the wastewater treatment facility under the Water and Wastewater Facility Operators Regulation. In some cases actual numbers or answers must be supplied, but in most cases it will only be necessary to check the appropriate criteria.

Forward the completed form to:

Director
Environmental Assessment & Licensing Branch
Manitoba Conservation
160 – 123 Main Street
Winnipeg MB R3C 1A5

Please direct questions to:

Certification Program Coordinator
Phone: (204) 945-7065
Fax: (204) 945-5229

FOR MANITOBA CONSERVATION USE ONLY

Operation ID # _____

Stakeholder ID # _____

Approval ID # _____

EO/DWO _____

Application for Wastewater Treatment Facility Classification

SYSTEM *(choose all that apply)*			
1.	New or proposed Facility seeking classification	☑	
	Proposed start of operations (month / year) 10/01/2016		
	Existing Facility seeking classification (in operation prior to December 31, 2005)	☐	
	Facility has been in operation since (approximate month/year)		
2.	The facility **WILL** employ mechanical treatment processes	○	
	The facility **WILL NOT** employ mechanical treatment processes	◉	

SIZE *(refer to Supplemental Information for point designation) (2 point minimum to 20 point maximum)*				
1.	Maximum population or part served, peak day	# 685		1-10
2.	Design flow average day **Estimated** or **Actual** (Circle volume option & units) ◉ ○ **OR** Peak month's flow average day **Estimated** or **Actual** ◉ ○	164 ◉ m^3/day ○ gal/day 247 ◉ m^3/day ○ gal/day		1-10

VARIATION IN RAW WASTE[1] *(choose all that apply) (0 point minimum to 6 point maximum)*			
1.	Variations do not exceed those normally or typically expected	☑	0
2.	Recurring deviations or excessive variations of 100-200% in strength	☐	2
	Recurring deviations or excessive variations of 100-200% in flow	☐	
	Recurring deviations or excessive variations of 100-200% in strength and flow	☐	
3.	Recurring deviations or excessive variations of more than 200% in strength	☐	4
	Recurring deviations or excessive variations of more than 200% in flow	☐	
	Recurring deviations or excessive variations of more than 200% in strength and flow	☐	
4.	Raw wastes subject to toxic waste discharges	☐	6
5.	Septage or truck-hauled waste discharge is accepted at the facility.	☑	0 - 4
	Estimated number of loads per day in peak haul times	4	

Application for Wastewater Treatment Facility Classification

PRELIMINARY TREATMENT *(choose all that apply)*			
1.	Facility pumping of main flow	☐	3
2.	Screening or comminution	☐	3
3.	Grit removal	☐	3
4.	Equalization	☐	1

PRIMARY TREATMENT *(choose all that apply)*			
1.	Clarifiers	☐	5
2.	Anaerobic treatment with biogas flare	☐	10
3.	Anaerobic treatment with biogas utilization facility	☐	15

SECONDARY TREATMENT *(choose all that apply)*			
1.	Fixed-film reactor	☐	10
2.	Activated sludge	☐	15
3.	Stabilization ponds without aeration (ie: sewage lagoon)	☑	5
4.	Stabilization ponds with aeration	☐	8

TERTIARY TREATMENT *(choose all that apply)*			
1.	Polishing ponds for advanced waste treatment	☐	2
2.	Chemical / physical advanced waste treatment without secondary treatment	☐	15
3.	Chemical / physical advanced waste treatment following secondary treatment	☐	10
4.	Biological or chemical / biological advanced waste treatment	☐	12
5.	Nitrification by designed extended aeration only	☐	5
6.	Ion exchange for advanced waste treatment	☐	10
7.	Reverse osmosis, electrodialysis and other membrane filtration techniques	☐	10
8.	Advanced waste treatment chemical recovery, carbon regeneration	☐	4

Application for Wastewater Treatment Facility Classification

9.	Media filtration	☐	5

ADDITIONAL TREATMENT PROCESSES *(choose all that apply)*			
1.	Chemical addition: *(Please list chemicals used, 2 pts per chemical to max. of 6)*	☐	0 - 6
2.	Dissolved air floatation (other than for sludge thickening)	☐	8
3.	Intermittent sand filter	☐	2
4.	Recirculating intermittent sand filter	☐	3
5.	Microscreens	☐	5
6.	Generation of oxygen	☐	5

SOLIDS HANDLING *(choose all that apply)*			
1.	Storage (other than for stabilization)	☐	2
2.	Stabilization by storage (including any storage afterwards)	☐	4
3.	Gravity thickening	☐	2
4.	Mechanical dewatering	☐	8
5.	Anaerobic digestion of solids	☐	10
6.	Utilization of digester gas for heating or cogeneration	☐	5
7.	Aerobic digestion of solids	☐	6
8.	Air-drying of sludge	☐	2
9.	Solids reduction (including incineration and wet oxidation)	☐	12
10.	Disposal in landfill	☐	2
11.	Solids composting	☐	10
12.	Land application of biosolids by contractor	☐	2
13.	Land application of biosolids by facility personnel	☐	10

Application for Wastewater Treatment Facility Classification

DISINFECTION *(choose all that apply) (0 point minimum to 10 point maximum)*			
1.	Chlorination	☐	5
	Ultraviolet irradiation	☐	
2.	Ozonization	☐	10

EFFLUENT DISCHARGE *(choose all that apply) (0 point minimum to 10 point maximum)*			
1.	Discharge to surface water (ditch or lake or _____)	☑	0
2.	Mechanical post-aeration	☐	2
3.	Direct recycling and reuse	☐	6
4.	Land treatment and surface or subsurface disposal		4

INSTRUMENTATION *(choose one) (0 point minimum to 6 point maximum)*			
1.	SCADA or similar instrumentation systems are used to provide:		
	• Data with no process operation	◉	0
	• Data with limited process operation	○	2
	• Data with moderate process operation	○	4
	• Data with extensive or total process operation	○	6

LABORATORY CONTROL[2] *(choose all that apply) (0 point minimum to 15 point maximum)*			
1.	Bacteriological / Biological *(0 point minimum to 5 point maximum)*		
	• Lab work done outside the facility	☑	0
	• Membrane filter procedures	☐	3
	• Use of fermentation tubes or any dilution method of fecal coliform determination	☐	5
2.	Chemical / Physical *(0 point minimum to 10 point maximum)*		
	• Lab work done outside the facility	☑	0

Application for Wastewater Treatment Facility Classification

	• Push button or visual methods for simple tests such as pH or settleable solids *(List tests)*	☐	3
	• Additional procedures such as DO, COD, BOD, gas analysis, titration, solids content or volatile content *(List tests)*	☐	5
	• More advanced determinations such as specific constituents, nutrients, total oils or phenols *(List tests)*	☐	7
	• Highly sophisticated instrumentation such as atomic absorption or gas chromatograph *(List tests)*	☐	10

APPLICANT VERIFICATION	
I HEREBY DECLARE THAT ALL INFORMATION IN THIS APPLICATION IS TRUE.	
Name of Applicant[3]: (Print) Paul Barsalou, P.Eng	
Title: Project Manager	
Telephone: (204) 477-5381	Fax: (204) 284-2040
Email: paul.barsalou@aecom.com	
Signature of Authorized Representative: Paul Barsalou	Date: 02/25/2016

[1]The key concepts are frequency or intensity of deviation, or excessive variation from normal or typical fluctuations. The deviations in strength, toxicity, ratio of infiltration to inflow, or shock loads.

[2] The key concept is to credit laboratory analyses done on-site by facility personnel under the direction of an operator-in-charge with points from 0-15.

[3] Applicant must be an authorized representative of the owner/operating authority (i.e. manager, P. Eng., or overall responsible operator).

Print Application Form

Wastewater Treatment Form Supplemental Information

This is supplemental information for completing the Application for Wastewater Treatment Facility Classification Form only.

For exact definitions and text refer to Manitoba Regulation 77/2003, Water and Wastewater Facility Operators Regulation and amendment M.R. 162/2005, under The Environment Act (C.C.S.M. c E125).

A copy of the regulation is available by following the link for Manitoba Regulations at: http://www.gov.mb.ca/conservation/envapprovals/publs/index.html

Facilities are classified as follows:

Small system class
A wastewater treatment facility that otherwise meets the criteria of a class 1 wastewater treatment facility shall be classified in the small system class if

a) it treats wastewater from a population of no more than 500; and
b) no mechanical treatment processes are employed at the facility.

Classes 1 to 4
Wastewater treatment facilities shall be classified in classes 1 to 4 in accordance with the following table, on the basis of the number of classification points assessed under the classification point system set out in the Water and Wastewater Facility Operators Regulation.

Range of Classification Points	Classification
0 to 30	Class 1
31 to 55	Class 2
56 to 75	Class 3
76 or more	Class 4

Size

Points for size: (2 point minimum to 20 point maximum)

Maximum population or part served, peak day (1 point minimum to 10 point maximum). Points are assigned at 1 point per 10,000 population or part.

Design flow average day or peak month's flow average day, whichever is larger (1 point minimum to 10 point maximum). Points are assigned at 1 point per 4.5 megalitres per day or part.

Authorized Representative

Signatures for the Applicant Verification section must be an individual recognized by the Owner of the facility as able to sign official documentation (i.e. P.Eng., Manager, CAO, etc).

Appendix B

Application for Wastewater Treatment Facility Classification

Water & Wastewater Facility Operators Certification Program

Manitoba Conservation

Application for Wastewater Treatment Facility Classification

also available online at http://www.manitoba.ca/certification

Please print clearly or type and follow the instructions on the application form.
NOTE: If using Adobe Reader text can be inserted into form and tab between fields.

This application is pursuant to the Water and Wastewater Facility Operators Regulation issued under The Environment Act.

Name of Facility:	Lowe Farm Lagoon
Name of Facility Owner: (Municipality/Commission/ Company/Individual/etc)	Rural Municipality of Morris
Civic Address of Facility:	Northwest corner of SW 1/4 of 5-5-1W
Mailing Address of Owner:	RM of Morris, Box 518, 207 Main Street, Morris, Manitoba

Postal Code:	R0G 1K0	Telephone:	(204) 746-7300
Contact Person:	Larry Driedger, CMMA	Position:	Chief Administrative Officer
Cell or Pager:		Fax: (204) 746-8801	Email: larry@rmofmorris.ca

Is this a REAPPLICATION? (●) Yes ( ) No

Please complete the following. The information provided will be used to classify the wastewater treatment facility under the Water and Wastewater Facility Operators Regulation. In some cases actual numbers or answers must be supplied, but in most cases it will only be necessary to check the appropriate criteria.

Forward the completed form to:

Director
Environmental Assessment & Licensing Branch
Manitoba Conservation
160 – 123 Main Street
Winnipeg MB R3C 1A5

Please direct questions to:

Certification Program Coordinator
Phone: (204) 945-7065
Fax: (204) 945-5229

FOR MANITOBA CONSERVATION USE ONLY

Operation ID # _____

Stakeholder ID # _____

Approval ID # _____

EO/DWO _____

Application for Wastewater Treatment Facility Classification

SYSTEM *(choose all that apply)*			
1.	New or proposed Facility seeking classification	☑	
	Proposed start of operations (month / year) 10/01/2016		
	Existing Facility seeking classification (in operation prior to December 31, 2005)	☐	
	Facility has been in operation since (approximate month/year)		
2.	The facility **WILL** employ mechanical treatment processes	○	
	The facility **WILL NOT** employ mechanical treatment processes	◉	

SIZE *(refer to Supplemental Information for point designation) (2 point minimum to 20 point maximum)*				
1.	Maximum population or part served, peak day	# 685		1-10
2.	Design flow average day **Estimated** or **Actual** (Circle volume option & units) ◉ ○ **OR** Peak month's flow average day **Estimated** or **Actual** ◉ ○	164 ◉ m^3/day ○ gal/day 247 ◉ m^3/day ○ gal/day		1-10

VARIATION IN RAW WASTE[1] *(choose all that apply) (0 point minimum to 6 point maximum)*			
1.	Variations do not exceed those normally or typically expected	☑	0
2.	Recurring deviations or excessive variations of 100-200% in strength	☐	2
	Recurring deviations or excessive variations of 100-200% in flow	☐	
	Recurring deviations or excessive variations of 100-200% in strength and flow	☐	
3.	Recurring deviations or excessive variations of more than 200% in strength	☐	4
	Recurring deviations or excessive variations of more than 200% in flow	☐	
	Recurring deviations or excessive variations of more than 200% in strength and flow	☐	
4.	Raw wastes subject to toxic waste discharges	☐	6
5.	Septage or truck-hauled waste discharge is accepted at the facility.	☑	0 - 4
	Estimated number of loads per day in peak haul times	4	

Application for Wastewater Treatment Facility Classification

PRELIMINARY TREATMENT *(choose all that apply)*			
1.	Facility pumping of main flow	☐	3
2.	Screening or comminution	☐	3
3.	Grit removal	☐	3
4.	Equalization	☐	1

PRIMARY TREATMENT *(choose all that apply)*			
1.	Clarifiers	☐	5
2.	Anaerobic treatment with biogas flare	☐	10
3.	Anaerobic treatment with biogas utilization facility	☐	15

SECONDARY TREATMENT *(choose all that apply)*			
1.	Fixed-film reactor	☐	10
2.	Activated sludge	☐	15
3.	Stabilization ponds without aeration (ie: sewage lagoon)	☑	5
4.	Stabilization ponds with aeration	☐	8

TERTIARY TREATMENT *(choose all that apply)*			
1.	Polishing ponds for advanced waste treatment	☐	2
2.	Chemical / physical advanced waste treatment without secondary treatment	☐	15
3.	Chemical / physical advanced waste treatment following secondary treatment	☐	10
4.	Biological or chemical / biological advanced waste treatment	☐	12
5.	Nitrification by designed extended aeration only	☐	5
6.	Ion exchange for advanced waste treatment	☐	10
7.	Reverse osmosis, electrodialysis and other membrane filtration techniques	☐	10
8.	Advanced waste treatment chemical recovery, carbon regeneration	☐	4

Application for Wastewater Treatment Facility Classification

9.	Media filtration	☐	5

ADDITIONAL TREATMENT PROCESSES *(choose all that apply)*			
1.	Chemical addition: *(Please list chemicals used, 2 pts per chemical to max. of 6)*	☐	0 - 6
2.	Dissolved air floatation (other than for sludge thickening)	☐	8
3.	Intermittent sand filter	☐	2
4.	Recirculating intermittent sand filter	☐	3
5.	Microscreens	☐	5
6.	Generation of oxygen	☐	5

SOLIDS HANDLING *(choose all that apply)*			
1.	Storage (other than for stabilization)	☐	2
2.	Stabilization by storage (including any storage afterwards)	☐	4
3.	Gravity thickening	☐	2
4.	Mechanical dewatering	☐	8
5.	Anaerobic digestion of solids	☐	10
6.	Utilization of digester gas for heating or cogeneration	☐	5
7.	Aerobic digestion of solids	☐	6
8.	Air-drying of sludge	☐	2
9.	Solids reduction (including incineration and wet oxidation)	☐	12
10.	Disposal in landfill	☐	2
11.	Solids composting	☐	10
12.	Land application of biosolids by contractor	☐	2
13.	Land application of biosolids by facility personnel	☐	10

Application for Wastewater Treatment Facility Classification

DISINFECTION *(choose all that apply) (0 point minimum to 10 point maximum)*			
1.	Chlorination	☐	5
	Ultraviolet irradiation	☐	
2.	Ozonization	☐	10

EFFLUENT DISCHARGE *(choose all that apply) (0 point minimum to 10 point maximum)*			
1.	Discharge to surface water (ditch or lake or _____)	☑	0
2.	Mechanical post-aeration	☐	2
3.	Direct recycling and reuse	☐	6
4.	Land treatment and surface or subsurface disposal		4

INSTRUMENTATION *(choose one) (0 point minimum to 6 point maximum)*			
1.	SCADA or similar instrumentation systems are used to provide:		
	• Data with no process operation	◉	0
	• Data with limited process operation	○	2
	• Data with moderate process operation	○	4
	• Data with extensive or total process operation	○	6

LABORATORY CONTROL[2] *(choose all that apply) (0 point minimum to 15 point maximum)*			
1.	Bacteriological / Biological *(0 point minimum to 5 point maximum)*		
	• Lab work done outside the facility	☑	0
	• Membrane filter procedures	☐	3
	• Use of fermentation tubes or any dilution method of fecal coliform determination	☐	5
2.	Chemical / Physical *(0 point minimum to 10 point maximum)*		
	• Lab work done outside the facility	☑	0

Application for Wastewater Treatment Facility Classification

	• Push button or visual methods for simple tests such as pH or settleable solids *(List tests)*	☐	3
	• Additional procedures such as DO, COD, BOD, gas analysis, titration, solids content or volatile content *(List tests)*	☐	5
	• More advanced determinations such as specific constituents, nutrients, total oils or phenols *(List tests)*	☐	7
	• Highly sophisticated instrumentation such as atomic absorption or gas chromatograph *(List tests)*	☐	10

APPLICANT VERIFICATION	
I HEREBY DECLARE THAT ALL INFORMATION IN THIS APPLICATION IS TRUE.	
Name of Applicant[3]: (Print) Paul Barsalou, P.Eng	
Title: Project Manager	
Telephone: (204) 477-5381	Fax: (204) 284-2040
Email: paul.barsalou@aecom.com	
Signature of Authorized Representative: Paul Barsalou	Date: 02/25/2016

[1]The key concepts are frequency or intensity of deviation, or excessive variation from normal or typical fluctuations. The deviations in strength, toxicity, ratio of infiltration to inflow, or shock loads.

[2] The key concept is to credit laboratory analyses done on-site by facility personnel under the direction of an operator-in-charge with points from 0-15.

[3] Applicant must be an authorized representative of the owner/operating authority (i.e. manager, P. Eng., or overall responsible operator).

Print Application Form

Wastewater Treatment Form Supplemental Information

This is supplemental information for completing the Application for Wastewater Treatment Facility Classification Form only.

For exact definitions and text refer to Manitoba Regulation 77/2003, Water and Wastewater Facility Operators Regulation and amendment M.R. 162/2005, under The Environment Act (C.C.S.M. c E125).

A copy of the regulation is available by following the link for Manitoba Regulations at: http://www.gov.mb.ca/conservation/envapprovals/publs/index.html

Facilities are classified as follows:

Small system class
A wastewater treatment facility that otherwise meets the criteria of a class 1 wastewater treatment facility shall be classified in the small system class if

a) it treats wastewater from a population of no more than 500; and
b) no mechanical treatment processes are employed at the facility.

Classes 1 to 4
Wastewater treatment facilities shall be classified in classes 1 to 4 in accordance with the following table, on the basis of the number of classification points assessed under the classification point system set out in the Water and Wastewater Facility Operators Regulation.

Range of Classification Points	Classification
0 to 30	Class 1
31 to 55	Class 2
56 to 75	Class 3
76 or more	Class 4

Size

Points for size: (2 point minimum to 20 point maximum)

Maximum population or part served, peak day (1 point minimum to 10 point maximum). Points are assigned at 1 point per 10,000 population or part.

Design flow average day or peak month's flow average day, whichever is larger (1 point minimum to 10 point maximum). Points are assigned at 1 point per 4.5 megalitres per day or part.

Authorized Representative

Signatures for the Applicant Verification section must be an individual recognized by the Owner of the facility as able to sign official documentation (i.e. P.Eng., Manager, CAO, etc).

Appendix C

Functional Design Report

Rural Municipality of Morris

Lowe Farm Lagoon
Functional Design Report

Prepared by:

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

Project Number:

60447253

Date:

March, 2016

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. Consultant accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

Consultant agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but Consultant makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by Consultant represent Consultant's professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since Consultant has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, Consultant, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

Except (1) as agreed to in writing by Consultant and Client; (2) as required by-law; or (3) to the extent used by governmental reviewing agencies for the purpose of obtaining permits or approvals, the Report and the Information may be used and relied upon only by Client.

Consultant accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information ("improper use of the Report"), except to the extent those parties have obtained the prior written consent of Consultant to use and rely upon the Report and the Information. Any injury, loss or damages arising from improper use of the Report shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

AECOM: 2012-01-06

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

March 1, 2016

Larry Driedger, CMMA
Chief Administrative Officer
Rural Municipality of Morris
Box 518, 207 Main Street N
Morris, MB R0G 1K0

Dear Mr. Driedger:

Project No: **60447253**

Regarding: **Lowe Farm Wastewater Lagoon Functional Design Report Update**

We are pleased to submit a revised Functional Design Report for the Lowe Farm Wastewater Lagoon. The report includes information on the site selection, wastewater flows, lagoon layout and construction considerations, and forms the basis for the detailed design and implementation phases of the project.

We appreciate the assistance provided by the Rural Municipality of Morris during the preparation of the report. Please contact us if you have any questions or further requirements.

Sincerely,
AECOM Canada Ltd.

Paul Barsalou, M. Sc., P. Eng.
Project Manager
ER:td

Distribution List

# of Hard Copies	PDF Required	Association / Company Name
1	1	Rural Municipality of Morris

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
0	E. Rajaratnam	December 2015	Final
1	Paul Barsalou	February 2016	Revised Final

AECOM Signatures

Report Prepared By:

Elizabeth Rajaratnam, B. Sc., E.I.T
Water Resources Engineer in Training
Water

Report Reviewed By:

Paul Barsalou, M. Sc., P. Eng.
Project Manager
Water

Executive Summary

The Rural Municipality (RM) of Morris has retained AECOM to prepare a Functional Design and Environment Act Proposal for the Lowe Farm Lagoon Upgrade. The existing lagoon is located east of the Lowe Farm community and north of Provincial Trunk Highway 23 (PTH 23). The lagoon consists of two cells with a total area of approximately 2.0 hectares. With community growth, the existing lagoon has reached its hydraulic loading capacity and requires upgrading.

The existing primary and secondary cells will be combined to form the new primary cell by removing the inter-cell berm between them. The primary cell will be hydraulically connected to the secondary cell by a new 300 mm pipe through the common berm. A new secondary cell will be located in a parcel of farm land directly to the north of the two existing cells. The RM has purchased this parcel of land and is in the process of acquiring the land title certificate.

Phosphorus reduction through natural attenuation methods will be used for the effluent. Natural grasses, reeds and the soil present in the ditch promote phosphorus reduction. In addition, the lagoon will utilize trickle discharge over a 2-3 week period to reduce the rate of discharge and facilitate nutrient uptake. Additional phosphorus controls by alum addition are not recommended at present due to low population and phosphorus loading rate and the long discharge route.

The estimated capital costs for the new facultative lagoon and all associated piping, infrastructure and rehabilitation of the existing lagoon are expected to be $ 1.1 million.

Based on the preliminary schedule, the Environment Act Proposal (separate document) was completed in December 2015 and it is now being updated for February 23, 2016 to include comments from Manitoba Conservation. The project is currently being tendered, but the award date will be delayed by an estimated 90 day period, once the draft licence has been obtained. Lagoon construction is scheduled to be completed either by October 2016 or July 2017, depending upon the contractor that is selected.

Table of Contents

List of Figures

List of Tables

Appendices

1. Introduction

The Rural Municipality (RM) of Morris has retained AECOM to prepare a Functional Design Report and Environment Act Proposal for the design and construction of the Lowe Farm lagoon expansion/upgrade.

1.1 Background Information

AECOM completed a Wastewater Management Plan (WMP) in March 2014 for the RM of Morris. This work identified that the existing Lowe Farm lagoon has reached its hydraulic loading capacity and will reach the capacity for organic loading in the next few years. In the last few years, the population of the town has surpassed the design population of 400, and the hydraulic loading of the lagoon has exceeded its design capacity. In order to meet the future projected loadings, an upgrade of the lagoon is required.

AECOM performed a high level investigation of potential siting options for the expansion. Three options were considered (Appendix A). The selected option entails expansion of the existing lagoon by building a new secondary cell just to the north of the existing cells and combining the two existing cells into one large primary cell. A new secondary cell will be built on a parcel of farm land just north of the existing cells. The RM has purchased this land and is in the process of obtaining the land title certificate.

2. Existing Wastewater Lagoon

The Lowe Farm Lagoon is located to the east of the community in the northwest corner of SW ¼ of 5-5-1W and occupies a 2.04 ha site adjacent to the municipal landfill. The current distance to the nearest residence is 762 m. The lagoon was designed by J. R. Cousin Consultants (J. R. Cousin) in 1982 when the population of the Town was 359. A projected population of 400 for the year 2000 was used for calculating the design loadings.

The existing lagoon consists of two cells: a primary treatment cell and a secondary storage cell, and includes a septic truck dumping spillway. Cell dimensions are shown below in Table 1. The primary cell has a water surface area of 6,806 m^2, and a volume of 9,136 m^3. The secondary cell has a volume of 10,715 m^3 and was sized for a 200 day winter storage period (October 31 – May 15). Both cells have 3H:1V side slopes and a design freeboard of 0.75 m (actual is 0.8 to 1.0). The total 200 day storage volume of the lagoon system is 15,284 m^3.

Table 1: Existing Cells

Cells	Surface Area (m^2)	Storage Volume (m^3)
Primary (North)	6,806	9,136
Secondary (South)	7,920	10,715

The lagoon effluent discharges into the east ditch of Municipal Road 5W and then into the Anderson Drain. Effluent then flows east for approximately 13 km to the Morris River, which drains into the Red River just north of the Town of Morris.

Figure 1 shows an aerial view of Lowe Farm and the existing lagoon.

Figure 1: Community of Lowe Farm and Existing Lagoon

3. Design Criteria

Geometry Table shows a summary of the design criteria considered for the sizing of the new secondary cell.

Table 2: Geometric Design Criteria

Description	Value
Side slope	4H:1V
Depth	1.5 m
Freeboard	1 m
Distance to nearest residence	> 305 m

3.1 Population

The design year for the lagoon expansion at Lowe Farm will be 2041, or a 25-year service life. The *Detailed Development Plan for the RM of Morris (DDP)*, prepared by AECOM, developed population projections for the RM based on historic population growth trends. Based on the *DDP* report, a growth rate of 1.38% was selected for the projection of population for Lowe Farm. The projected population contributing to the wastewater system in 2041 was estimated to be 685.

3.2 Influent Criteria

A population of 685 with 240 L/person/day was used in the lagoon sizing calculations. As the community obtains its potable water from the local Co-operative, no water treatment plant backwash flow was accounted for. Infiltration into the existing sewer system is another potential source of wastewater production and has been estimated at 10% of the total loading. Table 3 shows a summary of the Influent criteria.

Table 3: Influent Criteria

Description	Value
Hydraulic Loading	240 L/person/day
Organic Loading	0.076 kg BOD_5/person/day
Primary Cell Treatment Loading	56 kg BOD/ha/day
Infiltration	10% of Hydraulic Loading

3.3 Effluent Criteria

The Lowe Farm lagoon is currently operated under a Clean Environment Commission (CEC) licence to meet the following parameters:

- Effluent Biological Oxygen Demand (BOD_5) less than 30 mg/L
- Effluent total coliform bacteria content less than 1500 per 100 ml sample
- Maximum organic loading on the primary cell, based on BOD_5, not greater than 56 kg/ha/day
- Liquid depth in the cells not to exceed 1.5 m
- Lagoon must not be discharged during the wintertime period between November 1 and May 15 (196 days)

Newer licenses now prohibit discharge between November 1 and June 15, or 227 days in order to give additional storage and treatment time.

It is anticipated that by upgrading the lagoon to meet the current and future populations, a new licence will be required from Manitoba Conservation. The Lowe Farm lagoon will be required to meet new effluent regulations and will have to implement a phosphorus removal or nutrient management strategy. Since the population of the Town is less than 2,000 people, a demonstrated nutrient management strategy instead of the more stringent 1 mg/L phosphorus limit is deemed acceptable. The anticipated effluent limits that will be met are outlined in Table 4.

Table 4: Expected Sewage Lagoon Effluent Criteria

Parameter	Limit
$CBOD_5$	25 mg/L
TSS	25 mg/L
Total Coliform	1500 mg/L per 100 mL
Fecal coliform	200 mg/L per 100 mL
Un-ionized ammonia	1.25 mg/L expressed as nitrogen (N), at 15°C ± 1°C
Total Phosphorus	Nutrient management strategy to reduce phosphorus
Discharge Period	June 15 to November 1 (~230 days storage)

4. Wastewater Lagoon Upgrade

The wastewater lagoon must be sized to treat the projected organic and hydraulic wastewater loads based on the design criteria and the design population. The calculations performed during the design process are attached in Appendix B.

4.1 Organic Loading

Organic loading is estimated based on the projected population. The organic loading recommended for Lowe Farm is 0.076 kg BOD_5/person/day. With the future population of 685 people, this yields an organic load of 52.06 kg BOD_5/day. This results in a primary treatment area requirement of 0.93 hectares (9,296 m^2). The following is a summary of the organic loading calculations:

Table 5: Lagoon Design Loadings

Description	Value
Organic Loading	0.076 kg BOD/person/day
Population (Year 2041)	685
Estimated BOD Load	52.06 kg BOD/day
Influent Flow	66,000 m^3/year
Influent BOD	288 mg/L
Primary treatment area required	9,296 m^2

The combined surface area of the existing cells is approximately 14,700 m^2, which exceeds the required area and will provide adequate treatment. This provides a treatment rate of 35 kg BOD per hectare of surface area per day, which is much lower than the requirement of 56 kg BOD/ha/day. This will lower the odor potential from primary treatment.

4.2 Hydraulic Loading

The hydraulic load on the lagoon with a design population of 685 and a wastewater production rate of 240 L/person/day is 66,000 m^3/year. This includes the infiltration into the existing sewer estimated at 10% of the total loading. Assuming 230 days of storage, the required storage volume would be 41,593 m^3. The two existing cells will be combined to make the new primary cell by removing the existing inter-cell berm. The floor of the existing old secondary cell will also be dropped by 0.2 m so that the full new primary will have an operating depth of up to 1.5 m. Storage available from the combination of the existing cells and the opening of the berm is 11,566 m^3. This is the upper 0.75 m of the new primary cell. With an additional storage of 30,027 m^3, plus 1000 m^3 contingency, a total of 31,027 m^3 will be used for lagoon sizing.

The secondary cell requirements were determined using a liquid depth of 1.5 m, with the bottom 0.3 m of the cell containing the future sludge blanket, a freeboard of 1 m, and a side slope of 4:1. The lagoon cells were sized using the following equation:

$$V = (d/6) \times (A_t + A_b + 4\ A_m)$$

Where:

V = Volume
d = depth of the lagoon
A_t = Area of the top of the lagoon, $A_t = L \times W$
A_b = Area of the bottom of the lagoon, $A_b = (L - 2 \times ES \times d)\ (W - 2 \times SS \times d)$
A_m = Area of the midsection of the lagoon, $A_m = (L - ES \times d)(W - SS \times d)$
SS = slope of the sides of the lagoon

ES = slope of the ends of the lagoon
L = Length of the top of the lagoon
W = Width of the top of the lagoon

Assuming twice a year discharge and using the above equation the secondary cell volume and dimensions are shown below on Table 6.

Table 6: Secondary Cell Size and Dimensions

Secondary Cell Size	Units
Storage Time	230 days
Sludge Blanket Volume (volume below the pipes)	7,226 m^3
Storage Volume (required 30,027 m^3)	31,192 m^3
Total Volume of the Secondary Cell (not including 1 m freeboard)	38,418 m^3
Water Surface Area (not including 1 m freeboard)	27,556 m^2
Cell Dimensions (Top of cell)	174 x 174 m
Cell Dimensions (Top of water)	166 x 166 m
Cell Dimensions (Base of cell)	154 x 154 m

4.3 Wastewater Lagoon Expansion

The proposed secondary cell is to be constructed in the farm land directly to the north of the two existing cells. The existing primary and secondary cells will be combined into one large primary cell. In addition, the influent force main is to be extended so that the effluent now enters from the existing secondary cell (through the south berm).

A new truck dump site and access road would be constructed on the south berm and would be accessed from the landfill road. The trucks will dump waste into a corrugated metal half pipe mounted on the south clay berm with riprap at the base and around the pipe. The effluent discharge outfall would be constructed to discharge to the same discharge ditch route. Some ditch clearing and grading will be required.

The existing cells currently have a freeboard of 0.80 m to 1.0 m depending on the area. The berms of the existing cells will be raised by 0.20 m of clay in required areas to provide a freeboard of 1.0 m.

A compacted clay cut-off will be installed around the existing berms as the methods of initial construction are not recorded. Although the clay berms are most likely impermeable, the addition of a 3 m wide compacted clay cut-off, keyed into the underlying soil will provide the minimum 1.0 clay liner with a hydraulic conductivity not exceeding 1 x 10^{-9} m/s.

The base of the existing secondary cell will be stripped of 0.2 m of clay soil and scarified and compacted in order to make the new primary cell a constant elevation of 238.8 m. The existing old cells are 0.2 m different in elevation and this work will make the floor even.

4.4 Geotechnical Investigation

A geotechnical investigation (Appendix C) was performed on December 29, 2014 where seven test holes were completed based on the preliminary layout of the new secondary cell. Topsoil was encountered at the ground surface, underlain by a thick deposit of silty clay in all of the test holes. The thickness of the topsoil ranged from 0.1 to 0.2 m. The silty clay extended to the termination depth in all the test holes at depths ranging from 7.6 to 8.1 m. The clay was generally brown changing to grey with depth, firm to stiff and of high plasticity.

Stockpile locations for excavated topsoil have been identified to the east of the proposed expansion area. These stockpiles will be maintained by the Municipality and will be used at various locations as required. Excavated clay will be placed as berm and lagoon liner material for the new cell and will be used to raise the elevation of the berms of the existing cells where required.

For the proposed floor elevations of the lagoon cells, a combination of cut slopes and placed fill dykes will be used to create the necessary cell capacity. The Geotechnical Investigation report recommended that slope drainage measures be implemented to lower the phreatic surface and reduce erosion of cut slopes. Toe drains on the slope benches will be constructed to promote drainage.

The provincial guidelines for a clay-lined lagoon are to provide a minimum 1 m thick clay seal having a hydraulic conductivity of 1×10^{-9} m/s lining the floor of the interior surfaces of the facility. The in-situ clays encountered in this area have a hydraulic conductivity ranging from 2.4×10^{-10} to 3.5×10^{-10} m/s. The clay was consistent and was found at depths up to 7.6 to 8.1 m, well beyond the requirement of 1 m. Based on the results of the geotechnical investigation, the existing natural clay meets and exceeds the criteria for a natural clay liner.

The existing clay should be excavated to the proposed floor elevation and the surface should be scarified for 15 cm and compacted to at least 95% Standard Proctor Maximum Dry Density (SPMDD) at moisture contents within 0 and +3% of the optimum moisture content. Refer to Appendix C for full details of the geotechnical investigation.

A second geotechnical assessment was completed to review slope stability. It was determined that a slope of 3 H: 1V provides adequate stability. The slopes of the existing cells are being reduced to 3.5H: 1V to provide a more gentle slope for construction, and in process improve slope stability. This assessment is included in Appendix C.

4.5 Clay Borrow

The volume of clay excavated during construction of the new secondary will be adequate for construction of the secondary cell with some left over material. If additional clay is required, it may be borrowed from a location just east of the secondary cell. Once clay is removed, the area will be filled with waste excavation soil material that is not used to reconstruct the clay embankments. The site will be returned to its existing condition, complete with topsoil cover once work is complete.

5. Nutrient Management Strategy

5.1 Nutrient Reduction

Recent nutrient standards regulations now include an effluent phosphorus limit of less than 1 mg/L for all new, expanding or modified wastewater treatment facilities including lagoons and mechanical systems. Lagoons servicing communities discharging less than 820 kg/year (population less than 2000 people) will have the option of implementing a demonstrated nutrient reduction strategy instead of meeting the more stringent 1 mg/L phosphorus limit. Lowe Farm falls into this category.

Within Manitoba the processes of effluent irrigation, chemical dosing, constructed wetlands and trickling discharge have been used as potential nutrient reduction practices.

The option of alum precipitation has been reviewed as it is a process that is commonly used for phosphorus control. It is possible to add alum a week or two prior to testing and discharge. The precipitation process draws the phosphorus out of solution, forming a precipitate. A few disadvantages of this process is that it generates significantly more sludge than normally is generated in a facultative lagoon, it permanently binds the phosphorus so that it does not have a phosphorus fertilizer value if it is ever land applied and it increases operating costs significantly.

It is recommended that the process of phosphorus reduction through natural attenuation methods will be used for the effluent from the Lowe Farm Lagoon for the reasons noted. Significant phosphorus absorption by the natural grasses, reeds and the soil in the ditch drains is possible due to the long discharge route (approximately 14 km). Effluent drains via the ditch (Anderson drain) to flow into the Morris River. In addition to this, the lagoon will utilize a slow trickle discharge over a 2-3 week period to minimize hydraulic loading and facilitate nutrient uptake. During drier years much of the water and phosphorus will be absorbed or retained within the ditch drains, and it wet years, there will be a lesser degree of treatment within the drains. However, this long distance discharge over an extended period will control phosphorus levels prior to entering the ultimate discharge point. If it is required, the level of phosphorus in the drain water could be monitored, provided that background levels of phosphorus from the field runoff was collected first as a baseline.

5.2 Construction Considerations

The proposed expansion of the lagoon system involved utilizing the two existing cells as one large primary storage cell. To achieve this, part of the existing center berm will be removed to create a full width opening at the top of the berm with slopes of 3.5H:1V. This base area will be compacted using earth moving equipment to within 0.1 m of the existing cell bottom. The scarified and compacted in situ clay will act as the required liner which extends to a significant distance below the lagoon.

The existing cells have a freeboard roughly from 1.0 m to 0.8 m and are somewhat below the design standards for this project. Therefore, the existing berms will be raised in some areas to achieve the required freeboard of 1.0 m.

The proposed new secondary cell will be constructed against the existing north berm of the lagoon. The north face of the berm will require work to excavate and replace existing organic soil material to create a liner.

The new berms will be constructed with a 3.0 m wide top to provide vehicular access. The berm top will be covered with top soil and seeded which will require periodic maintenance.

A 3.0 m wide compacted clay cut-off will be constructed around the perimeter berms and will be keyed into the underlying insitu soil. The compacted clay will have hydraulic conductivity meeting the Manitoba Conservation requirement of 1 x 10^{-9} m/s.

5.3 Existing Sludge

AECOM conducted a sludge sounding survey at the lagoon site on October 29, 2015 to determine the sludge volume and distribution. The results of this survey are as follows:

Table 7: Sludge Volume

Cell	Average Depth	Volume
Existing Primary	0.26 m	1,300 m^3
Existing Secondary	0.18 m	1,060 m^3
Total	N/A	2,360 m^3

The amount of sludge within the cells is relatively low and will not interfere or impair operation of the expanded facility. It is believed that there is adequate capacity for at least another 10 years of operation without removal. Within the next 5 to 10 year period, the sludge levels should be reassessed, for potential removal. At that point a composite sludge sample will be collected and an assessment will be completed to determine whether the sludge can be land applied to agricultural land or disposed of in the landfill. Regulations change over time, so this will be reassessed in the future once it is determined that sludge needs to be removed. The existing sludge may be transferred around within the existing two cells to allow for earth work during construction. The Lagoon site plan and layout are illustrated in Appendix D Wastewater System Classification attached to this report.

5.4 Zoning Bylaws

In discussion with the town, the proposed lagoon will be located in what was previously farmland. The RM has purchased this parcel of land and is awaiting the land title certificate. As part of the construction and license approval, Manitoba Conservation will require documentation that the ownership has been transferred or easements obtained.

Manitoba Conservation also requires that all new sewage lagoons be located a minimum of 305 m (1000 ft) from any existing residential dwellings. The closest residence from the existing lagoon is located outside the 305 m limit – 762 m away.

5.5 Discharge Frequency and Route

Treated effluent from the lagoon will be discharged twice a year through a new outfall ditch connecting to the existing lagoon outfall ditch once the system approaches design capacity. In the first 5 years of operation, it is anticipated that the lagoon will only release once per year, however this will increase to twice per year as the population increases. The lagoon effluent discharges into the east ditch of Municipal Road 5W and then into the Anderson Drain. Part of the existing outfall pipe will be removed, plugged with concrete, and the valve will be closed.

5.6 Contracting Strategies

In order to encourage local contractors to participate, some components of the project will be constructed outside of the general contract. Local contractors will be contacted for quotes on some of the base work. During detailed design, AECOM will work with the RM to identify items that can be completed by local forces outside of the main contract. This potentially may include:

- Fencing around the existing and new lagoon cells

- Extending the existing forcemain up to the south berm of the existing secondary cell (the forcemain through the berm will be done by the earthworks contractor)
- Haul gravel for the construction of a new access road and truck dump leading to the existing secondary cell (south side of new primary cell)

6. Schedule

Figure 2 shows a brief outline of the expected sequence of events throughout the design and construction of the new Lowe Farm lagoon cell.

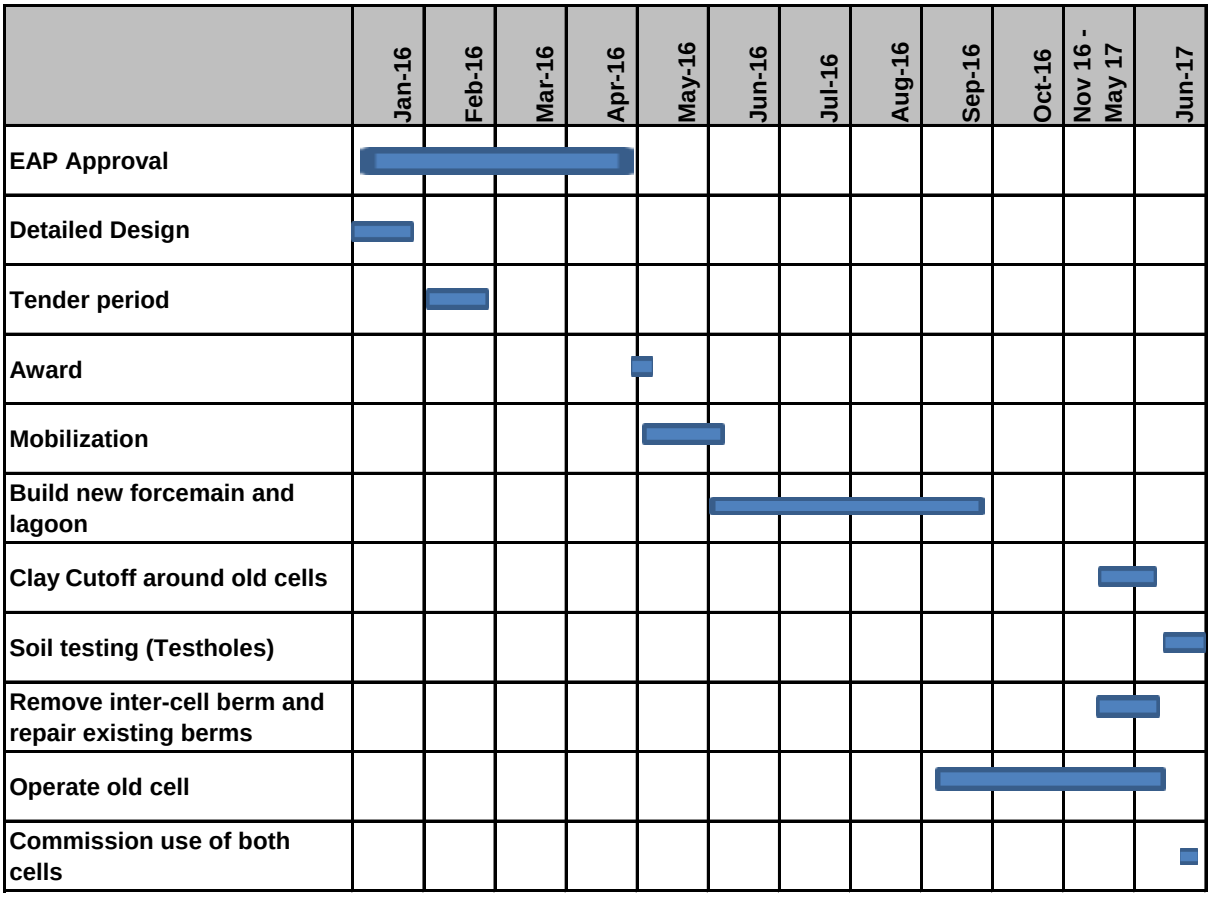


Figure 2: Proposed Construction Schedule

7. Wastewater Lagoon Operation

7.1 Wastewater Classification Form

The Wastewater Treatment System Application is included in Appendix D.

7.2 Operation and Maintenance

The wastewater lagoon has been operated in Lowe Farm for over two decades successfully. Operation of the proposed upgrade will not alter operation substantially. Maintenance will include:

- Grass cutting around the site, in particular on the berm.
- Maintenance of the perimeter fence and gate
- Check the berms for burrowing animals. If required, start a program with pest control for removal.
- Maintain the truck dump location and the secondary access location
- Weekly check for mischief items that may occur
- Perform road grading and add granular if required

Testing and discharging lagoon will include:

- One week prior to the desire discharge, close the intercell pipe valve
- Collect a representative sample of the secondary cell contents
- Send sample for testing at commercial laboratory for the Licensed parameters
- If the secondary cell meets effluent licence, open the discharge valve partially for a 2 week discharge period.
- Retain the sample results for records and submit as required to regulatory bodies
- Once the discharge to 0.3 m depth is complete, close the discharge valve
- Open the interconnection valve and allow the liquid levels to equalize
- This discharge procedure can be followed in the spring and fall as the population and flow rate requires, provided it is within the Licence discharge date requirements.

8. Recommendations and Capital Cost Estimate

8.1 General

The purpose of this section is to provide a summary of recommendations and capital cost for the project.

8.2 Scope of Work

The scope of the work is as follows:

- One new clay-lined secondary cell
- Removing part of the existing inter-cell berm between the primary and secondary cells
- New forcemain inlet pipe and valving
- New truck dump facility
- New perimeter fencing
- Effluent discharge ditch clearing
- Decreasing slope of existing cells and install clay cut-off
- Commissioning plan and critical tie-ins
- Detailed design drawings and specifications
- Contract administration services

8.3 Estimated Costs

Capital costs for the upgrade of the Lowe Farm lagoon are summarized below.

Table 8: Preliminary Cost Estimate

Lowe Farm Lagoon Preliminary Cost Estimate			
A	Access Road and Truck Dump Facility	$	33,120
B	Lagoon and Related Works	$	626,250
C	Miscellaneous	$	120,000
	Sub-Total	**$**	**779,370**
	Contingency	$	116,906
	Subtotal	$	896,276
	TOTAL	**$**	**1,069,111**
	Engineering	$	151,000
	Land Purchase	$	160,000
	Total	$	1,380,111

Appendix A
Site Selection and Cost Estimate

RM of Morris - Lowe Farm Lagoon Site Expansion Options
OPTION 1 - Site Expansion to the North of Existing Lagoon Site
Table B.1: Class "C" Capital Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Estimated Unit Price	Estimated Total Cost
A	**Truck Dump Facility and Access Road**				
A1	Topsoil Stripping (200 mm of topsoil)	cu. m.	60	$ 7.00	$ 420
A2	Common Excavation	cu. m.	90	$ 9.00	$ 810
A3	Subgrade Compaction	sq. m.	300	$ 0.50	$ 150
A4	Granular Subbase (300 mm Thickness)	cu. m.	90	$ 40.00	$ 3,600
A5	Granular Base Coarse (150 mm Thickness)	cu. m.	45	$ 40.00	$ 1,800
A6	Supply & Install Geotextile, Roads (Woven)	sq. m.	300	$ 5.00	$ 1,500
A7	Cleaning and Deepening of Existing Ditches	lin. m.	60	$ 20.00	$ 1,200
A8	Supply & Install 600 mm diameter CSP 1.6 mm wall thickness	lin. m.	15	$ 300.00	$ 4,500
A9	Riprap around and at base of culvert (including Geotextile)	sq. m.	16	$ 40.00	$ 640
A10	Supply and install Stop sign (MUTCD type R1-1 750mm x 750mm)	lump sum	1	$ 1,500.00	$ 1,500
A11	Supply and install 2 concrete Jersey barriers, complete with reflective tube on both sides	lump sum	1	$ 4,000.00	$ 4,000
A12	Supply and install 900 mm half culvert (flanged) for truck dump complete with splash pad (1.6 mm wall thickness)	lump sum	1	$ 7,000.00	$ 7,000
A13	Truck Dump grouted riprap pad (4m x 5m)	lump sum	1	$ 6,000.00	$ 6,000
Sub-Total Section A					**$ 33,120**
B	**Lagoon and Related Works**				
B1.	Topsoil Stripping (New Lagoon Cell and Ditching - 200 mm of topsoil)	cu. m.	8000	$ 7.00	$ 56,000
B2.	Common Excavation (New lagoon cell, perimeter ditching), placement of secondary cell berms)	cu. m.	25000	$ 9.00	$ 225,000
	Scarification (15 cm) and Compaction				
B3	a) new secondary cell floor	lump sum	1	$ 7,500.00	$ 7,500
B4	b) existing secondary cell floor (south cell)	lump sum	1	$ 2,000.00	$ 2,000
	Supply and Install erosion pads				
B5	a) Forcemain inlet (reinforced concrete)	each	1	$ 6,500.00	$ 6,500
B6	b) intercell pipe inlet and outlet (grouted riprap)	each	2	$ 6,000.00	$ 12,000
B7	c) lagoon discharge pipe inlet and outlet (grouted riprap)	each	2	$ 6,000.00	$ 12,000
B8	Supply and install Lagoon Signage (Reflective Aluminum)	each	2	$ 1,800.00	$ 3,600

RM of Morris - Lowe Farm Lagoon Site Expansion Options
OPTION 1 - Site Expansion to the North of Existing Lagoon Site
Table B.1: Class "C" Capital Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Estimated Unit Price	Estimated Total Cost
	Supply and Install Wastewater Sewer Gate Valve				
B9	a) 300 mm	each	2	$ 8,000.00	$ 16,000
B10	b) 150 mm	each	1	$ 6,500.00	$ 6,500
B11	c) 100 mm	each	1	$ 6,500.00	$ 6,500
	Supply and Install Sewage Forcemain				
B12	a) Open trench 150 mm HDPE DR11 pipe (Sandbedding - Class 3 backfill)	lin. m.	164	$ 350.00	$ 57,400
B13	b) Trenchless 150 mm HDPE DR11 Influent Pipe	lin. m.	50	$ 450.00	$ 22,500
B14	c) Temporary 100 mm above ground pipe to new secondary cell	lump sum	1	$ 10,000.00	$ 10,000
B15	Supply and install 100 mm HDPE pipe to surface, marker and camlock connection for temporary flow diversion	lump sum	1	$ 10,000.00	$ 10,000
	Supply and install Fittings				
B16	a) 150 mm 45^{o} long sweep bends	each	10	$ 550.00	$ 5,500
B17	b) 150 x 150 x 100 Tee (for temporary pipe to new secondary cell)	each	1	$ 550.00	$ 550
B18	Tie into Forcemain	lump sum	1	$ 550.00	$ 550
B19	Supply and Install Lagoon Piping (300 mm HDPE DR11 Interconnection Pipe)	lin. m.	65	$ 350.00	$ 22,750
B20	Supply and Install Lagoon Discharge Piping (300 mm HDPE DR11 Effluent Pipe)	lin. m.	30	$ 350.00	$ 10,500
B21	Cleaning and Deepening of Existing Ditches (leading away from the lagoon)	lin. m.	150	$ 20.00	$ 3,000
B22	Existing lagoon cell floor excavation, berm stripping and wasting of material to create 3.5:1 interior slope	cu.m.	2500	$ 10.00	$ 25,000
B23	Placement of Clay liner in existing lagoon cell	cu.m.	2500	$ 15.00	$ 37,500
B24	Debris removal from existing lagoon and landfill disposal from existing cell	cu.m.	500	$ 15.00	$ 7,500
B25	Excavation and disposal of existing center berm	cu. m.	2400	$ 15.00	$ 36,000
B26	Topsoil spreading, finish grading and seeding (Lagoon berms, Perimeter and Effluent Ditching)	ha	1	$ 17,900.00	$ 17,900
B27	Supply and Install Monitoring Wells (optional)	each	3	$ 2,000.00	$ 6,000
Sub-Total Section B					**$ 626,250**
C	**Miscellaneous**				
C1	Mobilization, Insurance, Bonding, De-Mobilization	lump sum	1	$ 100,000.00	$ 100,000
C2	Material Testing (Standard Proctor and nuclear densometer quality control testing)	lump sum	1	$ 20,000.00	$ 20,000

RM of Morris - Lowe Farm Lagoon Site Expansion Options
OPTION 1 - Site Expansion to the North of Existing Lagoon Site
Table B.1: Class "C" Capital Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Estimated Unit Price	Estimated Total Cost
C3	Supply and installation of 75 mm layer of base course to existing roadway	cu. m.	300	$ 40.00	$ 12,000
Sub-Total Section C					**$ 120,000**
SUMMARY:					
A	Truck Dump Facility and Access Road				$ 33,120
B	Lagoon and Related Works				$ 626,250
C	Miscellaneous				$ 120,000
	Total				**$ 779,370**
	Contingency Allowance	15%			$ 116,906
	Total				**$ 896,276**

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

Technical Memorandum

To	Larry Driedger, CMMA	Page	1
CC	Heather Buhler, P.Eng. Alex Nezvesciuc, E.I.T.		
Subject	Lowe Farm Lagoon Site Expansion Options		
From	Barb Chaput, P.Eng,		
Date	May 27, 2014	Project Number	60322119 (400)

1. Introduction

As requested by the RM of Morris (RM), AECOM has performed a high level investigation of potential siting options for the Lowe Farm Lagoon expansion. Two additional sites were identified by the RM to be evaluated in addition to the recommendations made in AECOM's Wastewater Management Plan (WMP) (March 2014) in order to As requested by the RM of Morris (RM), we have performed a high level investigation for the potential siting options of the Lowe Farm Lagoon expansion. Three specific sites were identified by the RM to be evaluated further from the recommendations made in AECOM's Wastewater Management Plan develop a higher level of certainty in the options for Lowe Farm.

The three potential Site Selection Options investigated were as follows:

1. Option 1: Site Expansion to the North of existing lagoon site
2. Option 2: Site Expansion to the South of the existing lagoon site
3. Option 3: Re-purposing abandoned water reservoir

Each option was evaluated based on previously projected design flow demands for cell sizing, local construction unit costs, where available, and typical construction costs for 2014. Quotes received have been appended to this memorandum in **Appendix C.**

Cost estimates for all three options are a Class "C" estimate which are prepared based on limited site information and an estimate of the probable conditions that may affect the project. The typical 30% contingency has been included on all estimates to account for unknown conditions or constrains to the project. At this time these estimates do not include any geotechnical, environmental or topographic survey information as this is considered more or less equal for all three options. An exception to this is Option 3, where the existing abandoned water reservoir, as a second location, would also require geotechnical, survey and environmental work. Geotechnical, topographic and environmental work will be required prior to proceeding to detailed design with any of the options.

Where possible, local pricing was included to reflect local construction costs however local pricing was not available for the entire works. The local unit pricing received was found to be approximately 60-70% less than typical 2014 tender pricing for similar lagoon construction. In the event that the construction package is publically tendered, there is no guarantee that the bids submitted would reflect the local pricing received for this evaluation.

To potentially mitigate this, we have included an additional 10% mark-up on the local supply quotes to reflect a standard General Contractor mark-up that would be applied to all subcontractors in their submitted bid.

2. Lagoon Site Expansion Options

2.1 Wastewater Flow and Loads

As per the WMP, the population of 657 with 240 litres per capita per day (lpcd) was used in the lagoon sizing calculations. Details of the calculations for the hydraulic and organic loadings can be referenced in the report. As the community is provided water from the co-operative, no water treatment plant backwash flow is accounted for. However, infiltration into the existing sewer system is another potential source of wastewater production and has been estimated at 10% of the total loading. **Table 1** shows the total annual hydraulic load for the design of existing lagoon site expansion.

Table 1: Lagoon Design Wastewater Inflow

Population (Year 2038)	Storage (days)	Design Flow (lpcd)	Design Flow (L/d)	Hydraulic Volume (m^3/year)	Infiltration 10% ($m^{3/}$/year)	Total Hydraulic Load (m^3/year)
657	230*	240	157,680	36,266	3,627	**39,893**

** based on recent Lagoon Operating Licence issued by Manitoba Conservation*

The maximum organic loading permitted by the Province of Manitoba is 0.075 kg BOD/person/day. With the future population of 657 people this yields an organic load of 49.275 kg BOD/day. The following is a summary of the organic loading calculations:

Table 2: Lagoon Design Loadings

Description	Value
Organic Loading	0.075 kg BOD/person/day
Population (Year 2038)	657
Estimated BOD Load	49.275 kg BOD/day
Influent Flow	39,893 m^3/year
Influent BOD	450 mg/L

2.2 Option 1: Site Expansion to the North

Option 1 entails expansion to the existing lagoon by building a secondary cell to the north and combining the two existing cells into one large primary cell. In addition, the influent forcemain would

be extended south in order to enter into the newly converted primary cell. This new inlet will reduce short circuiting of the wastewater flow through the cells. With the new inlet location, the construction of a new access road and truck dump would be required. The effluent discharge outfall would be constructed to discharge into the same discharge ditch, north of the existing discharge.

The required primary surface area for treatment is estimated to be 8,800 m^2. The area of the existing primary and secondary cell is approximately 14,700 m^2, not including the volume associated with the breach of the inter-cell berm. We propose to open up the two cells, increasing the capacity further. This option was suggested in the WMP; however it was also suggested to install a new inter-cell berm. Further internal discussion with the design team have found that this would be an additional construction cost which can be avoided. This option provides more than enough capacity for primary treatment while being mindful of potential construction costs.

The volume of both existing cells operating as the new primary cell is approximately 19,800 m^3. For calculating storage volumes we assume that the bottom half of the primary cell volume can be used for storage. Therefore, the required total volume for the new proposed secondary cell is approximately 30,000 $m^{3.}$ This results in a square secondary cell, with a top of berm dimension of 155.4 m and interior base dimension of 127.0 m. **Figure 1.0** in **Appendix A** shows the site layout for the proposed lagoon site expansion to the North.

Please refer to **Table B.1** in **Appendix B** for capital costs for this option. It is estimated that the option of expanding the existing cells to the North to be approximately $ 935,025.

2.3 Option 2: Site Expansion to the South

Option 2 consists of expanding the lagoon by building a secondary cell to the south of the existing lagoon and also combining the two existing cells into one large primary cell. Unlike Option 1, the influent forcemain coming into the existing primary cell, the access road and truck dumping facility will all remain in their existing locations. There are no concerns of short circuiting the treatment process with this layout. This option has an advantage since it eliminates the costs associated with extending the forcemain to the south end of existing lagoon.

The size of the proposed secondary cell is identical to the size in Option 1. **Figure 2.0** in **Appendix A** shows the site layout for the proposed lagoon site expansion to the South.

Please refer to **Table B.2** in **Appendix B** for capital costs for this option. It is estimated that the option of expanding the existing cells to the South to be approximately $ 902,005.

2.4 Option 3: Re-purposing Abandoned Water Reservoir

Option 3 consists of expanding the existing lagoon by utilizing an existing abandoned water reservoir, located approximately 3 km southwest from the existing lagoon, for a secondary storage cell. Similar to previous two options, the existing primary and secondary lagoon cells will be combined into one large primary cell. The construction of a lift station and 150 mm HDPE forcemain pipe is required in order to pump the wastewater from the primary cell to the water reservoir.

The size of the existing water reservoir is similar in size to the proposed secondary cell in Option 1 and 2. Should there be insufficient capacity in the existing water reservoir; the earthwork calculations

have deliberately accounted for additional requirements to expand the size of the secondary storage after dredging and cleaning the reservoir has been completed. **Figure 3.0** in **Appendix A** shows the site layout for the proposed lagoon site expansion.

Please refer to **Table B.3** in **Appendix B** for capital costs for this option. It is estimated that the option of expanding the existing treatment to the water reservoir for repurposing as a secondary cell to be approximately $ 1,767,025.

2.5 Assumptions

As the site selection for each option was completed without prior site confirmation of the existing geotechnical and topography, assumptions were required. A list of the assumptions has been summarized below.

- Clay soils are assumed to be present in the vicinity of each expansion and thus could be used for the lagoon liner. We have carried an additional $5,000.00 in each option for the possible requirement of burrow material.
- Topsoil excavation depth is assumed at 300 mm consistently through each site location.
- The area is assumed to be relatively flat; however, a survey will be required to confirm construction elevations. The secondary cells in Option 1 and 2 have been assumed to have the same operating elevations as the existing cells.
- Option 3 requires power for the lift station. The cost estimate does not include the provisions of power to the site. This will require discussions with Hydro and more detailed design work to determine the power demand.
- Hauling or conveyance costs of raw wastewater during construction have not been included. This will need to be revisited once the option of the expansion location has been selected. Additional investigation will need to occur for the disposal into Sperling Lagoons, hauling and tipping fees.
- We have assumed that the soil conditions are favourable for construction at each site. A geotechnical investigation would be required as part of the preliminary design.
- We have assumed that the land required is available for each option. We have not included costs for the purchase acquisition of property for either the cell expansion or the forcemain routing. The forcemain is proposed to be located in the right-of-way along the roads.

2.6 Cost Analysis and Recommendations

Capital cost estimates have been prepared for all three lagoon site expansion options. From **Table 3** it can be seen that Option 2 has the lowest capital cost with Option 3 being the highest cost, based on the information provided. Detailed capital cost breakdowns for each alternatives can be found in **Appendix B**.

Table 3: Capital Cost Summary

Item	Description	OPTION 1	OPTION 2	OPTION 3
A	Access Road	$ 18,250	$ 13,750	$ 32,000
B	Forcemain and Lift Station	-	-	$ 510,850
C	Lagoon and Related Works	$ 621,000	$ 598,600	$ 273,100
D	Water Reservoir Re-purpose	-	-	$ 396,050
E	Miscellaneous	$ 80,000	$ 81,500	$ 147,250
	Sub-Total	**$ 719,250**	**$ 693,850**	**$ 1,359,250**
	Contingency Allowance (30%)	$ 215,775	$ 208,155	$ 407,775
	TOTAL	**$ 935,025**	**$ 902,005**	**$ 1,767,025**

As the estimate was established based on a number of unknowns and assumptions made; the above estimates may increase/decrease as the design progresses and the scope of work is finalized.

It should be noted that the cost estimates are based on both local supply and installation costs and typical lagoon tender closing costs. In the event that this project is tendered publically, there are no guarantees that local contractors will be utilized or what unit costs will be carried for this work. A potential method to mitigate this is specifying in the contract documents a preference will be made to local contractors or contractors employ local subcontractors.

Appendix A

Proposed Site Expansion Options

A3 SIZE 11.69" x 16.54" (297.0mm x 420.0mm)

PLOT: 5/27/2014 12:14 PM

ISS/REV:

AECOM FILE NAME:

N

155.4

127.0

155.4

127.0

OPTION 1

INTERCONNECTION PIPE

OPEN UP THE BERM TO CONVERT INTO SINGLE CELL

ABANDON EXISTING INFLUENT PIPE

EFFLUENT DISCHARGE PIPE

PROPOSED NEW INFLUENT PIPE. CONNECT TO EXISTING INFLUENT PIPE

EXISTING INFLUENT PIPE

0 50 100 m

1:2000

AECOM

Rural Municipality of Morris
Lowe Farm Lagoon Site Expansion Options

OPTION 1: Site Expansion to the North

Figure - 1.0

A3 SIZE 11.69" x 16.54" (297.0mm x 420.0mm)

PLOT: 5/27/2014 12:15 PM

ISS/REV:

AECOM FILE NAME:

N

155.4

127.0

INTERCONNECTION PIPE

OPEN UP THE BERM TO CONVERT INTO SINGLE CELL

OPTION 2

127.0

155.4

EFFLUENT DISCHARGE PIPE

EXISTING INFLUENT PIPE

0 50 100 m

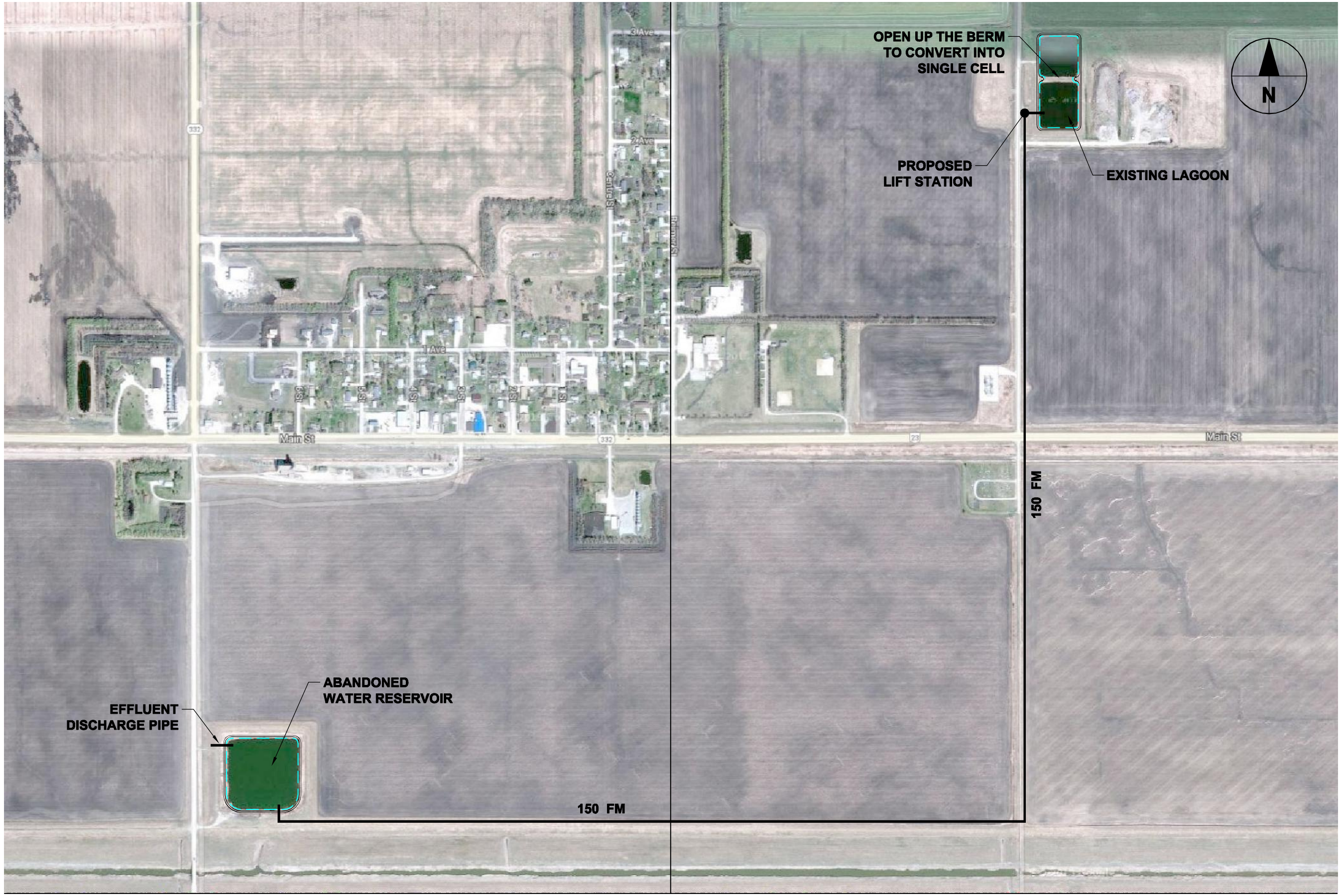
1:2000

Rural Municipality of Morris
Lowe Farm Lagoon Site Expansion Options

OPTION 2: Site Expansion to the South

Figure - 2.0

AECOM



0 187.5 375 m

1:7500

Rural Municipality of Morris
Lowe Farm Lagoon Site Expansion Options

AECOM

OPTION 3: Re-purposing Abandonded Water Reservoir
Figure - 3.0

Appendix B

Class “C” Cost Estimate

RM of Morris - Lowe Farm Lagoon Site Expansion Options
OPTION 1 - Site Expansion to the North of Existing Lagoon Site
Table B.1: Class "C" Capital Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Estimated Unit Price	Type of Pricing	Estimated Total Cost
A	**Access Road**					
A.1	Granular Base Coarse (150 mm Thickness)	cu. m.	75	$ 40	Local	$ 3,000
A.2	Granular Subbase (300 mm Thickness)	cu. m.	150	$ 35	Local	$ 5,250
A.3	Supply & Install Geotextile, Roads (Woven)	sq. m.	500	$ 3	Typical	$ 1,500
A.4	Supply & Install New Culvert	lin. m.	20	$ 225	Typical	$ 4,500
A.5	Cleaning and Deepening of Existing Ditches (Access Road)	lin. m.	80	$ 50	Typical	$ 4,000
Sub-Total Section A						**$ 18,250**
B	**Lagoon and Related Works**					
B.1	Desludge the Existing Lagoon	lump sum	1	$ 75,000	Quote	$ 75,000
B.2	Topsoil Excavation (New Lagoon Cell, Ditching, and Roads assuming 300mm of topsoil)	cu. m.	10500	$ 7	Local	$ 73,500
B.3	Common Excavation					
	a) New Lagoon Cell, Effluent Ditching, and Roads	cu. m.	20000	$ 7	Local	$ 140,000
	b) Open the Berm up in Existing Lagoon	cu. m.	2500	$ 7	Local	$ 17,500
B.4	Borrow Excavation and Placement (Lagoon Clay Liner and Roads)	cu. m.	5000	$ 7	Local	$ 35,000
B.5	Supply and Install Base Coarse on Lagoon Berms (300 mm Thickness)	cu. m.	1060	$ 40	Local	$ 42,400
B.6	Supply and Install Chain Link Fence	lin. m.	1300	$ 90	Typical	$ 117,000
B.7	Seeding (Lagoon, Perimeter and Effluent Ditching)	ha	1	$ 5,000	Typical	$ 5,000
B.8	Supply and Install Reinforced Concrete Pads	each	4	$ 4,000	Typical	$ 16,000
B.9	Supply and Install Truck Dump, Complete	lump sum	1	$ 20,000	Typical	$ 20,000
B.10	Supply and Install Wastewater Sewer Gate Valve	each	3	$ 4,000	Typical	$ 12,000
B.11	Supply and Install Sewage Forcemain (150 mm HDPE DR17 Influent Pipe)	lin. m.	210	$ 80	Local	$ 16,800
B.12	Supply and Install Lagoon Piping (250 mm HDPE DR17 Interconnection Pipe)	lin. m.	65	$ 120	Local	$ 7,800
B.13	Supply and Install Lagoon Discharge Piping (300 mm HDPE DR17 Effluent Pipe)	lin. m.	30	$ 150	Local	$ 4,500
B.14	Supply and Install Lagoon Monitoring Wells	each	4	$ 1,500	Typical	$ 6,000
B.15	Filling of New Lagoon to 0.6 m Depth	lump sum	1	$ 20,000	Typical	$ 20,000

RM of Morris - Lowe Farm Lagoon Site Expansion Options
OPTION 1 - Site Expansion to the North of Existing Lagoon Site
Table B.1: Class "C" Capital Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Estimated Unit Price	Type of Pricing	Estimated Total Cost
B.16	Ditch Lining c/w Geotextile (150 mm)	sq. m.	100	$ 50	Typical	$ 5,000
B.17	Cleaning and Deepening of Existing Ditches (Lagoon Site)	lin. m.	150	$ 50	Typical	$ 7,500
Sub-Total Section B						**$ 621,000**
C	**Miscellaneous**					
C.1	Mobilization, Insurance, Bonding, De-Mobilization	lump sum	1	$ 70,000	Local	$ 70,000
C.2	Material Testing (Cash Allowance)	lump sum	1	$ 10,000	Typical	$ 10,000
Sub-Total Section C						**$ 80,000**
SUMMARY:						
A	Access Road					$ 18,250
B	Lagoon and Related Works					$ 621,000
C	Miscellaneous					$ 80,000
	Total					**$ 719,250**
	Contingency Allowance	30%				$ 215,775
	Total					**$ 935,025**

RM of Morris - Lowe Farm Lagoon Site Expansion Options
OPTION 2 - Site Expansion to the South of Existing Lagoon Site
Table B.2: Class "C" Capital Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Estimated Unit Price	Type of Pricing	Estimated Total Cost
A	**Access Road**					
A.1	Upgrade Existing Acces Road	lump sum	1	$ 9,750	Local	$ 9,750
A.2	Cleaning and Deepening of Existing Ditches (Access Road)	lin. m.	80	$ 50	Typical	$ 4,000
Sub-Total Section A						**$ 13,750**
B	**Lagoon and Related Works**					
B.1	Desludge the Existing Lagoon	lump sum	1	$ 75,000	Quote	$ 75,000
B.2	Topsoil Excavation (New Lagoon Cell, Ditching, and Roads assuming 300mm of topsoil)	cu. m.	10500	$ 7	Local	$ 73,500
B.3	Common Excavation					
	a) New Lagoon Cell, Effluent Ditching, and Roads	cu. m.	20000	$ 7	Local	$ 140,000
	b) Open the Berm up in Existing Lagoon	cu. m.	2500	$ 7	Local	$ 17,500
B.4	Borrow Excavation and Placement (Lagoon Clay Liner and Roads)	cu. m.	5000	$ 7	Local	$ 35,000
B.5	Supply and Install Base Coarse on Lagoon Berms (300 mm Thickness)	cu. m.	1060	$ 40	Local	$ 42,400
B.6	Supply and Install Chain Link Fence	lin. m.	1300	$ 90	Typical	$ 117,000
B.7	Seeding (Lagoon, Perimeter and Effluent Ditching)	ha	1	$ 5,000	Typical	$ 5,000
B.8	Supply and Install Reinforced Concrete Pads	each	3	$ 4,000	Typical	$ 12,000
B.9	Upgrade Existing Truck Dump	lump sum	1	$ 20,000	Typical	$ 20,000
B.10	Supply and Install Wastewater Sewer Gate Valve	each	2	$ 4,000	Typical	$ 8,000
B.11	Supply and Install Lagoon Piping (250 mm HDPE DR17 Interconnection Pipe)	lin. m.	85	$ 120	Local	$ 10,200
B.12	Supply and Install Lagoon Discharge Piping (300 mm HDPE DR17 Effluent Pipe)	lin. m.	30	$ 150	Local	$ 4,500
B.13	Supply and Install Lagoon Monitoring Wells	each	4	$ 1,500	Typical	$ 6,000
B.14	Filling of New Lagoon to 0.6 m Depth	lump sum	1	$ 20,000	Typical	$ 20,000
B.15	Ditch Lining c/w Geotextile (150 mm)	sq. m.	100	$ 50	Typical	$ 5,000
B.16	Cleaning and Deepening of Existing Ditches (Lagoon Site)	lin. m.	150	$ 50	Typical	$ 7,500
Sub-Total Section B						**$ 598,600**

RM of Morris - Lowe Farm Lagoon Site Expansion Options
OPTION 2 - Site Expansion to the South of Existing Lagoon Site
Table B.2: Class "C" Capital Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Estimated Unit Price	Type of Pricing	Estimated Total Cost
C	**Miscellaneous**					
C.1	Mobilization, Insurance, Bonding, De-Mobilization	lump sum	1	$ 70,000	Local	$ 70,000
C.2	Rigid Box Insulation (Above Interconnection Pipe)	lin. m.	20	$ 75	Typical	$ 1,500
C.3	Material Testing (Cash Allowance)	lump sum	1	$ 10,000	Typical	$ 10,000
Sub-Total Section C						**$ 81,500**
SUMMARY:						
A	Access Road					$ 13,750
B	Lagoon and Related Works					$ 598,600
C	Miscellaneous					$ 81,500
	Total					**$ 693,850**
	Contingency Allowance	30%				$ 208,155
	Total					**$ 902,005**

RM of Morris - Lowe Farm Lagoon Site Expansion Options
OPTION 3 - Re-purposing Abandoned Water Reservoir
Table B.3: Class "C" Capital Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Estimated Unit Price	Type of Pricing	Estimated Total Cost
A	**Access Road**					
A.1	Upgrade Existing Acces Road	lump sum	1	$ 9,750	Local	$ 9,750
A.2	Granular Base Coarse (150 mm Thickness)	cu. m.	75	$ 40	Local	$ 3,000
A.3	Granular Subbase (300 mm Thickness)	cu. m.	150	$ 35	Local	$ 5,250
A.4	Supply & Install Geotextile, Roads (Woven)	sq. m.	500	$ 3	Typical	$ 1,500
A.5	Supply & Install New Culvert	lin. m.	20	$ 225	Typical	$ 4,500
A.6	Cleaning and Deepening of Existing Ditches (Access Roads)	lin. m.	160	$ 50	Typical	$ 8,000
Sub-Total Section A						**$ 32,000**
B	**Forcemain and Lift Station**					
B.1	Supply and Install Sewage Forcemain Pipe					
	a) 150 mm HDPE DR17, Common Backfill	lin. m.	3000	$ 80	Local	$ 240,000
	b) 150 mm HDPE DR16, Trenchless under PTH 5	lin. m.	30	$ 95	Local	$ 2,850
B.2	Lift Station, Complete	lump sum	1	$ 250,000	Typical	$ 250,000
B.3	Supply and Install Encasement Pipe	lin. m.	30	$ 600	Typical	$ 18,000
Sub-Total Section B						**$ 510,850**
C	**Lagoon and Related Works**					
C.1	Desludge the Existing Lagoon	lump sum	1	$ 75,000	Quote	$ 75,000
C.2	Common Excavation					
	a) Existing Lagoon, Ditching, and Roads	cu. m.	5000	$ 7	Local	$ 35,000
	b) Open the Berm up in Existing Lagoon	cu. m.	2500	$ 7	Local	$ 17,500
C.3	Borrow Excavation and Placement (Lagoon Clay Liner and Roads)	cu. m.	1000	$ 7	Local	$ 7,000
C.4	Supply and Install Base Coarse on Lagoon Berms (300 mm Thickness)	cu. m.	540	$ 40	Local	$ 21,600
C.5	Supply and Install Chain Link Fence	lin. m.	700	$ 90	Typical	$ 63,000
C.6	Seeding (Lagoon, Perimeter, Ditching)	ha	0.5	$ 5,000	Typical	$ 2,500
C.7	Supply and Install Reinforced Concrete Pads	each	1	$ 4,000	Typical	$ 4,000
C.8	Upgrade Existing Truck Dump	lump sum	1	$ 20,000	Typical	$ 20,000
C.9	Supply and Install Wastewater Sewer Gate Valve	each	1	$ 4,000	Typical	$ 4,000
C.10	Supply and Install Lagoon Monitoring Wells	each	2	$ 3,000	Typical	$ 6,000
C.11	Filling of New Lagoon to 0.6 m Depth	lump sum	1	$ 10,000	Typical	$ 10,000

RM of Morris - Lowe Farm Lagoon Site Expansion Options
OPTION 3 - Re-purposing Abandoned Water Reservoir
Table B.3: Class "C" Capital Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Estimated Unit Price	Type of Pricing	Estimated Total Cost
C.12	Ditch Lining c/w Geotextile (150 mm)	sq. m.	100	$ 50	Typical	$ 5,000
C.13	Cleaning and Deepening of Existing Ditches (Lagoon Site)	lin. m.	50	$ 50	Typical	$ 2,500
Sub-Total Section C						**$ 273,100**
D	**Water Reservoir Re-purpose**					
D.1	Dredge the Existing Water Reservoir	lump sum	1	$ 67,000		$ 67,000
D.2	Clearing and Grubbing (Water Reservoir, Ditching, and Roads)	ha	1.5	$ 6,500	Typical	$ 9,750
D.3	Topsoil Excavation (Water Reservoir, Ditching, assuming 300mm of topsoil)	cu. m.	3000	$ 7	Local	$ 21,000
D.4	Common Excavation (Water Reservoir, Ditching, and Road)	cu. m.	20000	$ 7	Local	$ 140,000
D.5	Borrow Excavation and Placement (Lagoon Clay Liner and Roads)	cu. m.	5000	$ 7	Local	$ 35,000
D.6	Supply and Install Base Coarse on Lagoon Berms (300 mm Thickness)	cu. m.	520	$ 40	Local	$ 20,800
D.7	Supply and Install Chain Link Fence	lin. m.	600	$ 90	Typical	$ 54,000
D.8	Seeding (Water Reservoir, Ditching)	ha	1	$ 5,000	Typical	$ 5,000
D.9	Supply and Install Reinforced Concrete Pads	each	2	$ 4,000	Typical	$ 8,000
D.10	Supply and Install Wastewater Sewer Gate Valve	each	2	$ 4,000	Typical	$ 8,000
D.11	Supply and Install Lagoon Discharge Piping (300 mm HDPE DR17 Effluent Pipe)	lin. m.	30	$ 150	Local	$ 4,500
D.12	Supply and Install Lagoon Monitoring Wells	each	2	$ 1,500	Typical	$ 3,000
D.13	Filling of New Lagoon to 0.6 m Depth	lump sum	1	$ 10,000	Typical	$ 10,000
D.14	Ditch Lining c/w Geotextile (150 mm)	sq. m.	100	$ 50	Typical	$ 5,000
D.15	Cleaning and Deepening of Existing Ditches (Water Reservoir Site)	lin. m.	100	$ 50	Typical	$ 5,000
Sub-Total Section D						**$ 396,050**
E	**Miscellaneous**					
E.1	Mobilization, Insurance, Bonding, De-Mobilization	lump sum	1	$ 135,000	Local	$ 135,000
E.2	Rigid Box Insulation (Across PTH 5)	lin. m.	30	$ 75	Typical	$ 2,250
E.3	Material Testing (Cash Allowance)	lump sum	1	$ 10,000	Typical	$ 10,000
Sub-Total Section E						**$ 147,250**

RM of Morris - Lowe Farm Lagoon Site Expansion Options
OPTION 3 - Re-purposing Abandoned Water Reservoir
Table B.3: Class "C" Capital Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Estimated Unit Price	Type of Pricing	Estimated Total Cost
SUMMARY:						
A	Access Road					$ 32,000
B	Forcemain and Lift Station					$ 510,850
C	Lagoon and Related Works					$ 273,100
D	Water Reservoir Re-purpose					$ 396,050
E	Miscellaneous					$ 147,250
	Total					**$ 1,359,250**
	Contingency Allowance	30%				$ 407,775
	Total					**$ 1,767,025**

Appendix C

Supplied Quotes

Nezvesciuc, Alexandr

From: Byron Loewen <byron@dirtpro.ca>
Sent: Saturday, May 24, 2014 8:03 AM
To: Nezvesciuc, Alexandr
Subject: Re: Costs for Lagoon Work

Clearing and grubbing about $1 000 per acre
Approx $20 000 for insurance, bonding, and mobilization
Granular base course $35 per meter including placement and compaction.

Byron Loewen
Box 94
Rosenort, MB R0G 1W0
Phone 204 746 8694
Cell 204 746 4245
Fax 1 204 201 0672
Email byron@dirtpro.ca

On Fri, May 23, 2014 at 9:48 AM, Nezvesciuc, Alexandr <Alexandr.Nezvesciuc@aecom.com> wrote:

Byron,

Thank you very much for this information. If it is at all possible, could you also provide us with additional costs for the following:

- Clearing and Grubbing ($ per area)
- Granular Base Course, Sub-base ($ per cubic meter)
- Approximate cost of mobilization, camp, demobilization, etc. for this work (lump sum) – I attached a PDF of proposed lagoon work for reference

Thanks in advance,

Alex Nezvesciuc, EIT

204.928.9239

AECOM

From: Byron Loewen [mailto:byron@dirtpro.ca]
Sent: Thursday, May 22, 2014 5:32 PM
To: Nezvesciuc, Alexandr
Subject: Re: Costs for Lagoon Work

Here are the budget prices.

Common and borrow excavation $6 per meter including compaction

Supply, fuse and install 6" HDPE DR17 Pipe, Common Backfill - $68/m

Supply, fuse and install 6" HDPE Dr16 pipe, Trenchless Under highway - $83/m
(does not include encasement carrier pipe)

Byron Loewen

Box 94

Rosenort, MB R0G 1W0

Phone 204 746 8694

Cell 204 746 4245

Fax 1 204 201 0672

Email byron@dirtpro.ca

On Wed, May 21, 2014 at 5:30 PM, Nezvesciuc, Alexandr <Alexandr.Nezvesciuc@aecom.com> wrote:

Hello Byron,

As per our phone conversation, I would like to know the costs for the following items:

- Common excavation and placement ($ per cubic meter)

- Local borrow excavation and placement of lagoon clay liner ($ per cubic meter)

- Supply and installation of 150mm forcemain pipe with common backfill, HDPE DR17 pipe ($ per lineal meter)

- Supply and **trenchless** installation of 150mm forcemain pipe across PTH 5 , HDPE DR17 pipe ($ per lineal meter)

If it's possible, please provide the prices as soon as possible (this Friday at the latest). Our schedule is very tight.

Also, I attached a PDF of local prices that we got from meeting with Don Harder from Public Works, RM of Morris.

Feel free to call me if you have any questions.

Regards,

Alex Nezvesciuc, EIT

Municipal Engineer in Training

Community Infrastructure - Water Group

D 204.928.9239

alexandr.nezvesciuc@aecom.com

AECOM

99 Commerce Drive, Winnipeg, MB R3P 0Y7

T 204.477.5381 F 204.284.2040

www.aecom.com

Twitter I Facebook I LinkedIn I Google+

Explore ***ONE***, AECOM's global e-magazine.

Assiniboine Injections Ltd.

BOX 160 177 NOTRE DAME AVE E NOTRE DAME, MB R0G 1M0 PH: 204-248-2559 FAX: 204-248-2799

May 23, 2014

AlexandrNezvesciuc

RE: Price Quote for Desludging Lowe Farm Lagoon

Assiniboine Injections Ltd specializes in the removal and application of biosolids (municipal sewage sludge) from lagoons to drying bed, dykes, or agriculture land and geo bags.

Desludge primary and secondary lagoons.

We propose to do the following:
- Mode and demode of equipment:
- Dredge biosolids from primary and secondary lagoon.
- Haul to landfill.

Dredge existing water reservoir in Lowe Farm
- Dredge water reservoir
- Haul to Landfill

For sum of approximately $ 142,000.00 plus GST.

Note: This quote depends on environment decision.

If you would like more information please contact Ron at 204-248-2559or cell 204-745-7235.
Thank you for the opportunity to provide our services. We look forward to your reply.

Sincerely,

Ron Jamault / Ron Boisvert
Assiniboine Injections Ltd

Assiniboine Injections Ltd.

BOX 160 177 NOTRE DAME AVE E NOTRE DAME, MB R0G 1M0 PH: 204-248-2559 FAX: 204-248-2799

May 23, 2014

AlexandrNezvesciuc

RE: Price Quote for Desludging Lowe Farm Lagoon

Assiniboine Injections Ltd specializes in the removal and application of biosolids (municipal sewage sludge) from lagoons to drying bed, dykes, or agriculture land and geo bags.

We propose to do the following:
-Mode and demode of equipment:

Desludge primary and secondary lagoons. Haul to landfill.

For sum of approximately $ 75,000.00 plus GST.

Note: This quote depends on environment decision.

If you would like more information please contact Ron at 204-248-2559or cell 204-745-7235.
Thank you for the opportunity to provide our services. We look forward to your reply.

Sincerely,

Ron Jamault / Ron Boisvert
Assiniboine Injections Ltd

Appendix B
Lagoon Analysis

Facultative Lagoon
Lowe Farm

Design Parameters

2041 Population (Future)	**685**	**people**
Storage Period	**230**	**days**

Existing Pond

	Primary	Secondary
Cell Volume in m^3	9,136	10,715
Cell Area in m^2 (surface area)	6,806	7,920
3.5:1 Slope		

Hydraulic Loading (2041)

Community	240	L / capita / day
	685	persons
	60,006	m^3 / year
Estimated Infiltration	10%	Percent of total Loading
Total Infiltration	6,001	m^3 / year
Total Hydraulic Loading	66,007	m^3 / year

Organic Loading (Present Day)

Community	0.076	kg BOD / capita / day
	685	persons
Total Organic Loading	52.06	kg BOD / day

Inter-cell Berm Removal

Top width	70	m
Bottom width	56.50	m
Slope	3	:1
volume of removed berm/additional storage	**1091**	m^3

Primary Cell Design

Loading	52.06	kg BOD / day	
Treatment Rate	5.6	kg / 1000 sm / day	
Required Primary Surface Area	**9,296**	**m^2**	
Existing Primary Surface Area	6,806	m^2	**Too small**
Area of both existing cells combined (new primary)	**14726**	m^2	adequate

Secondary Cell Design

Retention Period	230	days	
Fraction of annual Hydraulic Loading to Store	63%		
Required Storage	**41,593**	**m^3**	
Top Half existing Secondary Cell Volume	4,831	m^3	
Top Half Existing Primary Cell Volume	5,644	m^3	
Available Storage Volume	**11,566**	**m^3**	
	Too small		
Required Additional Storage	**30,027**	**m^3**	
Sideslope	4	:1	
Depth	1.2	m	
Top Surface Area (Top of water)	27,556	m^2	
Top Width	166	m	
Top Length	166	m	
Bottom Surface Area	23,716	m^2	
Bottom Width	154	m	
Bottom Length	154	m	
Storage Volume of new Secondary Cell	**31,192**	**m^3**	**> 30,027 m^3, OK**

Appendix C
Geotechnical Investigation

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

Memorandum

To	Paul Barsalou, P.Eng	Page	1
CC			
Subject	Lowe Farm Sewage Lagoon Expansion – Existing Lagoon Stability		
From	Omer Eissa, P.Eng		
Date	February 4, 2016	Project Number	60447253

1. Introduction

The Rural Municipality of Morris (RM) is planning an expansion cell at the Lowe Farm Sewage Lagoon in Lowe Farm, Manitoba. The existing sewage lagoon facility is located northeast of the community of Lowe Farm as shown on Drawing 01 in Appendix A. The facility consists of two existing cells. It is understood that the two existing cells will be merged into one large cell by removing the existing dike separating the cells and a new cell will be constructed directly to the north of the existing cells.

The purpose of this memorandum is to provide a geotechnical assessment of the existing lagoon slopes and to identify any upgrades or changes to the existing slopes if required.

2. Stability Analysis

The existing lagoon geometry was modelled based on the survey data presented on Drawings C-0001 and C-0002 attached in Appendix A. Based on the elevations shown on the drawings, the crest of the existing lagoon dikes vary in elevation from 241.30 to 241.40 m. The minimum existing ground elevation outside of the existing lagoon cell is at elevation 240.0 m and the clay floor elevation within the cell is at 238.75 m.

A preliminary slope stability assessment was carried out on the existing 3.0H:1V dike slopes to investigate stability of the 3H:1V dike slopes in the long-term, short-term and rapid drawdown conditions. The analysis was performed using GeoStudio 2007 software package. The soil stratigraphy and parameters assigned to the subsoil and fill material in the analysis were based on available test results, correlation with soil index properties and knowledge of local conditions and are presented in Table 01. This exercise utilized the test holes advanced by AECOM in December 2014 with the assumption that the lagoon dikes were constructed using material from the base of the cells. Test hole logs and description of the subsurface conditions are provided in a separate technical memorandum submitted by AECOM dated February 11, 2015. The location of the test holes is presented on Drawing 01 in Appendix A.

Table 01 - Soil Strength Parameters for Slope Stability Analysis

Material	Unit Weight (kN/m^3)	Cohesion (kPa)	Angle of Internal Friction (°)
Clay (Fill)	18	5	17
Silty Clay (Native soil)	17	5	17

Groundwater was assumed at elevation 238.75 m corresponding to the cell floor elevation.Target factor of safety (FS) of 1.5 for the long-term, 1.3 for the short-term, and 1.3 for rapid drawdown condition are considered adequate for the existing cell dikes. These objective factors of safety are consistent with acceptable design practice.

Analysis results are presented in Table 2 below. Graphical illustrations of the analysis results are attached in Appendix B. Based on the analysis, 3H:1V slopes for the 2.6 m high cell dikes would satisfy the minimum required factor of safety. It is understood that the existing 3H:1V slopes show no evidence of slope instability or performance issues during the functional life of the facility. Based on the analysis results it is recommended that the existing dikes be maintained at 3H:1V slopes unless otherwise required for operational purposes.

Table 02 – Analysis Results

Analysis Case	Calculated Factor of Safety	Target Factor of Safety	Figure #
Long-Term	1.94	1.50	Figure 01
Short-Term	1.76	1.30	Figure 02
Rapid Drawdown	1.46	1.30	Figure 03

Should you have any questions or require any additional information, please contact the undersigned.

Respectfully submitted,

Omer Eissa, P.Eng
Geotechnical Engineer

Zeyad Shukri, M.Sc., P.Eng.
Senior Geotechnical Engineer

Enclosed;

Appendix A - Figures:

- Drawing 01: Lowe Farm Lagoon Test Hole Location Plan
- Sheet C-0001: Lowe Farm Sewage Lagoon Expansion - Overall Site Plan
- Sheet C-0002: Lowe Farm Sewage Lagoon Expansion – Typical Cross Sections

Appendix B - Stability Analysis Results:

- Figure 01: Long-Term Stability Analysis
- Figure 02: Short-Term Stability Analysis
- Figure 03: Rapid Drawdown Stability Analysis

Appendix A
Figures

Last saved by: MAHEC (2016-02-04) Last Plotted: 2013-04-22
Filename: P:\60447253\900-WORK\920-929 (GIS-GRAPHICS)\B\G001_60447253_01V1_TESTHOLELOCATIONPLAN.MXD

Project Management Initials: Designer: Checked: Approved:

ANSI A 215.9mm x 279.4mm

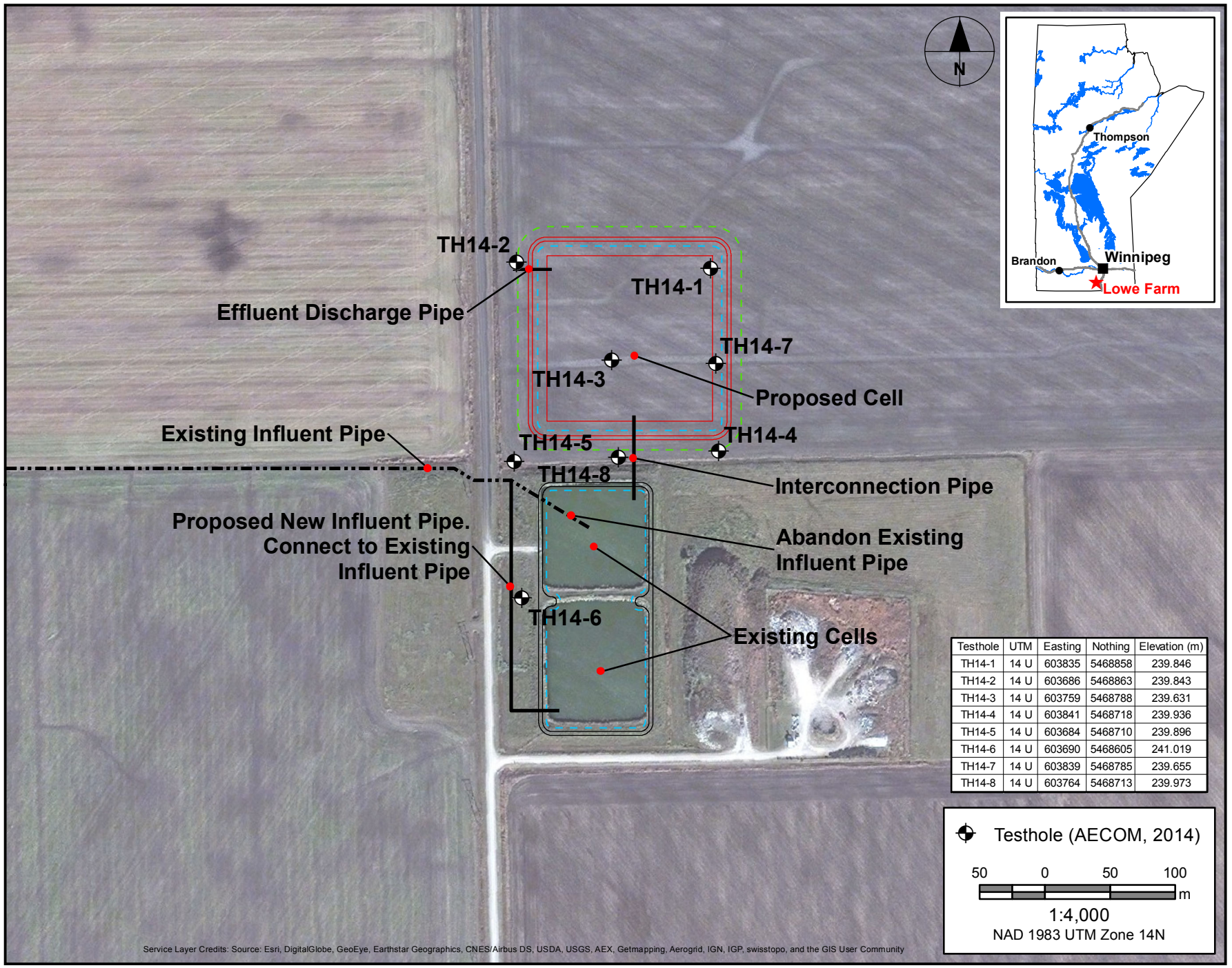
Rural Municipality of Morris

Lowe Farm Lagoon

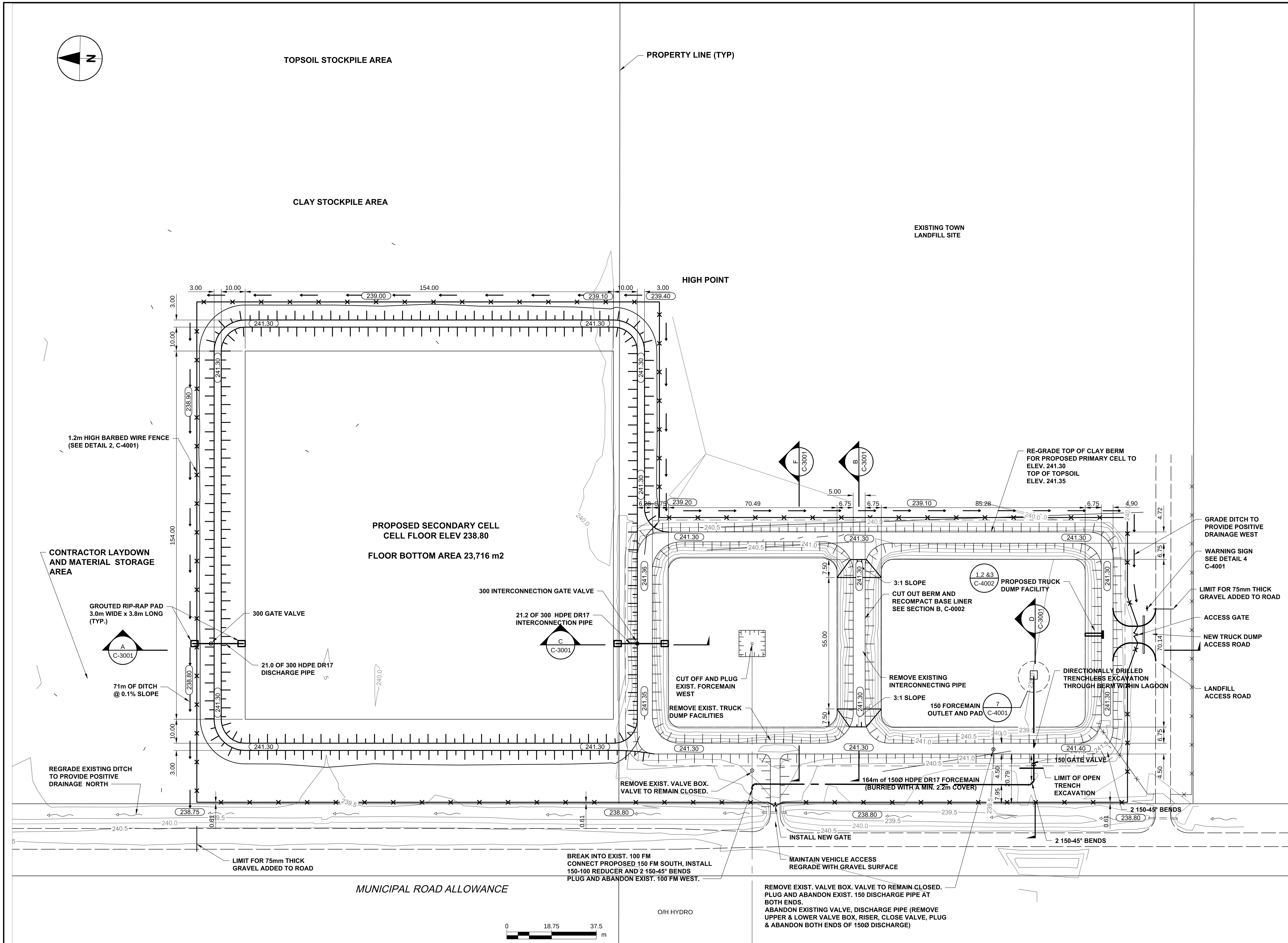
Test Hole Location Plan

Drawing: 01

AECOM



Testhole	UTM	Easting	Nothing	Elevation (m)
TH14-1	14 U	603835	5468858	239.846
TH14-2	14 U	603686	5468863	239.843
TH14-3	14 U	603759	5468788	239.631
TH14-4	14 U	603841	5468718	239.936
TH14-5	14 U	603684	5468710	239.896
TH14-6	14 U	603690	5468605	241.019
TH14-7	14 U	603839	5468785	239.655
TH14-8	14 U	603764	5468713	239.973



AECOM

PROJECT

LOWE FARM SEWAGE LAGOON EXPANSION

CLIENT

RM of Morris
Box 518
207 Main Street N
Morris, Manitoba R0G 1K0

CONSULTANT

AECOM
99 Commerce Drive
Winnipeg, Manitoba, R3P 0Y7
204.477.5381 tel 204.284.2040 fax
www.aecom.com

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
B	29/01/2016	ISSUED FOR TENDER
A	14/12/2015	ISSUED FOR PUBLIC MEETING

KEY PLAN

PROJECT NUMBER

60447253

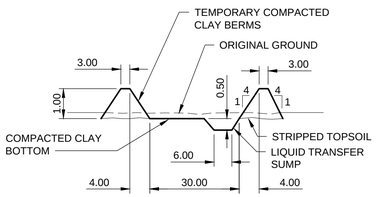
SHEET TITLE

OVERALL SITE PLAN

SHEET NUMBER

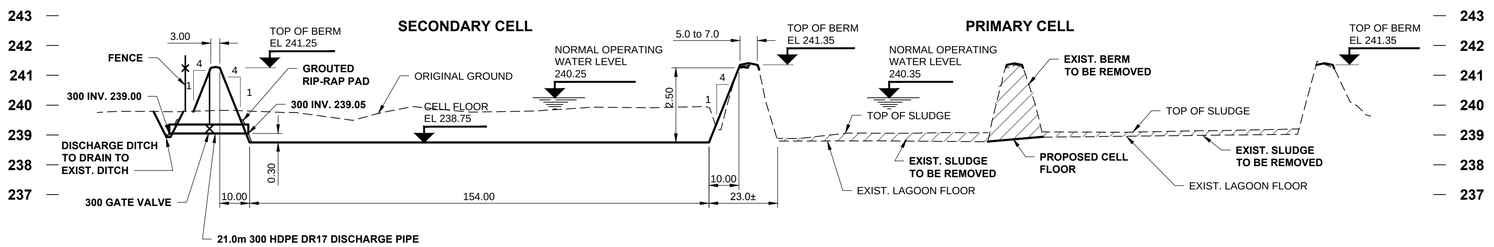
C-0001

ANSI D 864mm x 559mm
Project Management Initials: Designer: Checked: Approved:
Last saved by: DURANDA(2016-01-28) Last Plotted: 2016-02-01
Filename: P:\60447253\900-WORK\910-CAD\20-SHEETS\C\60447253-SHT-00-C-0001.DWG



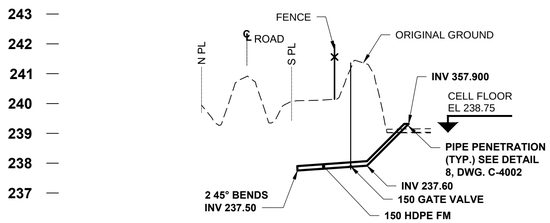
E | SECTION
TEMPORARY SLUDGE DEWATERING CELL

0 25 50 m H=1:1000 V=1:100
0 2.5 5



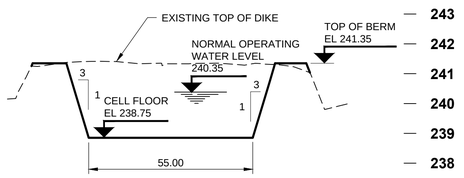
A | SECTION

0 25 50 m H=1:1000 V=1:100
0 2.5 5



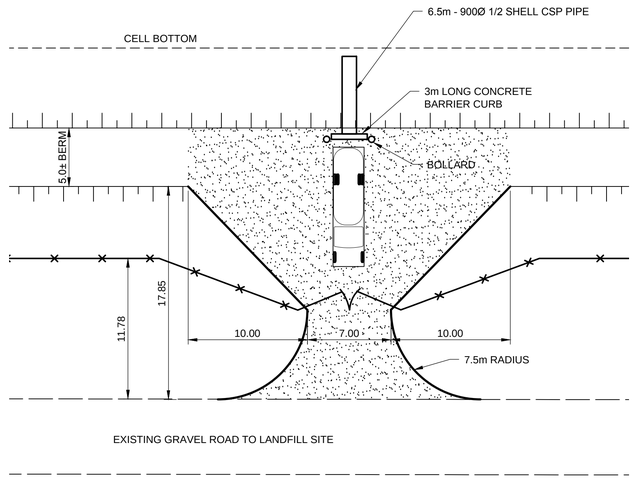
D | SECTION

0 25 50 m H=1:1000 V=1:100
0 2.5 5

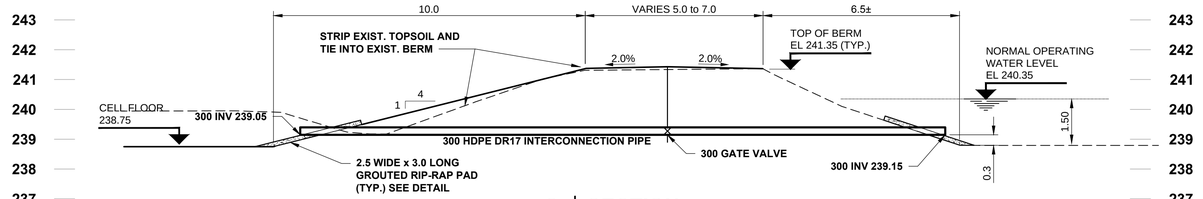


B | SECTION

0 25 50 m H=1:1000 V=1:100
0 2.5 5



1 | TRUCK DUMP DETAIL
Scale 1:250



C | SECTION
250 INTERCONNECTION PIPING.

0 2500 5000 mm
1:100

AECOM

PROJECT

LOWE FARM SEWAGE LAGOON EXPANSION

CLIENT

RM of Morris
Box 518
207 Main Street N
Morris, Manitoba R0G 1K0

CONSULTANT

AECOM
99 Commerce Drive
Winnipeg, Manitoba, R3P 0Y7
204.477.5381 tel 204.284.2040 fax
www.aecom.com

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	14/12/2015	ISSUED FOR PUBLIC MEETING

KEY PLAN

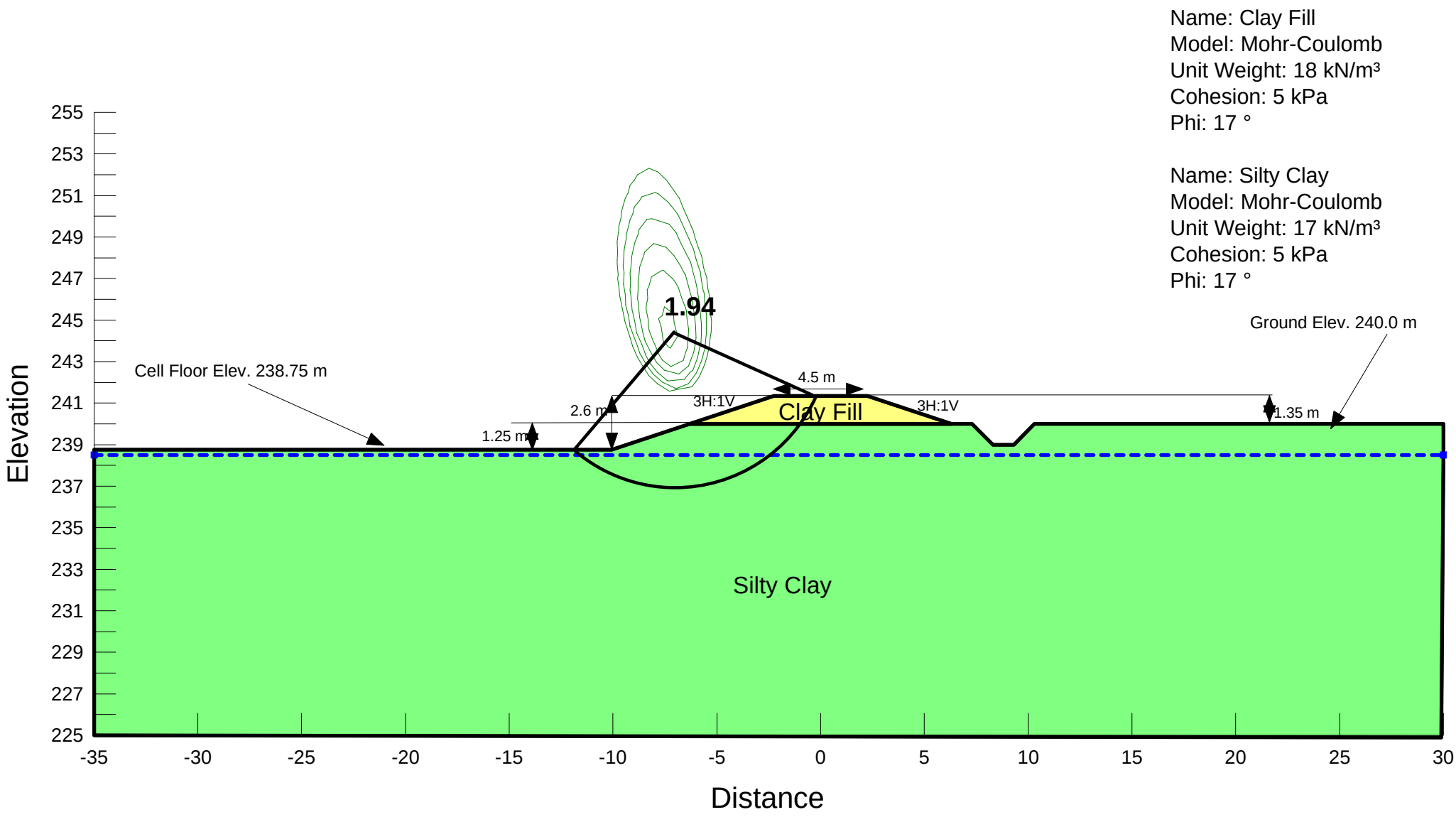
PROJECT NUMBER
60447253

SHEET TITLE
TYPICAL CROSS SECTIONS

SHEET NUMBER
C-0002

Appendix B
Stability Analysis Results

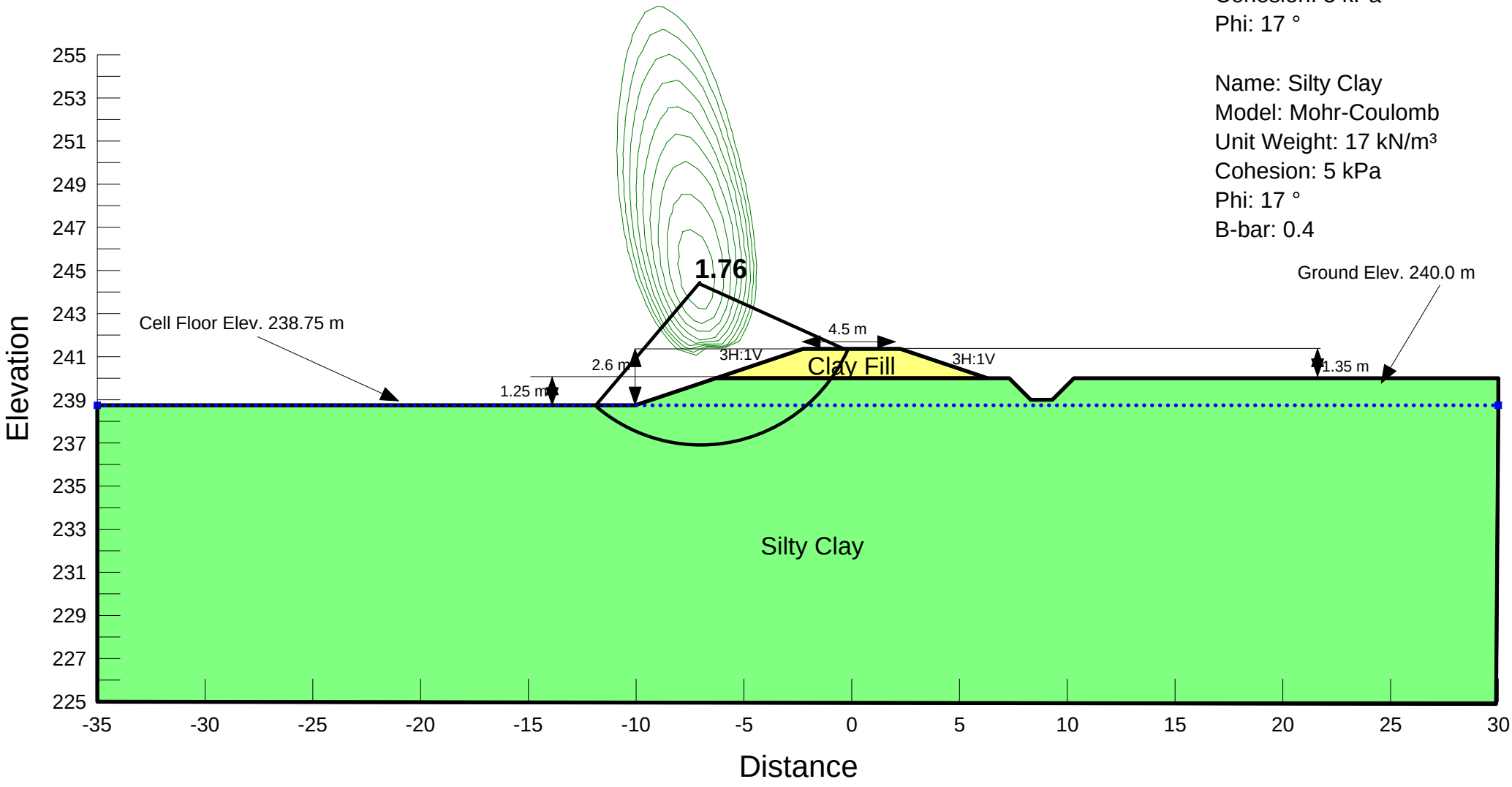
Description: Lowe Farm - Existing Lagoon Stability
Analysis: 3H:1V Long-Term Analysis
Figure 01



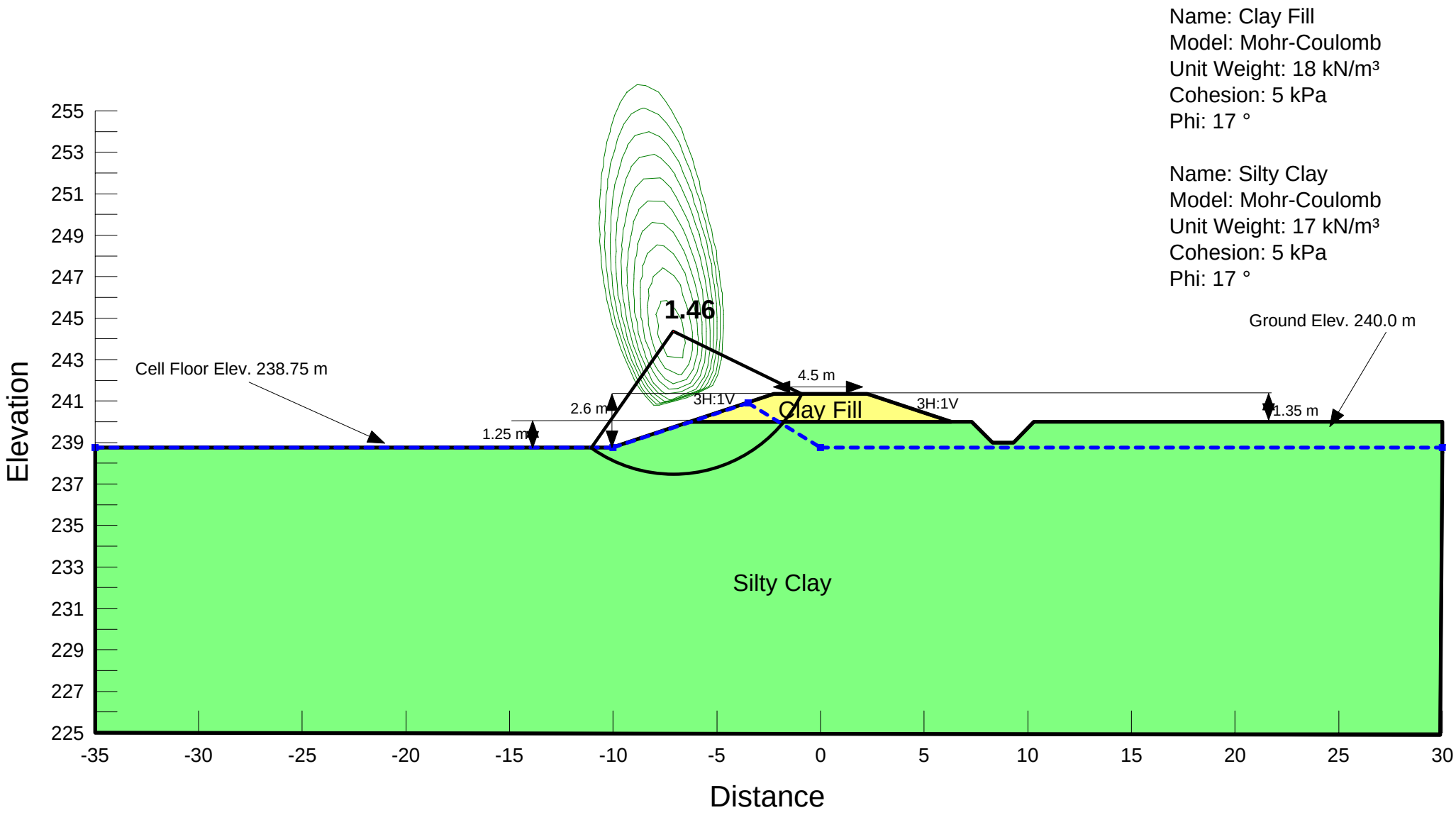
Description: Lowe Farm - Existing Lagoon Stability
Analysis: 3H:1V Short-Term Analysis
Figure #: 02

Name: Clay Fill
Model: Mohr-Coulomb
Unit Weight: 18 kN/m³
Cohesion: 5 kPa
Phi: 17 °

Name: Silty Clay
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 17 °
B-bar: 0.4



Description: Lowe Farm - Existing Lagoon Stability
Analysis: 3H:1V Rapid Drawdown Analysis
Figure #: 03



AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

To	Paul R. Barsalou, P.Eng	Page	1
CC			
Subject	Preliminary Geotechnical Assessment for Proposed Lowe Farm Lagoon Expansion		
From	Omer Eissa, P.Eng		
Date	February 11, 2015	Project Number	60322119 (403)

1. INTRODUCTION

The Rural Municipality of Morris (RM) is planning an expansion cell at the Lowe Farm Wastewater Lagoon in Lowe Farm, Manitoba. The existing wastewater lagoon is located northeast of the community of Lowe Farm at the location shown on Figure 1 in Appendix A. The wastewater lagoon consists of two existing cells. It is understood that the new cell will be located in the farm lands directly to the north of the two existing cells and associated influent and effluent discharge pipes.

The purpose of this memorandum is to provide geotechnical assessment for the lagoon construction at the proposed expansion location. This memorandum summarizes the results of the December 2014 geotechnical investigation, provides description of the subsurface conditions and evaluates the suitability of the site for the intended purpose.

2. FIELD INVESTIGATION

Seven (7) test holes, numbered TH14-01 to TH14-05 and TH14-07 to TH14-08, were drilled within the footprint of the proposed location of the expansion cell. TH14-07 was drilled west of the existing cells at the location of the proposed influent pipe. One (1) standpipe piezometers was installed in TH14-03. The approximate locations of the test holes are shown on Figure 01 in Appendix A. Test hole logs are presented in Appendix B.

The test holes were drilled on December 29th, 2014 by Maple Leaf Drilling Ltd. using a track mounted Acker drill rig equipped with 125 mm solid stem auger (SSA). General site supervision and test hole logging were performed by AECOM personnel. Representative disturbed samples were collected at regular intervals from auger cuttings, split spoon samples and relatively undisturbed thin-walled tube samples (Shelby) were obtained during the field investigation. The soil samples were transported to AECOM's Materials Testing Laboratory in Winnipeg for visual classification and testing. All test holes were backfilled with auger cuttings and bentonite upon completion.

The laboratory testing program consisted of determining moisture contents on all disturbed samples. Grain size analysis tests (hydrometers) and unconfined compressive strength testing were carried out on 3 selected samples. Plasticity index (Atterberg's limits) determination was carried out on 4

samples. A Flexible Wall Permeameter test was carried out on one sample. Results of the laboratory testing are presented on the test hole logs and attached in Appendix C.

3. SUBSURFACE CONDITIONS

Based on the test holes, a general soil profile was encountered as follows in descending order:

- Topsoil
- Silty Clay

3.1 Topsoil

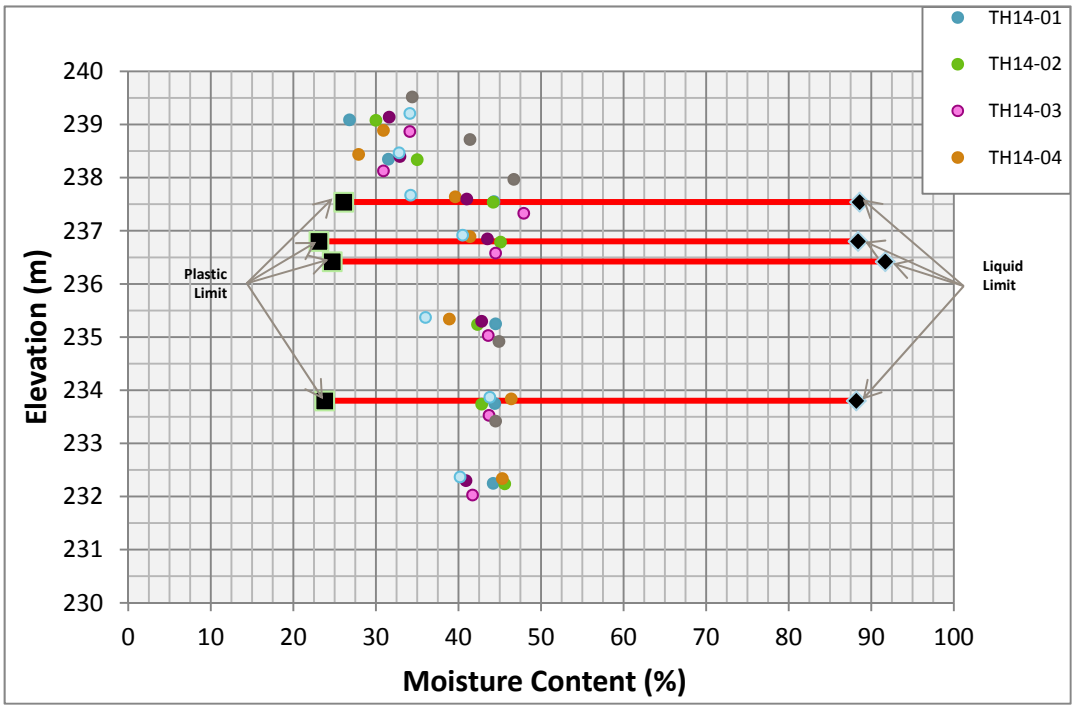
Topsoil was encountered at the ground surface in all of the test holes. The thickness of the topsoil ranged from 100 to 200 mm. The topsoil contained considerable amount of sand with rootlets throughout, black or brown in colour, and dry to moist.

3.2 Silty Clay

The topsoil was underlain by a thick deposit of silty clay. The silty clay extended to the termination depth in all the test holes at depths ranging from 7.6 to 8.1 m. The clay was generally brown changing to grey with depth, firm to stiff and of high plasticity.

The particle sizes of the soils ranged from 72 to 79 percent clay, 20 to 28 percent silt, 0 to 1 percent sand and no gravel particles. Moisture content ranged from 27 to 35 percent. Variation of moisture content and Atterberg limits with depth are presented in Figure 1 below. The undrained shear strength measured from unconfined compression tests ranged from 35 to 57 kPa.

Figure 01 –Moisture Content and Atterberg's Limits versus Depth



4. GROUNDWATER CONDITIONS

No sloughing or seepage was observed in the test holes immediately following the drilling. One (1) standpipe piezometer was installed to a depth of 7.6 m in TH14-03. Details of installations are provided on the test hole log in Appendix B. The groundwater in the piezometer was measured on January 27, 2015 and water was recorded at a depth of 7.1 m below ground surface.

It should be recognized that groundwater levels may fluctuate in response to seasonal factors or due to construction activities.

5. GEOTECHNICAL ASSESMENT

Based on the information provided, we understand the proposed lagoon facility expansion will consist of adding a primary cell north of the two existing cells in the subject site. Floor elevation in the expansion cell is expected to be approximately 1.8 m below existing ground. It is understood that suitable excavated soils will be used to construct perimeter dikes approximately 1 m high around the proposed cell.

5.1 Cut Slopes

Generally, the existing ground surface in the proposed area is flat farm land. For the proposed floor elevations of the lagoon cells, a combination of cut slopes and placed fill dykes will be used to create the necessary cell capacity. For cut slopes in the encountered clay soils, we recommend that all slopes not be steeper than 4H:1V. Benches are not required for cut slopes with the anticipated height of 1.8 m. Slope drainage measures must be implemented to lower the phreatic surface and reduce erosion of cut slopes. These measures may consist of armoured swales from benches or toe drains on the slope benches to promote drainage. Rip-rap protection can be placed along cut slopes to provide protection against rainfall, snowmelt, wave action, or any other erosive actions.

5.2 Floor of the Proposed Facility

The subsurface soils encountered on site consist of a thick deposit of high plasticity clay extending to the termination depth of drilling ranging between 7.6 m to 8 m below existing ground surface. The proposed site is considered feasible for a clay-lined or a geosynthetic-lined sewage lagoon facility.

The provincial guidelines for a clay-lined lagoon are to provide a minimum 1 m thick clay seal having a hydraulic conductivity of 1×10^{-9} m/s lining the floor and the interior surfaces of the facility. The results of the flexible wall permeability tests are provided in Appendix C, and show that the in-situ clays encountered during the test pits exploration were found to have a hydraulic conductivity range from 2.4×10^{-10} to 3.5×10^{-10} m/s. Based on the results of the field investigation, the existing natural clay meets the criteria for a natural clay liner. The existing clay should be excavated to the proposed floor elevation of the facility and the surface should be compacted to at least 95 percent Standard Proctor Maximum Dry Density (SPMDD) at moisture contents within 0 and +3 percent of the optimum moisture content.

If a geosynthetic liner design is selected, the liner should be placed on a 200 mm thick layer of compacted bedding sand. This bedding sand layer should be placed on prepared subgrade. The subgrade preparation consists of re-working and compacting the top 300 mm.

Further design and construction recommendations can be provided once the liner type has been selected.

5.3 Dykes of the Proposed Facility

The subsurface conditions encountered in the site are anticipated to provide suitable foundation for the proposed dykes subject to subgrade treatment. The recommended subgrade treatment includes clearing and stripping all organics and topsoil. The exposed subgrade, if found suitable, should be scarified and re-compacted to at least 95 percent of SPMDD. Soils with organic matter, soft or week zones should be excavated and replaced with compacted native clay. The native clay encountered within the area of the proposed lagoon can be used to replace detrimental zones and construct these dykes.

Clay dykes not exceeding 3 m in height can be designed with side slopes not exceeding 4H:1V. Detailed slope stability analysis is required for slopes with greater than 3 m in height. The clay should be placed in layers not to exceed 300 mm non-compacted thickness at moisture content within 0 and +3 percent of the optimum moisture content and compacted to at least 95 percent Standard Proctor maximum dry density (SPMDD).

Erosion protection measures will be required on the slope surfaces of the proposed dykes. The exterior slopes can be protected using a suitable vegetation cover. A rip-rap protection layer can be used on the interior slopes to provide protection against rainfall, snowmelt, wave action, or any other erosive actions. Further recommendations can be provided as part of the detailed design phase.

5.4 Temporary Excavations

Temporary excavations in the range of 1 to 3 m are anticipated for the installation of the new influent pipes. Based on subsurface conditions, open cut excavations can be utilized for the installation. Shoring related to temporary work is the responsibility of the contractor and all necessary measures should be undertaken to protect against adverse impact or undermining the foundation or stability of existing infrastructure. The silty clay can be classified as Category 1 firm, high plastic silty clay. Groundwater seepage into the excavation is expected to be minimal and can be managed by pumping from sumps if needed. All excavations must comply with the Manitoba Workplace Safety and Health Regulations.

We appreciate the opportunity to be of service to you on this project. If there are any questions with regard to the information and recommendations presented in this memorandum, or if we may be of further service to you, please contact the undersigned.

Respectfully Submitted,

Prepared by:

Omer Eissa, P.Eng.
Geotechnical Engineer

Reviewed by:

Zeyad Shukri, M.Sc., P.Eng.
Senior Geotechnical Engineer

APPENDIX A
Figure 01 – Test Hole Plan

Last saved by: MAHEC (2015-02-06) Last Plotted: 2013-04-22
Filename: P:\60322119\900-WORK\920-929 (GIS-GRAPHICS)\B\G002_60322119_01V1_SITEPLAN.MXD

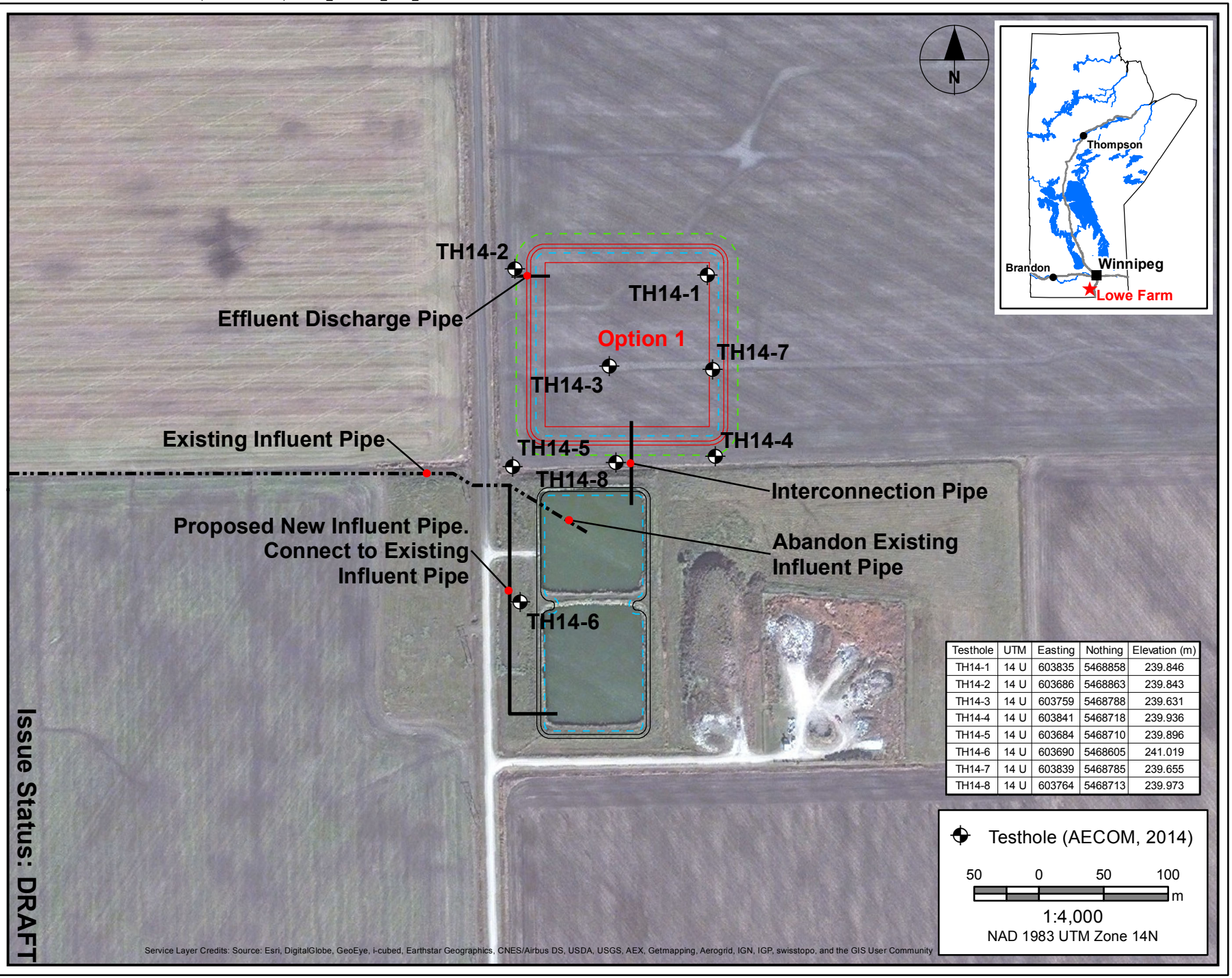
Project Management Initials: Designer: Checked: Approved:

ANSI A 215.9mm x 279.4mm

Rural Municipality of Morris

Lowe Farm Lagoon

Utility Locates Plan



Testhole	UTM	Easting	Nothing	Elevation (m)
TH14-1	14 U	603835	5468858	239.846
TH14-2	14 U	603686	5468863	239.843
TH14-3	14 U	603759	5468788	239.631
TH14-4	14 U	603841	5468718	239.936
TH14-5	14 U	603684	5468710	239.896
TH14-6	14 U	603690	5468605	241.019
TH14-7	14 U	603839	5468785	239.655
TH14-8	14 U	603764	5468713	239.973

Issue Status: DRAFT

AECOM

Figure: 02

APPENDIX B
Test Hole Logs

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

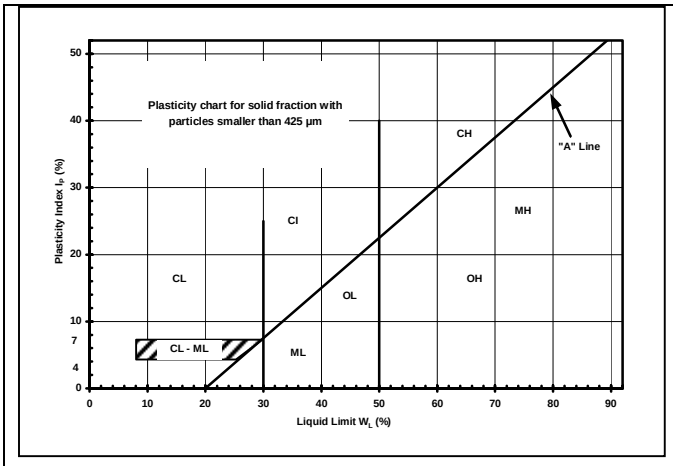
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				AECOM Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		
	Concrete		Bedrock (Undifferentiated)		AECOM
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

q_u - undrained shear strength (kPa) derived from unconfined compression testing.

T_v - undrained shear strength (kPa) measured using a torvane

pp - undrained shear strength (kPa) measured using a pocket penetrometer.

L_v - undrained shear strength (kPa) measured using a lab vane.

F_v - undrained shear strength (kPa) measured using a field vane.

γ - bulk unit weight (kN/m^3).

SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.

DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.

w - moisture content (W_L, W_P)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Su (kPa)	**CONSISTENCY**
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	**COMPACTNESS**
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Lowe Farm WTP- Expansion Cell	CLIENT: Rural Municipality of Morris	TESTHOLE NO: **TH14-01**
LOCATION: (14 U 603835 m N, 5468858 m E)		PROJECT NO.: 60322119
CONTRACTOR: Maple Leaf Drilling	METHOD: Track mounted SSA (125 mm)	ELEVATION (m): 239.85

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		TOPSOIL (0.15 m)						239
		CLAY - silty, trace sand - brown, firm to stiff, moist - high plasticity - trace silt inclusions (< 12 mm in diameter) - trace gypsum - ground frozen to approximately 0.46 m	■	G8				
1			■	G9				238
2			■	G10				
3			▥	T11			Tube Recovery: 100%	237
		- T11: Gravel 0%, Sand 1.3%, Silt 20.1%, Clay 78.7%						
4								236
5			☒	S12	7		SPT Blows: 3, 3, 4	235
6			■	G13				234
7								233
8			☒	S14	7		SPT Blows: 3, 3, 4	232
		END OF TEST HOLE AT 8.08 m m IN CLAY. NOTES: 1. No sloughing was observed. 2. No seepage was observed. 3. Hole open to 8.08 m. 4. Test hole backfilled with auger cuttings and bentonite upon completion.						
9								231
10								230
11								229
12								228

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH (kPa): + Torvane + × QU/2 × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ 50 100 150 200

AECOM

LOGGED BY: Ryan Harras	COMPLETION DEPTH: 8.08 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 29/12/14
PROJECT ENGINEER: Paul Barsalou	Page 1 of 1

LOG OF TEST HOLE 60322119 - RM OF MORRIS_DRAFT.GPJ UMA WINN.GDT 6/2/15

PROJECT: Lowe Farm WTP- Expansion Cell	CLIENT: Rural Municipality of Morris	TESTHOLE NO: **TH14-02**
LOCATION: (14 U 603686 m N, 5468863 m E)		PROJECT NO.: 60322119
CONTRACTOR: Maple Leaf Drilling	METHOD: Track mounted SSA (125 mm)	ELEVATION (m): 239.84

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▨ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		TOPSOIL (0.18 m)						
		CLAY - silty, trace sand - brown, firm to stiff, moist - high plasticity - trace silt inclusions (< 12 mm in diameter) - trace gypsum - ground frozen to approximately 0.46 m	■	G1				239
1			■	G2				238
2			■	G3				237
3			⊠	S4	9		SPT Blows: 4, 4, 5	236
4			■	G5				235
5								234
6			⊠	S6	11		SPT Blows: 5, 5, 6	233
7			■	G7				232
8		END OF TEST HOLE AT 7.62 m IN CLAY. NOTES: 1. No sloughing was observed. 2. No seepage was observed. 3. Hole open to 7.62 m. 4. Test hole backfilled with auger cuttings and bentonite upon completion.						231
9								230
10								229
11								228
12								

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU/2 × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

AECOM

LOGGED BY: Ryan Harras	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 29/12/14
PROJECT ENGINEER: Paul Barsalou	Page 1 of 1

LOG OF TEST HOLE 60322119 - RM OF MORRIS_DRAFT.GPJ UMA WINN.GDT 6/2/15

PROJECT: Lowe Farm WTP- Expansion Cell	CLIENT: Rural Municipality of Morris	TESTHOLE NO: **TH14-03**
LOCATION: (14 U 603759 m N, 5468788 m E)		PROJECT NO.: 60322119
CONTRACTOR: Maple Leaf Drilling	METHOD: Track mounted SSA (125 mm)	ELEVATION (m): 239.63

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SLOTTED PIEZOMETER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0			TOPSOIL (0.15 m)						239
			CLAY - silty, trace sand - brown, firm to stiff, moist - high plasticity - trace silt inclusions (< 12 mm in diameter) - trace gypsum - ground frozen to approximately 0.61 m		G15				
1									238
					S16	7		SPT Blows: 3, 3, 4	
2					G17				237
3					G18				
4									236
					S19	9		SPT Blows: 4, 4, 5	235
5									
6					G20				234
7									233
					G21				232
8			END OF TEST HOLE AT 7.62 m IN CLAY. NOTES: 1. No sloughing was observed. 2. No seepage was observed. 3. Hole open to 7.62 m. 4. Test hole backfilled with auger cuttings and bentonite upon completion. 5. Piezometer reading: January 27, 2015 - 7.07 m below ground surface						231
9									230
10									229
11									228
12									

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU/2 × | □ Lab Vane □ | △ Pocket Pen. △ | ☢ Field Vane ☢ (kPa) 50 100 150 200

LOG OF TEST HOLE 60322119 - RM OF MORRIS_DRAFT.GPJ UMA WINN.GDT 6/2/15

AECOM

LOGGED BY: Ryan Harras	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 29/12/14
PROJECT ENGINEER: Paul Barsalou	Page 1 of 1

PROJECT: Lowe Farm WTP- Expansion Cell	CLIENT: Rural Municipality of Morris	TESTHOLE NO: **TH14-04**
LOCATION: (14 U 603841 m N, 5468718 m E)		PROJECT NO.: 60322119
CONTRACTOR: Maple Leaf Drilling	METHOD: Track mounted SSA (125 mm)	ELEVATION (m): 239.94

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▨ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU/2 × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0		TOPSOIL (0.13 m)							
		CLAY - silty, trace sand - brown, firm to stiff, moist - high plasticity - trace silt inclusions (< 30 mm in diameter) - trace gypsum - ground frozen to approximately 0.61 m	■	G29		●			239
1			■	G30		●			
2			■	G31		●			238
3			■	G32		●			237
4									236
5			⊠	S33	9	◆ ●		SPT Blows: 4, 4, 5	235
6			■	G34		●			234
7									233
8			⊠	S35	8	◆ ●		SPT Blows: 4, 3, 5	232
		END OF TEST HOLE AT 8.08 m IN CLAY. NOTES: 1. No sloughing was observed. 2. No seepage was observed. 3. Hole open to 8.08 m. 4. Test hole backfilled with auger cuttings and bentonite upon completion.							
9									231
10									230
11									229
12									228

AECOM

LOGGED BY: Ryan Harras	COMPLETION DEPTH: 8.08 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 29/12/14
PROJECT ENGINEER: Paul Barsalou	Page 1 of 1

LOG OF TEST HOLE 60322119 - RM OF MORRIS_DRAFT.GPJ UMA WINN.GDT 6/2/15

PROJECT: Lowe Farm WTP- Expansion Cell	CLIENT: Rural Municipality of Morris	TESTHOLE NO: **TH14-05**
LOCATION: (14 U 603684 m N, 5468710 m E)		PROJECT NO.: 60322119
CONTRACTOR: Maple Leaf Drilling	METHOD: Track mounted SSA (125 mm)	ELEVATION (m): 239.90

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▨ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		TOPSOIL (0.13 m)						
		CLAY - silty - brown, firm to stiff, moist - high plasticity - trace silt inclusions (< 12 mm in diameter) - trace gypsum - ground frozen to approximately 0.61 m	■	G43				239
1			■	G44				
2			■	G45				238
3			▨	S46	6		SPT Blows: 3, 3, 3	237
4								236
5			■	G47				235
6		- T48: Gravel 0%, Sand 0%, Silt 28.4%, Clay 71.6%	▥	T48			Tube Recovery: 100%	234
7								233
8			▨	S49	12		SPT Blows: 5, 5, 7	232
		END OF TEST HOLE AT 8.08 m IN CLAY. NOTES: 1. No sloughing was observed. 2. No seepage was observed. 3. Hole open to 8.08 m. 4. Test hole backfilled with auger cuttings and bentonite upon completion.						
9								231
10								230
11								229
12								228

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU/2 × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

LOG OF TEST HOLE 60322119 - RM OF MORRIS_DRAFT.GPJ UMA WINN.GDT 6/2/15

AECOM

LOGGED BY: Ryan Harras	COMPLETION DEPTH: 8.08 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 29/12/14
PROJECT ENGINEER: Paul Barsalou	Page 1 of 1

PROJECT: Lowe Farm WTP- Expansion Cell	CLIENT: Rural Municipality of Morris	TESTHOLE NO: **TH14-06**
LOCATION: (14 U 603690 m N, 5468605 m E)		PROJECT NO.: 60322119
CONTRACTOR: Maple Leaf Drilling	METHOD: Track mounted SSA (125 mm)	ELEVATION (m): 241.02

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker ✳ | Dynamic Cone ◇ | SPT (Standard Pen Test) ◆ (Blows/300mm) | Total Unit Wt ■ (kN/m^3) | Plastic / MC / Liquid

UNDRAINED SHEAR STRENGTH (kPa): + Torvane + | × QU/2 × | □ Lab Vane □ | △ Pocket Pen. △ | Field Vane

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0		TOPSOIL (0.13 m)					
		CLAY - silty, trace sand - brown, firm to stiff, moist - high plasticity - trace silt inclusions (< 20 mm in diameter) - trace gypsum - ground frozen to approximately 0.76 m					
1				G50			240
				G51			
2							239
				G52			
3							238
				S53	7	SPT Blows: 3, 3, 4	
4							237
				T54		Tube Recovery: 95%	
5		- T54: Gravel 0%, Sand 1.2%, Silt 21.2%, Clay 77.6%					236
6							235
				S55	9	SPT Blows: 4, 4, 5	
7							234
				G56			
		END OF TEST HOLE AT 7.62 m IN CLAY. NOTES: 1. No sloughing was observed. 2. No seepage was observed. 3. Hole open to 7.62 m. 4. Test hole backfilled with auger cuttings and bentonite upon completion.					
8							233
9							232
10							231
11							230
12							

AECOM

LOGGED BY: Ryan Harras	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 29/12/14
PROJECT ENGINEER: Paul Barsalou	Page 1 of 1

LOG OF TEST HOLE 60322119 - RM OF MORRIS_DRAFT.GPJ UMA WINN.GDT 6/2/15

PROJECT: Lowe Farm WTP- Expansion Cell	CLIENT: Rural Municipality of Morris	TESTHOLE NO: **TH14-07**
LOCATION: (14 U 603839 m N, 5468785 m E)		PROJECT NO.: 60322119
CONTRACTOR: Maple Leaf Drilling	METHOD: Track mounted SSA (125 mm)	ELEVATION (m): 239.65

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		TOPSOIL (0.13 m)						239
		CLAY - silty, trace sand - brown, firm to stiff, moist - high plasticity - trace silt inclusions (< 12 mm in diameter) - trace gypsum - ground frozen to approximately 0.46 m		G22				
1				G23				238
2				G24				237
3				S25	5		SPT Blows: 3, 2, 3	236
4				G26				235
5								234
6				S27	9		SPT Blows: 4, 5, 4	233
7				G28				232
8		END OF TEST HOLE AT 7.62 m IN CLAY. NOTES: 1. No sloughing was observed. 2. No seepage was observed. 3. Hole open to 7.62 m. 4. Test hole backfilled with auger cuttings and bentonite upon completion.						231
9								230
10								229
11								228
12								

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU/2 × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

AECOM

LOGGED BY: Ryan Harras	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 29/12/14
PROJECT ENGINEER: Paul Barsalou	Page 1 of 1

LOG OF TEST HOLE 60322119 - RM OF MORRIS_DRAFT.GPJ UMA WINN.GDT 6/2/15

PROJECT: Lowe Farm WTP- Expansion Cell	CLIENT: Rural Municipality of Morris	TESTHOLE NO: **TH14-08**
LOCATION: (14 U 603764 m N, 5468713 m E)		PROJECT NO.: 60322119
CONTRACTOR: Maple Leaf Drilling	METHOD: Track mounted SSA (125 mm)	ELEVATION (m): 239.97

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		TOPSOIL (0.10 m)						
		CLAY - silty, trace sand - brown, firm to stiff, moist - high plasticity - trace silt inclusions (< 12 mm in diameter) - trace gypsum - ground frozen to approximately 0.61 m	■	G36				
1								239
			☒	S37	9		SPT Blows: 5, 4, 5	
2			■	G38				238
3			■	G39				237
4								236
			☒	S40	10		SPT Blows: 4, 5, 5	
5								235
6			■	G41				234
7								233
			■	G42				
		END OF TEST HOLE AT 7.62 m IN CLAY.						
8		NOTES: 1. No sloughing was observed. 2. No seepage was observed. 3. Hole open to 7.62 m. 4. Test hole backfilled with auger cuttings and bentonite upon completion.						232
9								231
10								230
11								229
12								

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU/2 × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

LOG OF TEST HOLE 60322119 - RM OF MORRIS_DRAFT.GPJ UMA WINN.GDT 6/2/15

AECOM

LOGGED BY: Ryan Harras	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 29/12/14
PROJECT ENGINEER: Paul Barsalou	Page 1 of 1

APPENDIX C
Laboratory Testing Results

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

Memorandum

To	Omer Eissa	Page	1
CC			
Subject	Lowe Farm Lagoon – Materials Testing Results		
From	Faris Khalil		
Date	January 27, 2014	Project Number	60322119.0400

Please find attached the following material test result(s) on sample(s) submitted to the Winnipeg Geotechnical Laboratory:

- Fifty-three (53) Moisture Content tests.
- Four (4) Atterberg Limits (3 points) tests.
- Three (3) Grain Size Distribution (hydrometer method) tests.
- Three (3) Torvane, Pocket Penetrometer, Moisture Content, Bulk Density and Visual Description with Unconfined Compressive Strength, on Shelby tube samples.
- One (1) Flexible Wall Permeameter test.

If you have any questions, please contact the undersigned.

Sincerely,

for **Faris Khalil, M.Sc., PMP, P.Eng.**
Manager, Geotechnical Engineering

Att.

AECOM Canada Ltd.
Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

Project Name:	Lowe Farm Lagoon	Supplier:	
Project Number:	60322119	Specification:	N/A
Client:	RM of Morris	Field Technician:	RHarras
Sample Location:	Morris, Mb.	Sample Date:	Varies
Sample Depth:	Varies	Lab Technician:	EManimbao
Sample Number:	Varies	Date Tested:	January 13, 2015

Moisture Content (ASTM D2216-10)

Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Location	Sample	Depth (m)	Moisture Content (%)
TH14-02	G1	0.76 - 0.91 m	**30.0**
	G2	1.52 - 1.68 m	**35.0**
	G3	2.29 - 2.44 m	**44.2**
	S4	3.05 - 3.51 m	**45.1**
	G5	4.57 - 4.72 m	**42.3**
	S6	6.10 - 6.55 m	**42.8**
	G7	7.62 - 7.77 m	**45.6**
TH14-01	G8	0.76 - 0.91 m	**26.8**
	G9	1.52 - 1.68 m	**31.5**
	G10	2.29 - 2.44 m	**44.3**
	S12	4.57 - 5.03 m	**44.5**
	G13	6.10 - 6.25 m	**44.4**
	S14	7.62 - 8.08 m	**44.2**
TH14-03	G15	0.76 - 0.91 m	**34.1**
	S16	1.52 - 1.98 m	**30.9**
	G17	2.29 - 2.44 m	**47.9**
	G18	3.05 - 3.20 m	**44.5**
	S19	4.57 - 5.03 m	**43.6**
	G20	6.10 - 6.25 m	**43.7**
	G21	7.62 - 7.77 m	**41.7**
TH14-07	G22	0.76 - 0.91 m	**31.9**
	G23	1.52 - 1.68 m	**34.4**
	G24	2.29 - 2.44 m	**47.8**
	S25	3.05 - 3.51 m	**44.9**
	G26	4.57 - 4.72 m	**42.9**
	S27	6.10 - 6.55 m	**40.6**
	G28	7.62 - 1.52 m	**40.7**
TH14-04	G29	0.76 - 0.91 m	**30.9**
	G30	1.52 - 1.68 m	**27.9**
	G31	2.29 - 2.44 m	**39.6**
	G32	3.05 - 3.20 m	**41.4**
	S33	4.57 - 5.03 m	**38.9**
	G34	6.10 - 6.25 m	**46.4**
	S35	7.62 - 8.08 m	**45.3**
TH14-08	G36	0.76 - 0.91 m	**34.1**
	S37	1.52 - 1.98 m	**32.8**
	G38	2.29 - 2.44 m	**34.2**
	G39	3.05 - 3.20 m	**40.5**

Location	Sample	Depth (m)	Moisture Content (%)
	S40	4.57 - 3.05 m	**36.0**
	G41	6.10 - 6.25 m	**43.8**
	G42	7.62 - 7.77 m	**40.2**
TH14-05	G43	0.76 - 0.91 m	**31.6**
	G44	1.52 - 1.68 m	**32.9**
	G45	2.29 - 2.44 m	**41.0**
	S46	3.05 - 3.51 m	**43.5**
	G47	4.57 - 4.72 m	**42.8**
	S49	7.62 - 8.08 m	**40.9**
TH14-06	G50	0.76 - 0.91 m	**31.5**
	G51	1.52 - 1.68 m	**34.4**
	G52	2.29 - 2.44 m	**41.4**
	S53	3.05 - 3.51 m	**46.7**
	S55	6.10 - 6.55 m	**44.9**
	G56	7.62 - 7.77 m	**44.5**

AECOM Canada Ltd.
Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

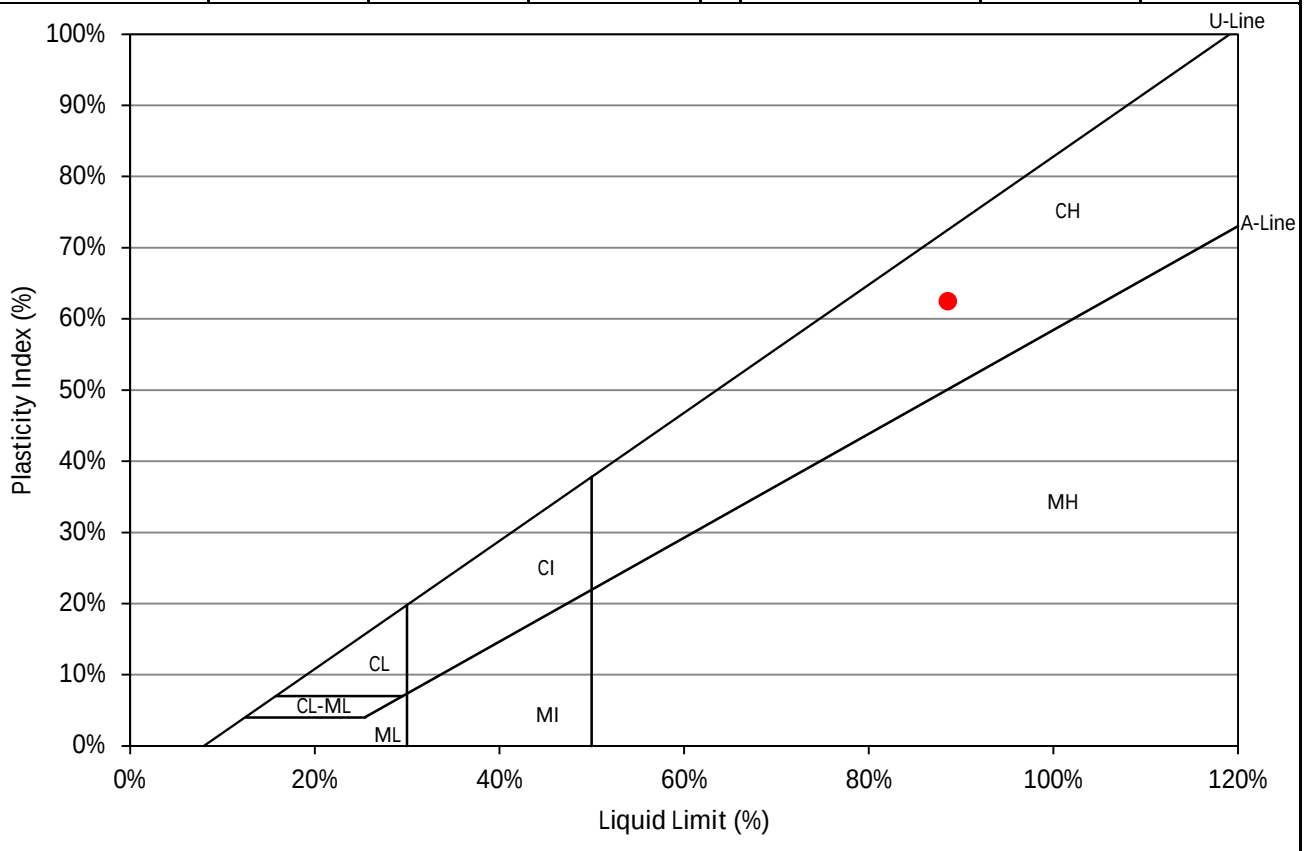
Project Name:	Lowe Farm Lagoon	Supplier:	AECOM
Project Number:	60322119	Specification:	N/A
Client:	RM of Morris	Field Technician:	RHarras
Sample Location:	TH14-02	Sample Date:	December 2014
Sample Depth:	2.29 - 2.44 m	Lab Technician:	EManimbao
Sample Number:	G3	Date Tested:	January 21, 2015

Atterberg Limits (ASTM D4318)

Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Liquid Limit			
Blows	31	26	21
Wet Sample (g)	9.5	8.8	11.5
Dry Sample (g)	5.1	4.7	6.1
Water Content (%)	87.4%	88.0%	89.9%

Plastic Limit		
Trial	1	2
Wet Sample (g)	7.6	6.7
Dry Sample (g)	6.0	5.3
Water Content (%)	26.0%	26.2%



Liquid Limit (%): 88.6%	Plastic Limit (%): 26.1%	Plasticity Index (%): 62.4%

AECOM Canada Ltd.
Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

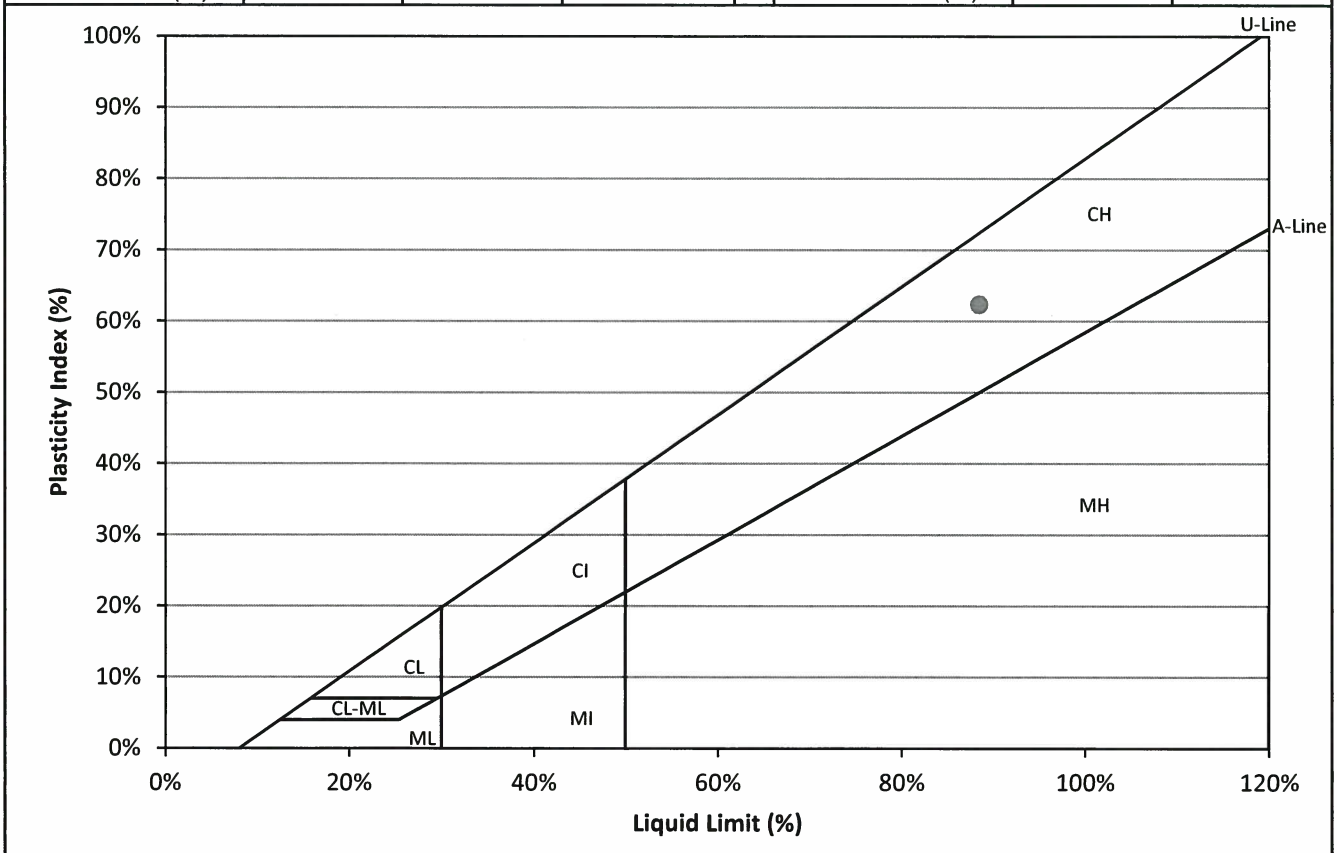
Project Name:	Lowe Farm Lagoon	Supplier:	AECOM
Project Number:	60322119	Specification:	N/A
Client:	RM of Morris	Field Technician:	RHarras
Sample Location:	TH14-01	Sample Date:	December 2014
Sample Depth:	3.05 - 3.66 m	Lab Technician:	EManimbao
Sample Number:	T11	Date Tested:	January 21, 2015

Atterberg Limits (ASTM D4318)

Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Liquid Limit			
Blows	33	29	20
Wet Sample (g)	7.3	7.8	9.9
Dry Sample (g)	4.0	4.2	5.2
Water Content (%)	85.7%	87.6%	89.9%

Plastic Limit		
Trial	1	2
Wet Sample (g)	7.6	6.7
Dry Sample (g)	6.0	5.3
Water Content (%)	26.0%	26.2%



Liquid Limit (%): 88.4%	Plastic Limit (%): 26.1%	Plasticity Index (%): 62.3%

AECOM Canada Ltd.
Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

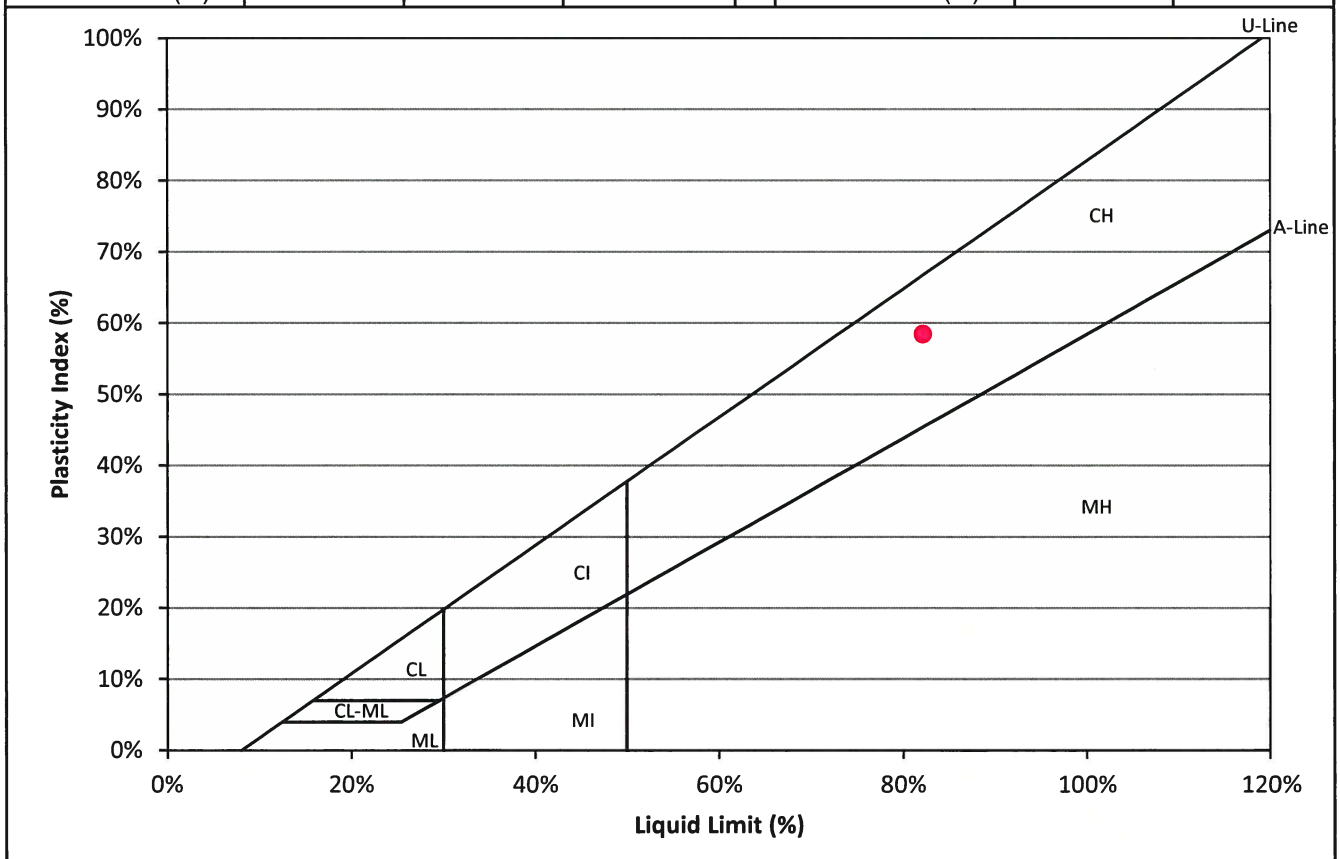
Project Name:	Lowe Farm Lagoon	Supplier:	AECOM
Project Number:	60221587	Specification:	N/A
Client:	RM of Morris	Field Technician:	AKaluzniak
Sample Location:	TH14-05	Sample Date:	December 2015
Sample Depth:	6.10 - 6.71 m	Lab Technician:	EManimbao
Sample Number:	T48	Date Tested:	January 22, 2015

Atterberg Limits (ASTM D4318)

Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Liquid Limit			
Blows	31	28	24
Wet Sample (g)	9.7	9.4	9.4
Dry Sample (g)	5.4	5.2	5.2
Water Content (%)	79.8%	80.9%	82.7%

Plastic Limit		
Trial	1	2
Wet Sample (g)	6.6	6.6
Dry Sample (g)	5.3	5.4
Water Content (%)	24.0%	23.6%



Liquid Limit (%): 82.2%	Plastic Limit (%): 23.8%	Plasticity Index (%): 58.4%

AECOM Canada Ltd.
Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

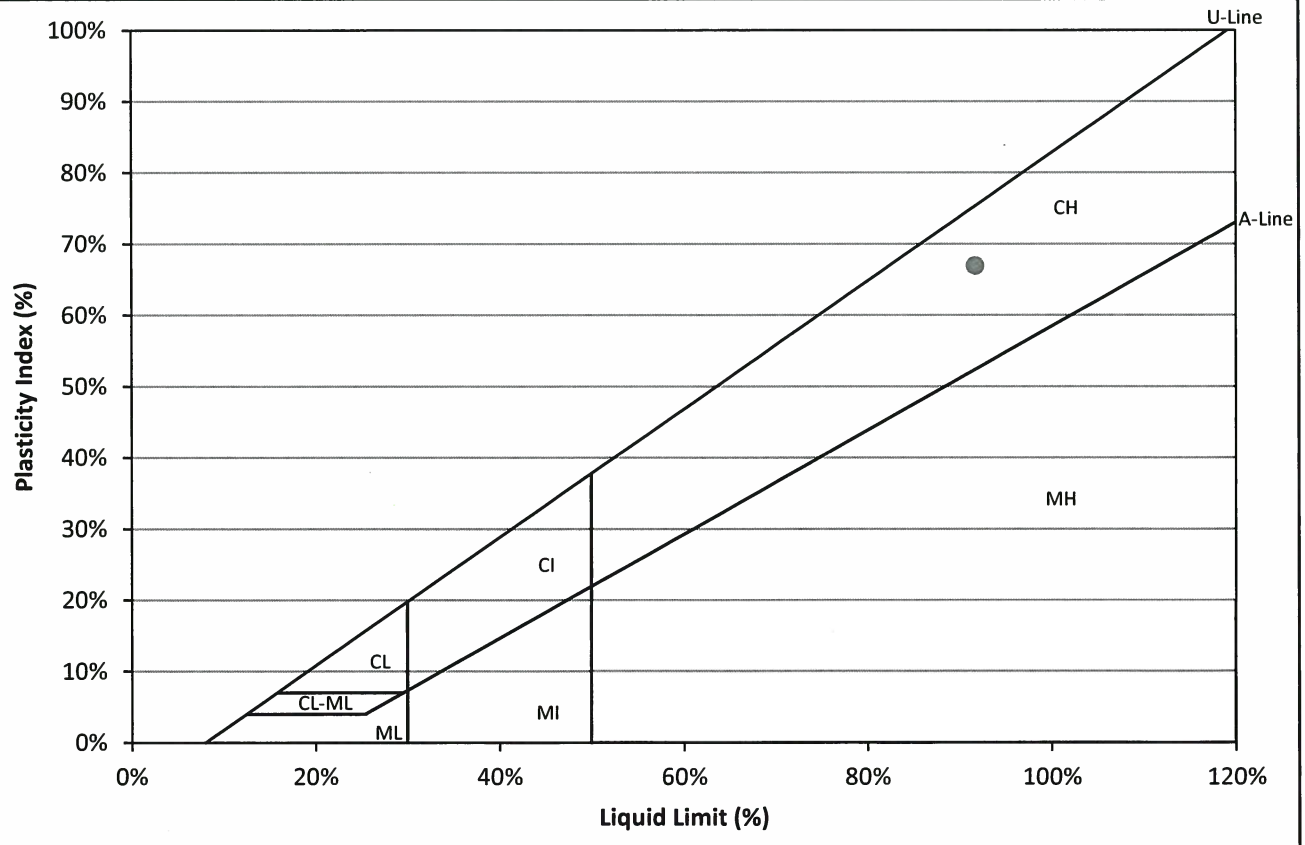
Project Name:	Lowe Farm Lagoon	Supplier:	AECOM
Project Number:	60322119	Specification:	N/A
Client:	RM of Morris	Field Technician:	RHarras
Sample Location:	TH14-06	Sample Date:	December 2014
Sample Depth:	4.57 - 5.18 m	Lab Technician:	EManimbao
Sample Number:	T54	Date Tested:	January 22, 2015

Atterberg Limits (ASTM D4318)

Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Liquid Limit			
Blows	34	25	16
Wet Sample (g)	7.7	8.0	8.5
Dry Sample (g)	4.1	4.2	4.4
Water Content (%)	90.0%	92.1%	94.0%

Plastic Limit		
Trial	1	2
Wet Sample (g)	6.6	5.9
Dry Sample (g)	5.3	4.7
Water Content (%)	24.5%	25.0%



Liquid Limit (%): 91.7%	Plastic Limit (%): 24.7%	Plasticity Index (%): 66.9%

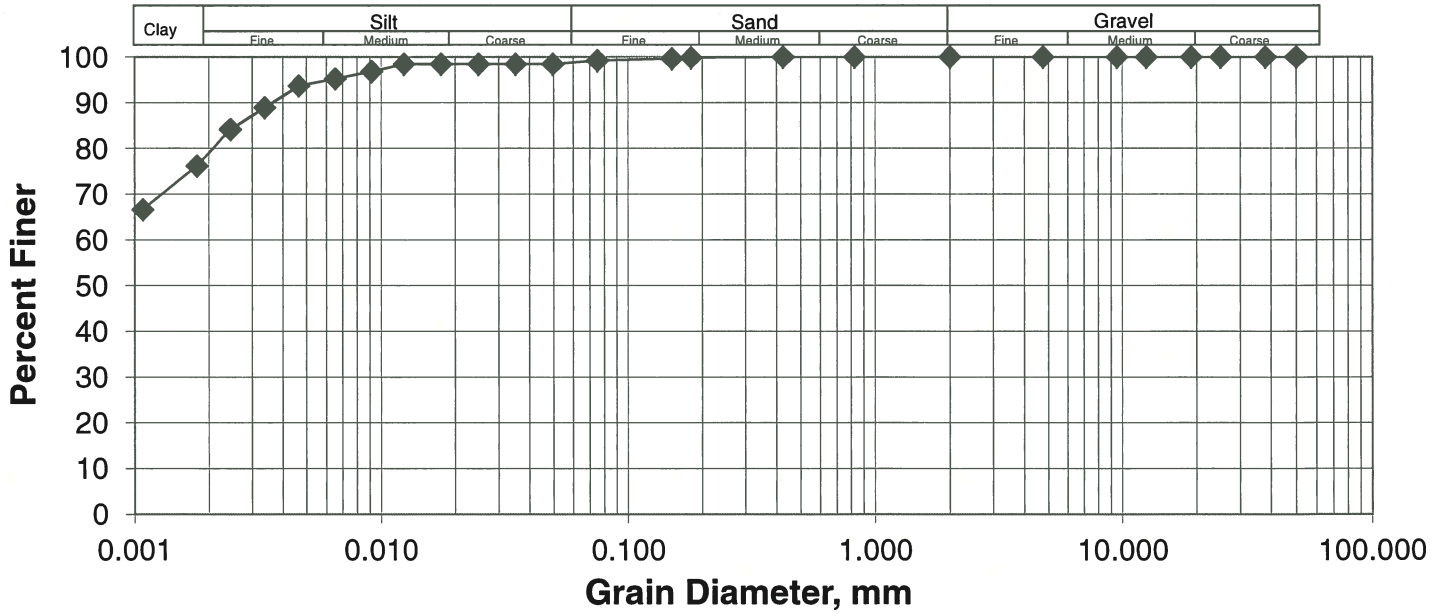
GRAIN SIZE DISTRIBUTION
(ASTM D422-63)

AECOM
MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

Job No.:	60322119	Hole No.:	TH14-01
Client:	Dillon Consulting	Sample No.:	T11
Project :	Lowe Farm Lagoon	Depth:	3.05 - 3.66 m
Date Tested:	22-Jan-15	Date Sampled:	
Tested By:	MLotecki	Sampled By:	AECOM (RHarras)

GRAVEL SIZES		SAND SIZES		FINES	
Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing
50.0	100.0	2.00	100.0	0.0750	99.2
38.0	100.0	0.83	100.0	0.0496	98.4
25.0	100.0	0.43	100.0	0.0351	98.4
19.0	100.0	0.18	99.8	0.0248	98.4
12.5	100.0	0.15	99.6	0.0175	98.4
9.5	100.0	0.075	99.2	0.0124	98.4
4.75	100.0			0.0091	96.8
2.00	100.0			0.0065	95.2
				0.0047	93.6
				0.0034	88.9
				0.0024	84.1
				0.0018	76.2
				0.0011	66.6

GRAIN SIZE DISTRIBUTION CURVE



Gravel	**0.0%**	**Silt**	**20.1%**
Sand	**1.3%**	**Clay**	**78.7%**

** Note: Soil Classification based on Grain Size from Canadian Foundation Engineering Manual, 3rd edition (1992).

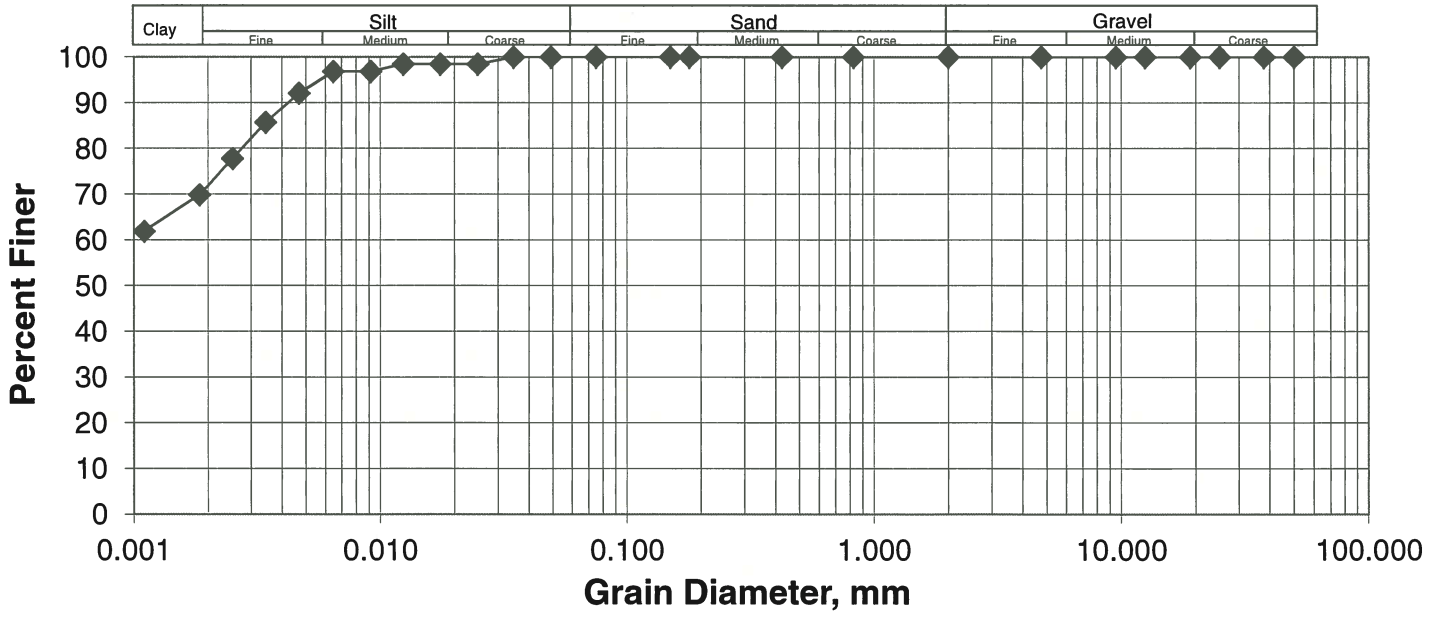
GRAIN SIZE DISTRIBUTION
(ASTM D422-63)

AECOM
MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

Job No.:	60322119	Hole No.:	TH14-05
Client:	Dillon Consulting	Sample No.:	T48
Project :	Lowe Farm Lagoon	Depth:	6.10 - 6.71 m
Date Tested:	22-Jan-15	Date Sampled:	
Tested By:	MLotecki	Sampled By:	AECOM (RHarras)

GRAVEL SIZES		SAND SIZES		FINES	
Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing
50.0	100.0	2.00	100.0	0.0750	100.0
38.0	100.0	0.83	100.0	0.0491	100.0
25.0	100.0	0.43	100.0	0.0347	100.0
19.0	100.0	0.18	100.0	0.0248	98.4
12.5	100.0	0.15	100.0	0.0175	98.4
9.5	100.0	0.075	100.0	0.0124	98.4
4.75	100.0			0.0091	96.8
2.00	100.0			0.0065	96.8
				0.0047	92.1
				0.0034	85.7
				0.0025	77.8
				0.0018	69.8
				0.0011	61.9

GRAIN SIZE DISTRIBUTION CURVE



Gravel	**0.0%**	**Silt**	**28.4%**
Sand	**0.0%**	**Clay**	**71.6%**

** Note: Soil Classification based on Grain Size from Canadian Foundation Engineering Manual, 3rd edition (1992).

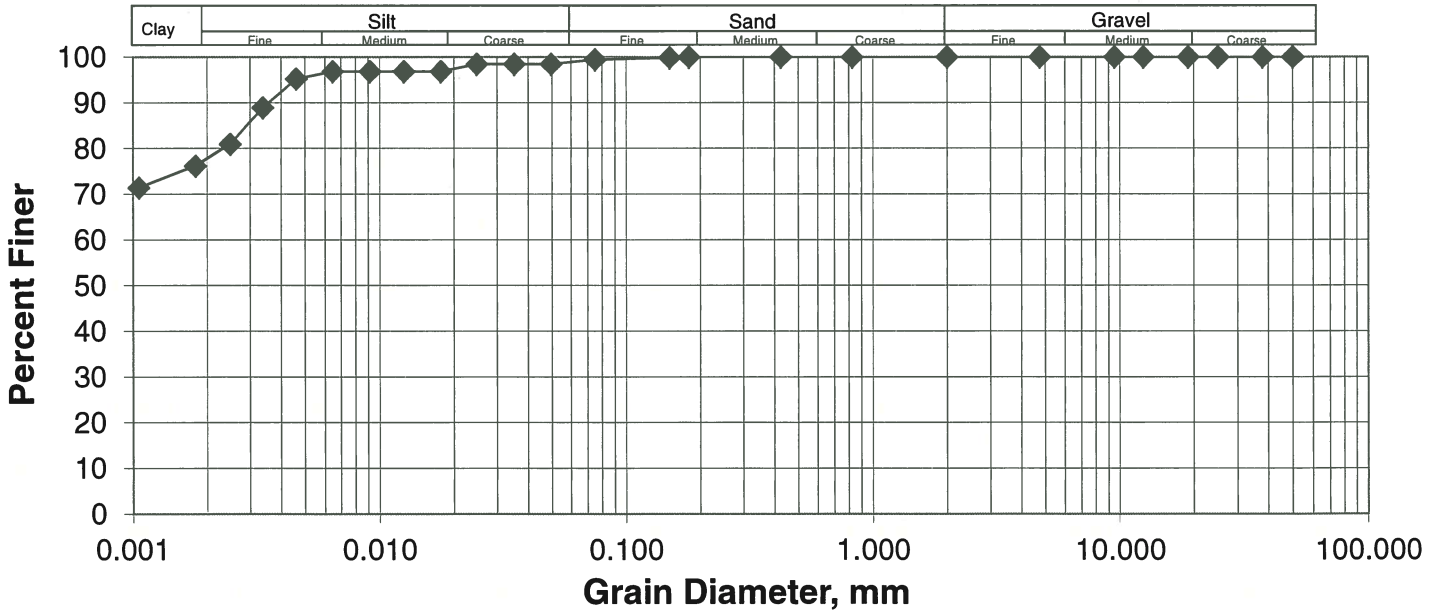
GRAIN SIZE DISTRIBUTION
(ASTM D422-63)

MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

Job No.:	60322119	Hole No.:	TH14-06
Client:	Dillon Consulting	Sample No.:	T54
Project :	Lowe Farm Lagoon	Depth:	4.57 - 5.18 m
Date Tested:	22-Jan-15	Date Sampled:	
Tested By:	MLotecki	Sampled By:	AECOM (RHarras)

GRAVEL SIZES		SAND SIZES		FINES	
Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing
50.0	100.0	2.00	100.0	0.0750	99.4
38.0	100.0	0.83	100.0	0.0496	98.4
25.0	100.0	0.43	100.0	0.0351	98.4
19.0	100.0	0.18	100.0	0.0248	98.4
12.5	100.0	0.15	99.8	0.0177	96.8
9.5	100.0	0.075	99.4	0.0125	96.8
4.75	100.0			0.0091	96.8
2.00	100.0			0.0065	96.8
				0.0046	95.2
				0.0034	88.9
				0.0025	80.9
				0.0018	76.2
				0.0011	71.4

GRAIN SIZE DISTRIBUTION CURVE



Gravel	**0.0%**	**Silt**	**21.2%**
Sand	**1.2%**	**Clay**	**77.6%**

** Note: Soil Classification based on Grain Size from Canadian Foundation Engineering Manual, 3rd edition (1992).

AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

CLIENT: RM of Morris
PROJECT: Lowe farm Lagoon
JOB NO.: 60322119

TEST HOLE NO.:	**TH14-01**
SAMPLE NO.:	**T11**
SAMPLE DEPTH:	3.05 - 3.66 m
DATE TESTED:	16-Jan-15
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.80
Vane Size (S, M, L)	M
Undrained Shear Strength (kPa)	**78.5**
Undrained Shear Strength (ksf)	1.64
POCKET PENETROMETER	
Reading - Qu (tsf)	1.50
Undrained Shear Strength (kPa)	**71.8**
Reading - Qu (tsf)	1.50
Undrained Shear Strength (kPa)	**71.8**
Reading - Qu (tsf)	1.50
Undrained Shear Strength (kPa)	**71.8**
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	**113.7**
Unconfined compressive strength (ksf)	**2.4**
Undrained Shear Strength (kPa)	**56.9**
Undrained Shear Strength (ksf)	**1.188**
MOISTURE CONTENT	
Tare Number	AB19
Wt. Sample wet + tare (g)	375.9
Wt. Sample dry + tare (g)	255.0
Wt. Tare (g)	8.4
Moisture Content %	**49.0**
BULK DENSITY	
Sample Wt. (g)	1085.4
Diameter 1 (cm)	7.16
Diameter 2 (cm)	7.18
Diameter 3 (cm)	7.20
Avg. Diameter (cm)	**7.18**
Length 1 (cm)	15.32
Length 2 (cm)	15.30
Length 3 (cm)	15.32
Avg. Length (cm)	**15.31**
Volume (cm^3)	620.0
Moisture content (%)	49.0
Bulk Density (g/cm^3)	1.751
Bulk Density (kN/m^3)	**17.2**
Bulk Density (pcf)	**109.3**
Dry Density (kN/m^3)	**11.52**

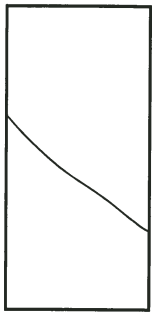
AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	RM of Morris
PROJECT:	Lowe farm Lagoon
JOB NO.:	60247924

TEST HOLE NO.:	TH14-01
SAMPLE NO.:	T11
SAMPLE DEPTH:	3.05 - 3.66 m
SAMPLE DATE:	February, 2014
TEST DATE:	16-Jan-15

SOIL DESCRIPTION:	
CLAY; silty, trace silt inclusions, brown, moist, firm, homogeneous, high plasticity	
MOISTURE CONTENT:	49.0



FAILURE SKETCH

SAMPLE DIAM.(Do):	71.80	(mm)	INITIAL AREA, Ao:	4048.9	(mm^2)
SAMPLE LENGTH, (Lo):	153.13	(mm)	PISTON RATE:	0.0602	(inches / minute)
L / D RATIO:	2.13	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	1.00	(0.5<R<2 % / minute)

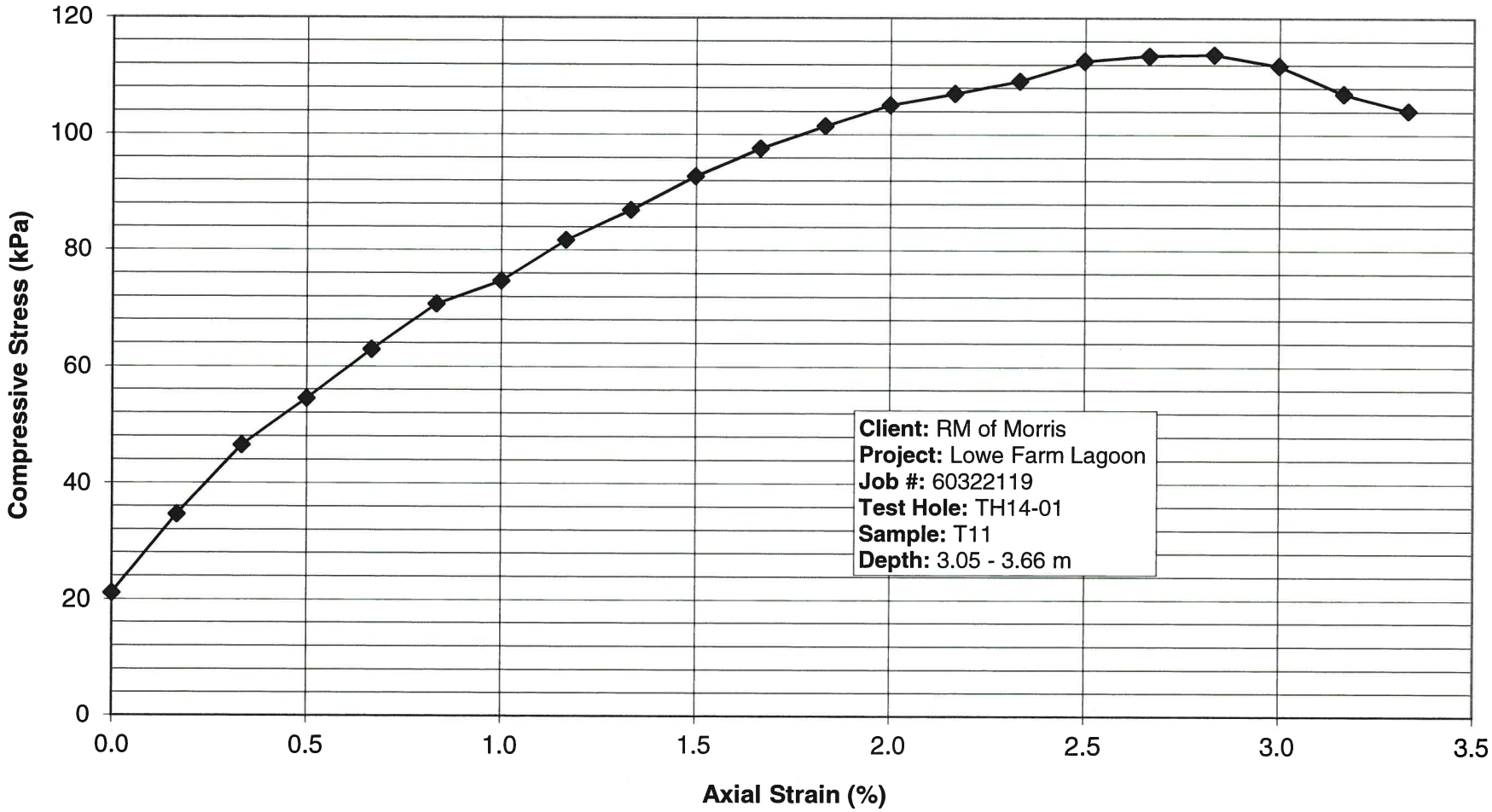
TEST DATA - DIAL READINGS

AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, E_1	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	(inches2)	(lbs)	(psi)	(ksf)	(kPa)
0.01	0.0021	0.00	6.28	19.21	3.06	0.441	21.1
0.02	0.0034	0.17	6.29	31.58	5.02	0.723	34.6
0.03	0.0045	0.33	6.30	42.45	6.74	0.971	46.5
0.04	0.0053	0.50	6.31	49.85	7.90	1.138	54.5
0.05	0.0062	0.67	6.32	57.63	9.12	1.313	62.9
0.06	0.0069	0.83	6.33	64.93	10.26	1.478	70.7
0.07	0.0073	1.00	6.34	68.68	10.83	1.560	74.7
0.08	0.0080	1.17	6.35	75.24	11.85	1.706	81.7
0.09	0.0086	1.33	6.36	80.21	12.61	1.816	86.9
0.10	0.0092	1.50	6.37	85.74	13.46	1.938	92.8
0.11	0.0096	1.67	6.38	90.33	14.15	2.038	97.6
0.12	0.0100	1.83	6.39	94.07	14.72	2.119	101.5
0.13	0.0104	2.00	6.40	97.64	15.25	2.195	105.1
0.14	0.0106	2.16	6.41	99.60	15.53	2.236	107.1
0.15	0.0109	2.33	6.43	101.76	15.84	2.280	109.2
0.16	0.0112	2.50	6.44	105.13	16.33	2.352	112.6
0.17	0.0113	2.66	6.45	106.16	16.47	2.371	113.5
0.18	0.0114	2.83	6.46	106.54	16.50	2.375	113.7
0.19	0.0112	3.00	6.47	104.94	16.22	2.336	111.8
0.20	0.0107	3.16	6.48	100.63	15.53	2.236	107.1
0.21	0.0105	3.33	6.49	98.10	15.11	2.176	104.2

UNCONFINED COMPRESSIVE STRENGTH, q_u:	113.73	kPa
(based on maximum q_u value)	2.375	ksf
UNDRAINED SHEAR STRENGTH, S_u:	56.87	kPa
(based on maximum q_u value)	1.188	ksf

NOTES:

AECOM
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
(ASTM D2166)



AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

CLIENT: RM of Morris
PROJECT: Lowe farm Lagoon
JOB NO.: 60322119

TEST HOLE NO.:	**TH14-05**
SAMPLE NO.:	**T48**
SAMPLE DEPTH:	6.10 - 6.71 m
DATE TESTED:	20-Jan-15
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.90
Vane Size (S, M, L)	M
Undrained Shear Strength (kPa)	**88.3**
Undrained Shear Strength (ksf)	1.84
POCKET PENETROMETER	
Reading - Qu (tsf)	2.25
Undrained Shear Strength (kPa)	**107.7**
Reading - Qu (tsf)	2.50
Undrained Shear Strength (kPa)	**119.7**
Reading - Qu (tsf)	2.50
Undrained Shear Strength (kPa)	**119.7**
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	**110.7**
Unconfined compressive strength (ksf)	**2.3**
Undrained Shear Strength (kPa)	**55.4**
Undrained Shear Strength (ksf)	**1.156**
MOISTURE CONTENT	
Tare Number	E39
Wt. Sample wet + tare (g)	457.8
Wt. Sample dry + tare (g)	322.6
Wt. Tare (g)	10.0
Moisture Content %	**43.3**
BULK DENSITY	
Sample Wt. (g)	1138.2
Diameter 1 (cm)	7.22
Diameter 2 (cm)	7.20
Diameter 3 (cm)	7.22
Avg. Diameter (cm)	**7.21**
Length 1 (cm)	15.31
Length 2 (cm)	15.32
Length 3 (cm)	15.30
Avg. Length (cm)	**15.31**
Volume (cm^3)	625.7
Moisture content (%)	43.3
Bulk Density (g/cm^3)	1.819
Bulk Density (kN/m^3)	**17.8**
Bulk Density (pcf)	**113.6**
Dry Density (kN/m^3)	**12.45**

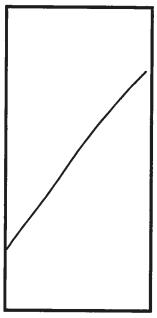
AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	RM of Morris
PROJECT:	Lowe farm Lagoon
JOB NO.:	60247924

TEST HOLE NO.:	TH14-05
SAMPLE NO.:	T48
SAMPLE DEPTH:	6.10 - 6.71 m
SAMPLE DATE:	
TEST DATE:	20-Jan-15

SOIL DESCRIPTION:	
CLAY; silty, trace sulphate seams, trace oxidation, brown, moist, firm,	
blocky, high plasticity	
MOISTURE CONTENT:	43.3



FAILURE SKETCH

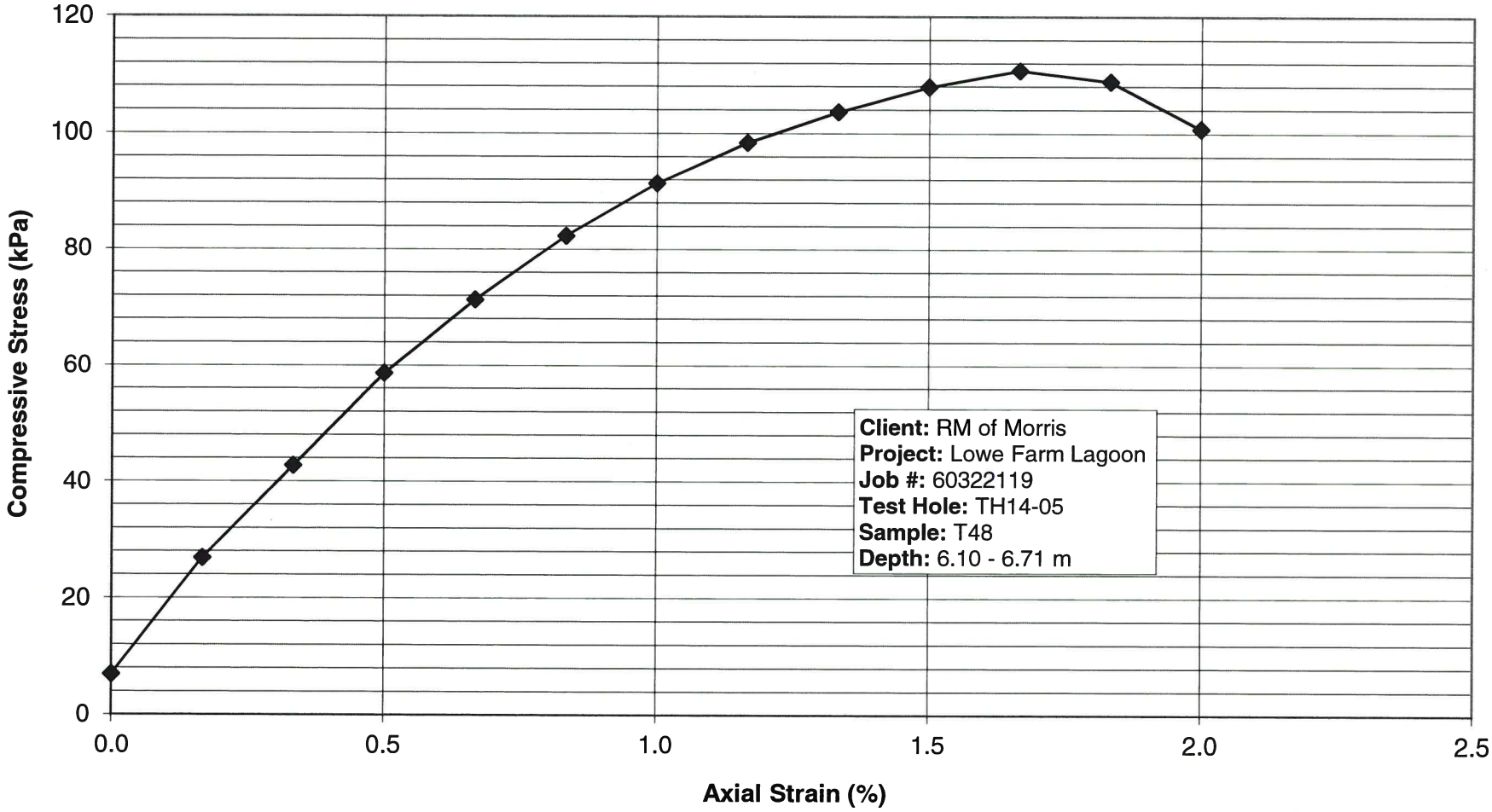
SAMPLE DIAM.(Do):	72.13	(mm)	INITIAL AREA, Ao:	4086.6	(mm^2)
SAMPLE LENGTH, (Lo):	153.10	(mm)	PISTON RATE:	0.0602	(inches / minute)
L / D RATIO:	2.12	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	1.00	(0.5<R<2 % / minute)

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, E_1	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	(inches2)	(lbs)	(psi)	(ksf)	(kPa)
0.01	0.0007	0.00	6.33	6.37	1.01	0.145	6.9
0.02	0.0026	0.17	6.34	24.74	3.90	0.561	26.9
0.03	0.0042	0.33	6.36	39.35	6.19	0.892	42.7
0.04	0.0058	0.50	6.37	54.16	8.51	1.225	58.7
0.05	0.0070	0.67	6.38	65.96	10.34	1.490	71.3
0.06	0.0081	0.83	6.39	76.27	11.94	1.719	82.3
0.07	0.0091	1.00	6.40	84.80	13.25	1.909	91.4
0.08	0.0098	1.17	6.41	91.45	14.27	2.055	98.4
0.09	0.0103	1.33	6.42	96.51	15.03	2.165	103.7
0.10	0.0107	1.50	6.43	100.63	15.65	2.253	107.9
0.11	0.0110	1.67	6.44	103.44	16.06	2.313	110.7
0.12	0.0109	1.83	6.45	101.85	15.78	2.273	108.8
0.13	0.0101	2.00	6.46	94.45	14.61	2.104	100.8

UNCONFINED COMPRESSIVE STRENGTH, q_u:	110.72	kPa
(based on maximum q_u value)	2.313	ksf
UNDRAINED SHEAR STRENGTH, S_u:	55.36	kPa
(based on maximum q_u value)	1.156	ksf

NOTES:

AECOM
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
(ASTM D2166)



AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

CLIENT: RM of Morris
PROJECT: Lowe farm Lagoon
JOB NO.: 60322119

TEST HOLE NO.:	**TH14-06**
SAMPLE NO.:	**T54**
SAMPLE DEPTH:	4.57 - 5.18 m
DATE TESTED:	20-Jan-15
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.95
Vane Size (S, M, L)	M
Undrained Shear Strength (kPa)	**93.2**
Undrained Shear Strength (ksf)	1.95
POCKET PENETROMETER	
Reading - Qu (tsf)	1.75
Undrained Shear Strength (kPa)	**83.8**
Reading - Qu (tsf)	1.50
Undrained Shear Strength (kPa)	**71.8**
Reading - Qu (tsf)	1.75
Undrained Shear Strength (kPa)	**83.8**
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	**69.2**
Unconfined compressive strength (ksf)	**1.4**
Undrained Shear Strength (kPa)	**34.6**
Undrained Shear Strength (ksf)	**0.723**
MOISTURE CONTENT	
Tare Number	AK20
Wt. Sample wet + tare (g)	396.4
Wt. Sample dry + tare (g)	268.1
Wt. Tare (g)	8.1
Moisture Content %	**49.3**
BULK DENSITY	
Sample Wt. (g)	1084.6
Diameter 1 (cm)	7.22
Diameter 2 (cm)	7.20
Diameter 3 (cm)	7.23
Avg. Diameter (cm)	**7.22**
Length 1 (cm)	15.34
Length 2 (cm)	15.33
Length 3 (cm)	15.34
Avg. Length (cm)	**15.34**
Volume (cm^3)	627.3
Moisture content (%)	49.3
Bulk Density (g/cm^3)	1.729
Bulk Density (kN/m^3)	**17.0**
Bulk Density (pcf)	**107.9**
Dry Density (kN/m^3)	**11.35**

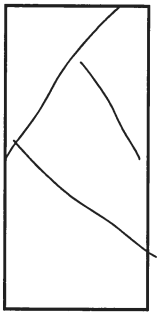
AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	RM of Morris
PROJECT:	Lowe farm Lagoon
JOB NO.:	60247924

TEST HOLE NO.:	TH14-06
SAMPLE NO.:	T54
SAMPLE DEPTH:	4.57 - 5.18 m
SAMPLE DATE:	
TEST DATE:	20-Jan-15

SOIL DESCRIPTION:	
CLAY; silty, trace sulphate seams, brown, moist, firm, homogeneous, high plasticity	
MOISTURE CONTENT:	49.3



FAILURE SKETCH

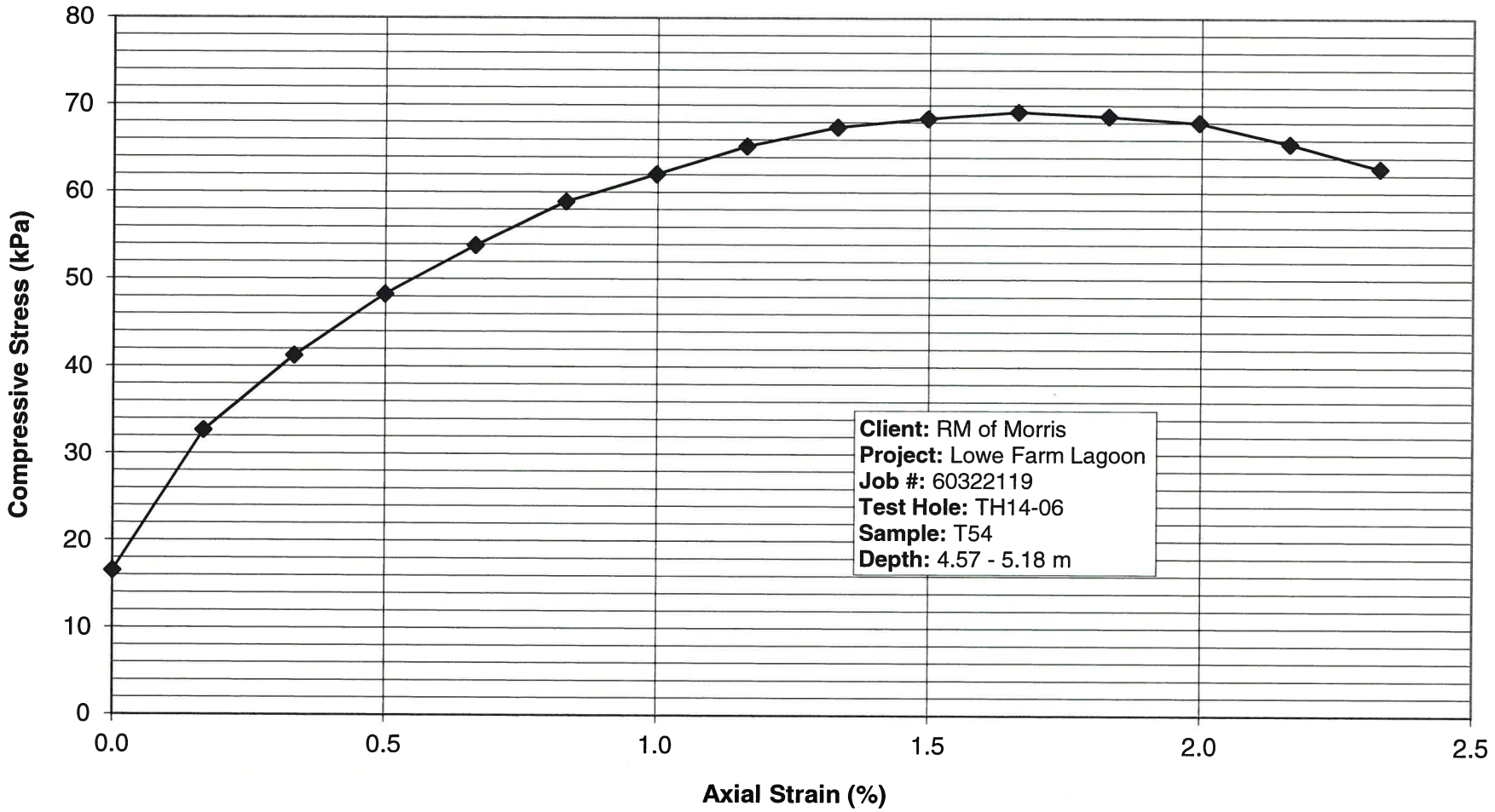
SAMPLE DIAM.(Do):	72.17	(mm)	INITIAL AREA, Ao:	4090.4	(mm^2)
SAMPLE LENGTH, (Lo):	153.37	(mm)	PISTON RATE:	0.0602	(inches / minute)
L / D RATIO:	2.13	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	1.00	(0.5<R<2 % / minute)

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, E_1	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	(inches2)	(lbs)	(psi)	(ksf)	(kPa)
0.01	0.0016	0.00	6.34	15.18	2.39	0.345	16.5
0.02	0.0032	0.17	6.35	30.08	4.74	0.682	32.7
0.03	0.0041	0.33	6.36	38.04	5.98	0.861	41.2
0.04	0.0048	0.50	6.37	44.60	7.00	1.008	48.3
0.05	0.0053	0.67	6.38	49.85	7.81	1.125	53.8
0.06	0.0058	0.83	6.39	54.63	8.54	1.230	58.9
0.07	0.0062	1.00	6.40	57.63	9.00	1.296	62.0
0.08	0.0065	1.16	6.41	60.72	9.47	1.363	65.3
0.09	0.0067	1.33	6.43	62.87	9.78	1.409	67.5
0.10	0.0068	1.50	6.44	63.90	9.93	1.430	68.5
0.11	0.0069	1.66	6.45	64.75	10.04	1.446	69.2
0.12	0.0069	1.83	6.46	64.37	9.97	1.435	68.7
0.13	0.0068	2.00	6.47	63.81	9.86	1.420	68.0
0.14	0.0066	2.16	6.48	61.65	9.51	1.370	65.6
0.15	0.0063	2.33	6.49	59.12	9.11	1.312	62.8

UNCONFINED COMPRESSIVE STRENGTH, q_u:	69.24	kPa
(based on maximum q_u value)	1.446	ksf
UNDRAINED SHEAR STRENGTH, S_u:	34.62	kPa
(based on maximum q_u value)	0.723	ksf

NOTES:

AECOM
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
(ASTM D2166)



AECOM Canada Ltd.
Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

Project Name:	Lowe Farm Lagoon	Supplier:	AECOM
Project Number:	60322119	Specification:	N/A
Client:	RM of Morris	Field Technician:	RHarras
Sample Location:	TH 14-01	Sample Date:	December 2014
Sample Depth:	3.05 - 3.66 m	Lab Technician:	MLotecki
Sample Number:	T11	Date Tested:	January 16-22, 2015

Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Material and Test Description

Material Description:
CLAY -silty, brown, firm, homogeneous, high plasticity

Test Type:	Constant Head
Mould Size:	Flexible Wall
Sample Source:	Shelby Tube Sample
Fluid Used:	Deaired Water
Fluid Reservoir:	Burrettes

Remoulding Details	
Max Dry Density (kg/m^3):	N/A
Proctor ID:	N/A
Percent Max (%):	N/A
Target Dry Density (kg/m^3):	N/A

Initial Sample Characteristics

Water Content	
Wet + Tare (g):	375.9
Dry + Tare (g):	255
Tare (g):	8.4
Water Content (%):	49.0%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	71.5	71.6	71.7	72	71.7
Length (mm):	57.2	57.4	57.4	57.2	57.3
Weight (g)	398.5				

Area (cm^2):	40.4
Volume (cm^3):	231.4
Wet Density (kg/m^3):	1,722.4
Dry Density (kg/m^3):	1,155.8

Specific Gravity (Note 2):	2.70
Void Ratio:	133.2%
Saturation:	99.2%
Porosity:	57.1%

Final Sample Characteristics

Water Content	
Wet + Tare (g):	418.1
Dry + Tare (g):	284.7
Tare (g):	8.2
Water Content (%):	48.2%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	72.3	72	72.1	72	72.1
Length (mm):	57.6	57.7	58	58	57.8
Weight (g)	410				

Area (cm^2):	40.8
Volume (cm^3):	236.1
Wet Density (kg/m^3):	1,736.6
Dry Density (kg/m^3):	1,171.5

Specific Gravity (Note 1):	2.70
Void Ratio:	130.1%
Saturation:	100.0%
Porosity:	56.5%

Note 1: Specific gravity for final sample characteristics calculation adjusted to result in 100.0% saturation.
Note 2: Specific gravity for initial sample characteristics calculation set equal to that of the final.

AECOM Canada Ltd.
Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

Project Name:	Lowe Farm Lagoon	Supplier:	AECOM
Project Number:	60322119	Specification:	N/A
Client:	RM of Morris	Field Technician:	RHarras
Sample Location:	TH 14-01	Sample Date:	December 2014
Sample Depth:	3.05 - 3.66 m	Lab Technician:	MLotecki
Sample Number:	T11	Date Tested:	January 16-22, 2015

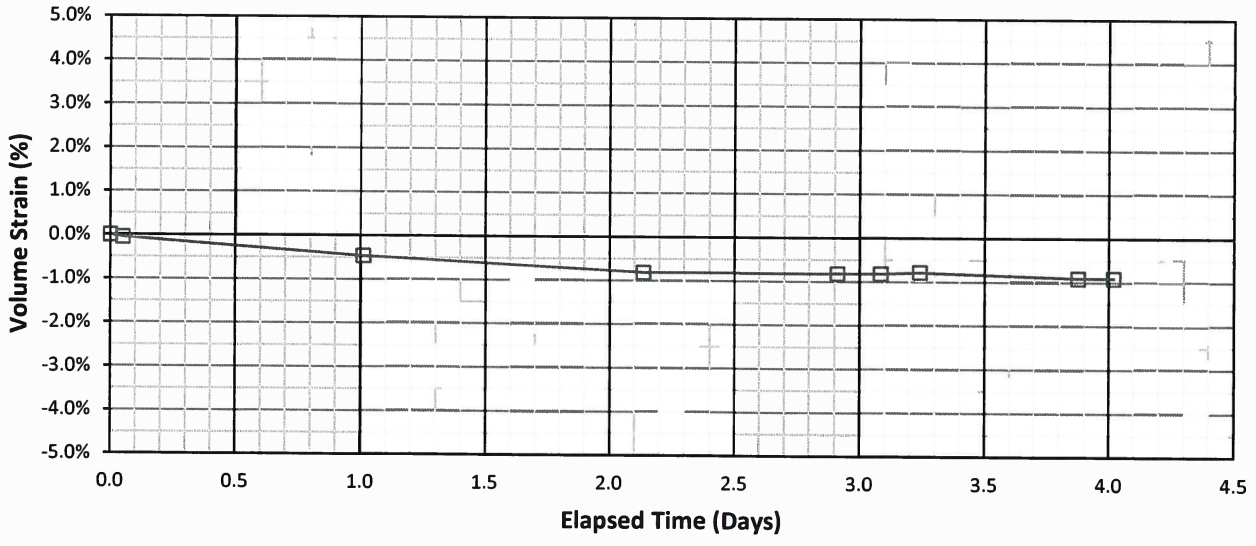
Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Consolidation Data

Cell Pressure (kPa):	172.4	Top Pressure (kPa):	137.9
Bottom Pressure (kPa):	137.9	Pressure Difference (kPa):	-

Date & Time	Elapsed Time (Days)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Cell (mL)	Total Vol. Change (mL)	Volume Strain (%)
1/16/15 10:43	0.00	22.9	3.36	3.3	19.4	0	0.00%
1/16/15 11:55	0.05	23.0	3.66	3.62	18.9	-0.12	-0.05%
1/17/15 11:00	1.01	23.5	4.74	4.7	17.7	-1.08	-0.47%
1/18/15 14:00	2.14	22.5	4.98	4.86	18.1	-1.88	-0.81%
1/19/15 8:35	2.91	23.5	5.06	4.9	18	-1.9	-0.82%
1/19/15 12:44	3.08	23.7	5.06	4.9	18	-1.9	-0.82%
1/19/15 16:30	3.24	23.4	5.08	4.9	17.9	-1.82	-0.79%
1/20/15 7:45	3.88	22.6	5.12	4.94	18.1	-2.1	-0.91%
1/20/15 11:12	4.02	23.6	5.12	4.94	18.1	-2.1	-0.91%
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-



AECOM Canada Ltd.
Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

Project Name:	Lowe Farm Lagoon	Supplier:	AECOM
Project Number:	60322119	Specification:	N/A
Client:	RM of Morris	Field Technician:	RHarras
Sample Location:	TH 14-01	Sample Date:	December 2014
Sample Depth:	3.05 - 3.66 m	Lab Technician:	MLotecki
Sample Number:	T11	Date Tested:	January 16-22, 2015

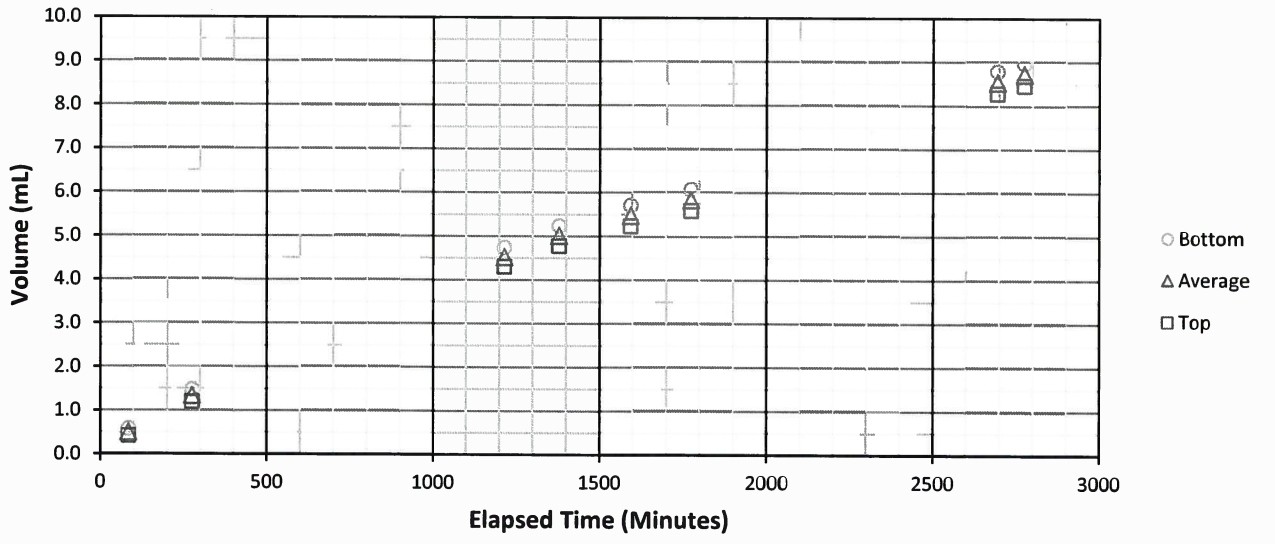
Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Permeation Data

Cell Pressure (kPa):	172.4	Top Pressure (kPa):	124.1
Bottom Pressure (kPa):	151.7	Pressure Difference (kPa):	27.6

Date & Time	Elapsed Time (Minutes)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Top Vol. Change (mL)	Bottom Vol. Change (mL)	Average Vol. Change (mL)
1/20/15 11:25	0	23.6	9.90	0.10	0.00	0.00	0.00
1/20/15 12:50	85	23.7	9.48	0.68	0.42	0.58	0.50
1/20/15 16:00	275	23.7	8.70	1.58	1.20	1.48	1.34
1/21/15 7:40	1215	22.3	5.60	4.84	4.30	4.74	4.52
1/21/15 10:23	1378	23.3	5.12	5.34	4.78	5.24	5.01
1/21/15 14:00	1595	23.3	4.66	5.80	5.24	5.70	5.47
1/21/15 16:59	1774	23.6	4.32	6.16	5.58	6.06	5.82
1/22/15 8:20	2695	22.7	1.62	8.88	8.28	8.78	8.53
1/22/15 9:40	2775	23.3	1.44	9.06	8.46	8.96	8.71
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-



AECOM Canada Ltd.
Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

Project Name:	Lowe Farm Lagoon	Supplier:	AECOM
Project Number:	60322119	Specification:	N/A
Client:	RM of Morris	Field Technician:	RHarras
Sample Location:	TH 14-01	Sample Date:	December 2014
Sample Depth:	3.05 - 3.66 m	Lab Technician:	MLotecki
Sample Number:	T11	Date Tested:	January 16-22, 2015

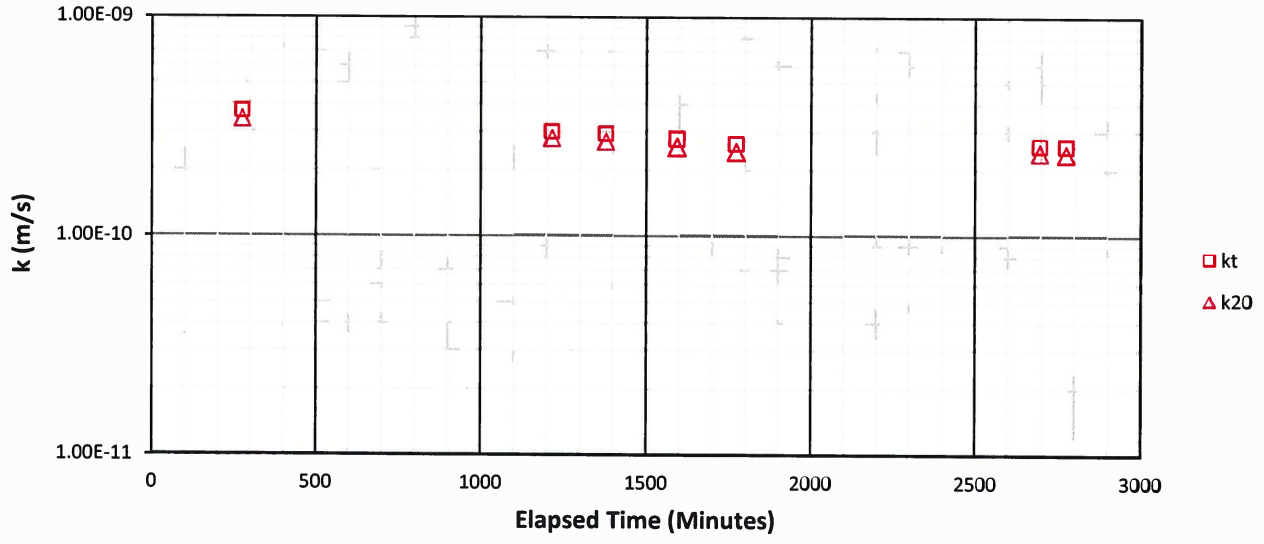
Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Permeation Data

Head Difference (m):	2.8	Area of Sample (m^2)	4.060E-03
Length of Sample (m):	5.756E-02	Gradient, i	4.884E+01

Elapsed Time (Minutes)	Average Volume Change (mL)	Average Temperature (°C)	k_t (m/s)	R_T	k_{20} (m/s)
275	1.34	23.7	3.716E-10	0.917	3.407E-10
1215	4.52	23.0	2.990E-10	0.932	2.787E-10
1378	5.01	23.5	2.932E-10	0.921	2.700E-10
1595	5.47	23.5	2.766E-10	0.921	2.548E-10
1774	5.82	23.6	2.647E-10	0.918	2.430E-10
2695	8.53	23.2	2.586E-10	0.928	2.400E-10
2775	8.71	23.5	2.565E-10	0.921	2.363E-10
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-



Appendix D
Wastewater System Classification

Water & Wastewater Facility Operators Certification Program

Manitoba Conservation

Application for Wastewater Treatment Facility Classification

also available online at http://www.manitoba.ca/certification

Please print clearly or type and follow the instructions on the application form.
NOTE: If using Adobe Reader text can be inserted into form and tab between fields.

This application is pursuant to the Water and Wastewater Facility Operators Regulation issued under The Environment Act.

Name of Facility:	Lowe Farm Lagoon
Name of Facility Owner: (Municipality/Commission/ Company/Individual/etc)	Rural Municipality of Morris
Civic Address of Facility:	Northwest corner of SW 1/4 of 5-5-1W
Mailing Address of Owner:	RM of Morris, Box 518, 207 Main Street, Morris, Manitoba

Postal Code:	R0G 1K0	Telephone:	(204) 746-7300
Contact Person:	Larry Driedger, CMMA	Position:	Chief Administrative Officer
Cell or Pager:		Fax: (204) 746-8801	Email: larry@rmofmorris.ca

Is this a REAPPLICATION? (●) Yes ( ) No

Please complete the following. The information provided will be used to classify the wastewater treatment facility under the Water and Wastewater Facility Operators Regulation. In some cases actual numbers or answers must be supplied, but in most cases it will only be necessary to check the appropriate criteria.

Forward the completed form to:

Director
Environmental Assessment & Licensing Branch
Manitoba Conservation
160 – 123 Main Street
Winnipeg MB R3C 1A5

Please direct questions to:

Certification Program Coordinator
Phone: (204) 945-7065
Fax: (204) 945-5229

FOR MANITOBA CONSERVATION USE ONLY

Operation ID # _____

Stakeholder ID # _____

Approval ID # _____

EO/DWO _____

Application for Wastewater Treatment Facility Classification

SYSTEM *(choose all that apply)*			
1.	New or proposed Facility seeking classification	☑	
	Proposed start of operations (month / year) 10/01/2016		
	Existing Facility seeking classification (in operation prior to December 31, 2005)	☐	
	Facility has been in operation since (approximate month/year)		
2.	The facility **WILL** employ mechanical treatment processes	○	
	The facility **WILL NOT** employ mechanical treatment processes	◉	

SIZE *(refer to Supplemental Information for point designation) (2 point minimum to 20 point maximum)*				
1.	Maximum population or part served, peak day	# 685		1-10
2.	Design flow average day **Estimated** or **Actual** (Circle volume option & units) ◉ ○ **OR** Peak month's flow average day **Estimated** or **Actual** ◉ ○	164 ◉ m^3/day ○ gal/day 247 ◉ m^3/day ○ gal/day		1-10

VARIATION IN RAW WASTE[1] *(choose all that apply) (0 point minimum to 6 point maximum)*			
1.	Variations do not exceed those normally or typically expected	☑	0
2.	Recurring deviations or excessive variations of 100-200% in strength	☐	2
	Recurring deviations or excessive variations of 100-200% in flow	☐	
	Recurring deviations or excessive variations of 100-200% in strength and flow	☐	
3.	Recurring deviations or excessive variations of more than 200% in strength	☐	4
	Recurring deviations or excessive variations of more than 200% in flow	☐	
	Recurring deviations or excessive variations of more than 200% in strength and flow	☐	
4.	Raw wastes subject to toxic waste discharges	☐	6
5.	Septage or truck-hauled waste discharge is accepted at the facility.	☑	0 - 4
	Estimated number of loads per day in peak haul times	4	

Application for Wastewater Treatment Facility Classification

PRELIMINARY TREATMENT *(choose all that apply)*			
1.	Facility pumping of main flow	☐	3
2.	Screening or comminution	☐	3
3.	Grit removal	☐	3
4.	Equalization	☐	1

PRIMARY TREATMENT *(choose all that apply)*			
1.	Clarifiers	☐	5
2.	Anaerobic treatment with biogas flare	☐	10
3.	Anaerobic treatment with biogas utilization facility	☐	15

SECONDARY TREATMENT *(choose all that apply)*			
1.	Fixed-film reactor	☐	10
2.	Activated sludge	☐	15
3.	Stabilization ponds without aeration (ie: sewage lagoon)	☑	5
4.	Stabilization ponds with aeration	☐	8

TERTIARY TREATMENT *(choose all that apply)*			
1.	Polishing ponds for advanced waste treatment	☐	2
2.	Chemical / physical advanced waste treatment without secondary treatment	☐	15
3.	Chemical / physical advanced waste treatment following secondary treatment	☐	10
4.	Biological or chemical / biological advanced waste treatment	☐	12
5.	Nitrification by designed extended aeration only	☐	5
6.	Ion exchange for advanced waste treatment	☐	10
7.	Reverse osmosis, electrodialysis and other membrane filtration techniques	☐	10
8.	Advanced waste treatment chemical recovery, carbon regeneration	☐	4

Application for Wastewater Treatment Facility Classification

9.	Media filtration	☐	5

ADDITIONAL TREATMENT PROCESSES *(choose all that apply)*			
1.	Chemical addition: *(Please list chemicals used, 2 pts per chemical to max. of 6)*	☐	0 - 6
2.	Dissolved air floatation (other than for sludge thickening)	☐	8
3.	Intermittent sand filter	☐	2
4.	Recirculating intermittent sand filter	☐	3
5.	Microscreens	☐	5
6.	Generation of oxygen	☐	5

SOLIDS HANDLING *(choose all that apply)*			
1.	Storage (other than for stabilization)	☐	2
2.	Stabilization by storage (including any storage afterwards)	☐	4
3.	Gravity thickening	☐	2
4.	Mechanical dewatering	☐	8
5.	Anaerobic digestion of solids	☐	10
6.	Utilization of digester gas for heating or cogeneration	☐	5
7.	Aerobic digestion of solids	☐	6
8.	Air-drying of sludge	☐	2
9.	Solids reduction (including incineration and wet oxidation)	☐	12
10.	Disposal in landfill	☐	2
11.	Solids composting	☐	10
12.	Land application of biosolids by contractor	☐	2
13.	Land application of biosolids by facility personnel	☐	10

Application for Wastewater Treatment Facility Classification

DISINFECTION *(choose all that apply) (0 point minimum to 10 point maximum)*			
1.	Chlorination	☐	5
	Ultraviolet irradiation	☐	
2.	Ozonization	☐	10

EFFLUENT DISCHARGE *(choose all that apply) (0 point minimum to 10 point maximum)*			
1.	Discharge to surface water (ditch or lake or _____)	☑	0
2.	Mechanical post-aeration	☐	2
3.	Direct recycling and reuse	☐	6
4.	Land treatment and surface or subsurface disposal		4

INSTRUMENTATION *(choose one) (0 point minimum to 6 point maximum)*			
1.	SCADA or similar instrumentation systems are used to provide:		
	• Data with no process operation	◉	0
	• Data with limited process operation	○	2
	• Data with moderate process operation	○	4
	• Data with extensive or total process operation	○	6

LABORATORY CONTROL[2] *(choose all that apply) (0 point minimum to 15 point maximum)*			
1.	Bacteriological / Biological *(0 point minimum to 5 point maximum)*		
	• Lab work done outside the facility	☑	0
	• Membrane filter procedures	☐	3
	• Use of fermentation tubes or any dilution method of fecal coliform determination	☐	5
2.	Chemical / Physical *(0 point minimum to 10 point maximum)*		
	• Lab work done outside the facility	☑	0

Application for Wastewater Treatment Facility Classification

	• Push button or visual methods for simple tests such as pH or settleable solids *(List tests)*	☐	3
	• Additional procedures such as DO, COD, BOD, gas analysis, titration, solids content or volatile content *(List tests)*	☐	5
	• More advanced determinations such as specific constituents, nutrients, total oils or phenols *(List tests)*	☐	7
	• Highly sophisticated instrumentation such as atomic absorption or gas chromatograph *(List tests)*	☐	10

APPLICANT VERIFICATION	
I HEREBY DECLARE THAT ALL INFORMATION IN THIS APPLICATION IS TRUE.	
Name of Applicant[3]: (Print) Paul Barsalou, P.Eng	
Title: Project Manager	
Telephone: (204) 477-5381	Fax: (204) 284-2040
Email: paul.barsalou@aecom.com	
Signature of Authorized Representative: Paul Barsalou	Date: 02/25/2016

[1]The key concepts are frequency or intensity of deviation, or excessive variation from normal or typical fluctuations. The deviations in strength, toxicity, ratio of infiltration to inflow, or shock loads.

[2] The key concept is to credit laboratory analyses done on-site by facility personnel under the direction of an operator-in-charge with points from 0-15.

[3] Applicant must be an authorized representative of the owner/operating authority (i.e. manager, P. Eng., or overall responsible operator).

Print Application Form

Wastewater Treatment Form Supplemental Information

This is supplemental information for completing the Application for Wastewater Treatment Facility Classification Form only.

For exact definitions and text refer to Manitoba Regulation 77/2003, Water and Wastewater Facility Operators Regulation and amendment M.R. 162/2005, under The Environment Act (C.C.S.M. c E125).

A copy of the regulation is available by following the link for Manitoba Regulations at: http://www.gov.mb.ca/conservation/envapprovals/publs/index.html

Facilities are classified as follows:

Small system class
A wastewater treatment facility that otherwise meets the criteria of a class 1 wastewater treatment facility shall be classified in the small system class if

a) it treats wastewater from a population of no more than 500; and
b) no mechanical treatment processes are employed at the facility.

Classes 1 to 4
Wastewater treatment facilities shall be classified in classes 1 to 4 in accordance with the following table, on the basis of the number of classification points assessed under the classification point system set out in the Water and Wastewater Facility Operators Regulation.

Range of Classification Points	Classification
0 to 30	Class 1
31 to 55	Class 2
56 to 75	Class 3
76 or more	Class 4

Size

Points for size: (2 point minimum to 20 point maximum)

Maximum population or part served, peak day (1 point minimum to 10 point maximum). Points are assigned at 1 point per 10,000 population or part.

Design flow average day or peak month's flow average day, whichever is larger (1 point minimum to 10 point maximum). Points are assigned at 1 point per 4.5 megalitres per day or part.

Authorized Representative

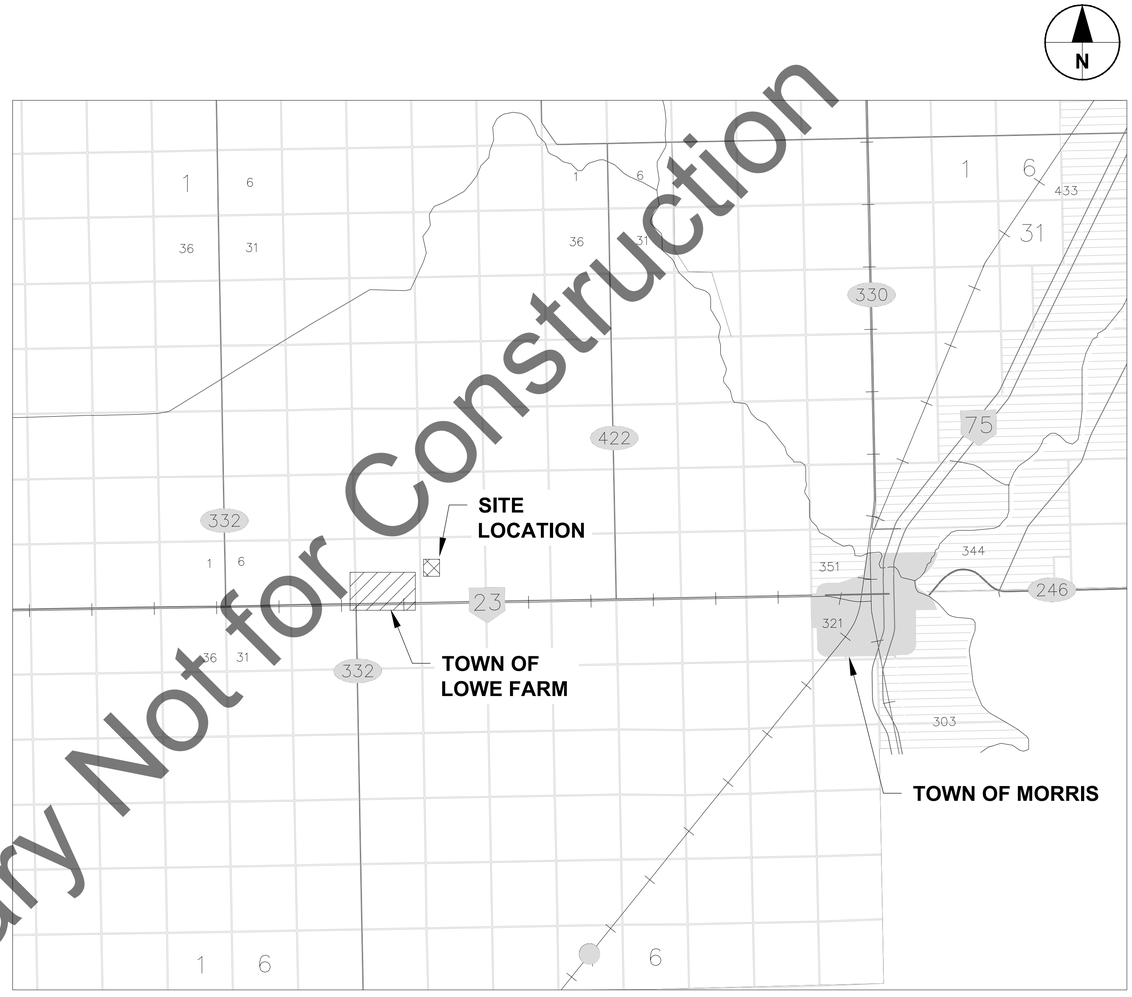
Signatures for the Applicant Verification section must be an individual recognized by the Owner of the facility as able to sign official documentation (i.e. P.Eng., Manager, CAO, etc).

Appendix E
Drawings

DRAWING INDEX

CIVIL

C-0001	CIVIL	OVERALL SITE PLAN
C-0002	CIVIL	EXISTING SITE PLAN AND SURVEY
C-3001	CIVIL	TYPICAL CROSS-SECTIONS
C-4001	CIVIL	TYPICAL DETAILS
C-4002	CIVIL	TYPICAL DETAILS (2)



OVERALL SITE LOCATION
N.T.S

AECOM

60447253

RM OF MORRIS
Lowe Farm
Sewage Lagoon Expansion

February 10, 2016

Project Management Initials: ____ Designer: ____ Checked: ____ Approved: ____ ANSI D 864mm x 559mm

Last saved by: DURANDA(2016-02-10) Last Plotted: 2016-02-22
Filename: P:\60447253\900-WORK\910-CAD\20-SHEETS\G\60447253-G-0001.DWG

PROPERTY LINE (TYP)

TOPSOIL STOCKPILE AREA

CLAY BORROW LOCATION.
REFILL EXCAVATION WITH
WASTE EXCAVATION
MATERIAL 30m x 100m

HIGH POINT

1.2m HIGH BARBED WIRE FENCE
(SEE DETAIL 2, C-4001)
(BY OTHERS)

PROPOSED SECONDARY CELL
CELL FLOOR ELEV 238.80

FLOOR BOTTOM AREA 23,716 m2

CONTRACTOR LAYDOWN
AND MATERIAL STORAGE
AREA

300 GATE VALVE

GROUTED RIP-RAP PAD
3.0m WIDE x 4.8m LONG
(SEE DETAIL C)

GROUTED RIP-RAP PAD
3.0m WIDE x 3.8m LONG (TYP)
(SEE DETAIL B)

21.0 OF 300 HDPE DR17
DISCHARGE PIPE

71m OF DITCH
@ 0.1% SLOPE

300 INTERCONNECTION GATE VALVE

21.2 OF 300 HDPE DR17
INTERCONNECTION PIPE

REGRADE EXISTING DITCH
TO PROVIDE POSITIVE
DRAINAGE NORTH

TEMPORARY ACCESS POINT FOR
CONTRACTOR.
PROVIDE TEMPORARY CULVERT.

LIMIT FOR 75mm THICK GRAVEL ADDED TO ROAD
ADDED ONCE EARTHWORK IS COMPLETED

75m OF TEMPORARY 100mm LAY FLAT HOSE

MUNICIPAL ROAD ALLOWANCE

O/H HYDRO

0 18.75 37.5 m
1:750

PLUG AND ABANDON
EXIST. 100 FM WEST.

CONNECT PROPOSED 150 FM
SOUTH, INSTALL 150-100 REDUCER

RISE END OF PIPE TO INSTALL 100 GATE VALVE
PROVIDE CAMLOCK CONNECTION
WITH CAP AND MARKER.
PROVIDE 75m OF TEMP. 100mm LAY
FLAT HOSE FOR FLOW DIVERSION.
SECURE WITH SAND BAGS.

INSTALL 2 150-45° BENDS
INSTALL 100 TEE

BREAK INTO EXIST. 100 FM

1 CONNECTION DETAIL
Scale 1:100

EXISTING TOWN
LANDFILL SITE

CUT BACK INTERIOR SLOPE OF EXISTING
LAGOON TO 3.5:1 SLOPE . MOVE SLUDGE AS
REQUIRED TO ACCESS FLOOR AND BERM
SLOPES. REMOVE DEBRIS ON SIDE SLOPES
AND HAUL TO LANDFILL.

RE-GRADE TOP OF CLAY BERM
FOR PROPOSED PRIMARY CELL TO
ELEV. 241.30
TOP OF TOPSOIL
ELEV. 241.35

LIMIT FOR 75mm THICK
BASE ADDED TO ROAD

GRADE DITCH TO
PROVIDE POSITIVE
DRAINAGE WEST

WARNING SIGN
SEE DETAIL 4
C-4001

ACCESS GATE

NEW TRUCK DUMP
ACCESS ROAD

LANDFILL
ACCESS ROAD

DIRECTIONALLY DRILLED
TRENCHLESS EXCAVATION
THROUGH BERM WITHIN LAGOON

PROPOSED TRUCK
DUMP FACILITY

CUT OUT BERM AND
RECOMPACT BASE LINER
SEE SECTION B, C-0002

NOTE: MOVE SLUDGE AND
EXCAVATE CELL FLOOR TO 238.80

REMOVE EXISTING
INTERCONNECTING PIPE
AND VALVE

150 FORCEMAIN
OUTLET AND PAD

CUT OFF AND PLUG
EXIST. FORCEMAIN
WEST

REMOVE EXIST. TRUCK
DUMP FACILITIES

164m of 150Ø HDPE DR17 FORCEMAIN
(BURRIED WITH A MIN. 2.2m COVER)

150 GATE VALVE

LIMIT OF OPEN
TRENCH
EXCAVATION

2 150-45° BENDS

2 150-45° BENDS

INSTALL NEW GATE

MAINTAIN VEHICLE ACCESS
REGRADE WITH GRAVEL SURFACE

REMOVE EXIST. VALVE BOX. VALVE TO REMAIN CLOSED.
PLUG AND ABANDON EXIST. 150 DISCHARGE AND INLET
PIPE AT BOTH ENDS.
ABANDON EXISTING VALVE, DISCHARGE PIPE (REMOVE
UPPER & LOWER VALVE BOX, RISER, CLOSE VALVE, PLUG
& ABANDON BOTH ENDS OF 150Ø DISCHARGE)

AECOM

PROJECT

LOWE FARM
SEWAGE LAGOON
EXPANSION

CLIENT

RM of Morris
Box 518
207 Main Street N
Morris, Manitoba R0G 1K0

CONSULTANT

AECOM
99 Commerce Drive
Winnipeg, Manitoba, R3P 0Y7
204.477.5381 tel 204.284.2040 fax
www.aecom.com

REGISTRATION

PROVINCE OF MANITOBA
ORIGINAL SIGNED BY
P.R. BARSALOU
FEB. 10 / 2016
REGISTERED PROFESSIONAL ENGINEER

APEGM
Certificate of Authorization
AECOM Canada Ltd.
No. 4671 Date: FEB. 10 / 2016
Original dated on:

ISSUE/REVISION

C	22/02/2016	ISSUED FOR TENDER REV. 1
B	10/02/2016	ISSUED FOR TENDER
A	14/12/2015	ISSUED FOR PUBLIC MEETING
I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER

60447253

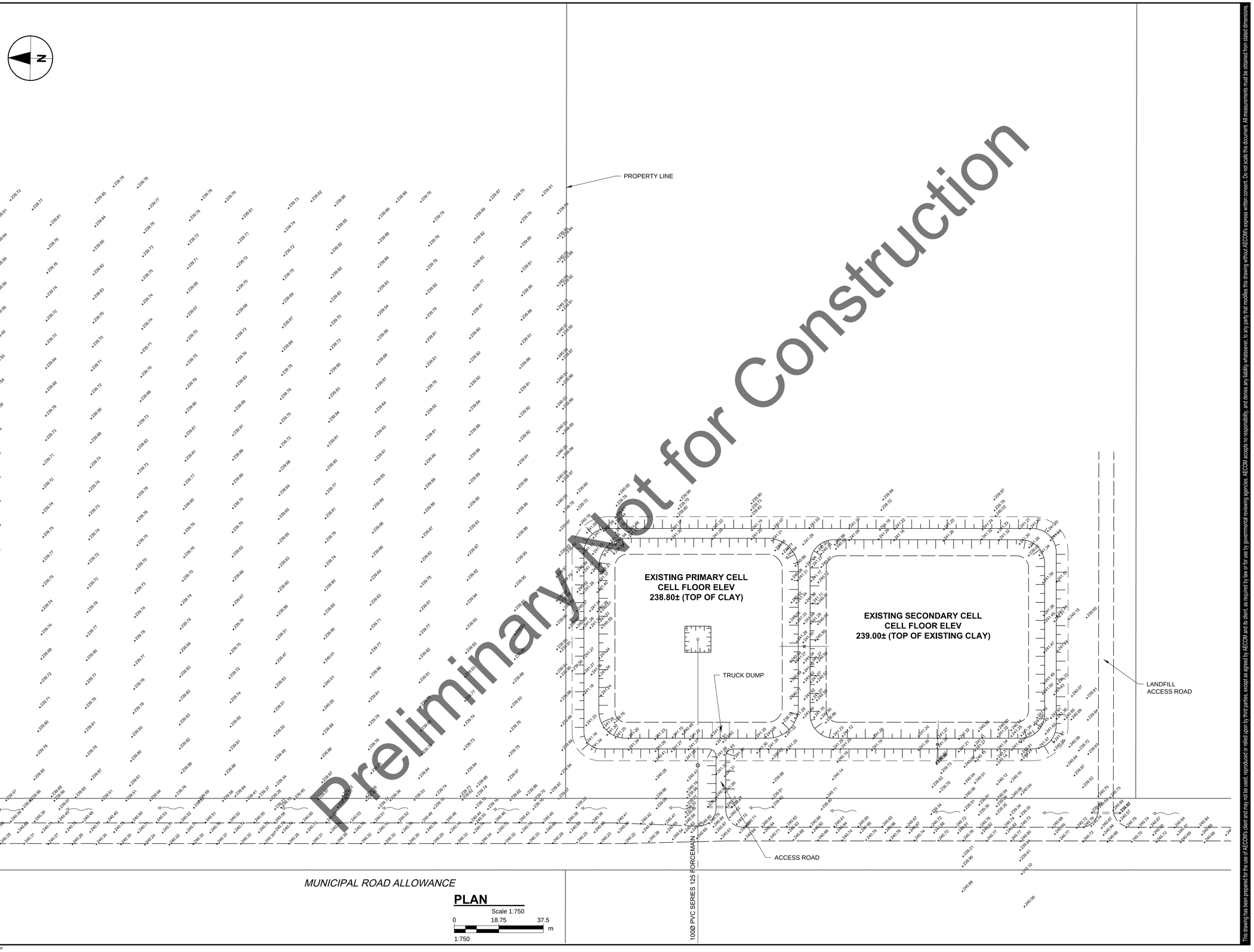
SHEET TITLE

OVERALL SITE PLAN

SHEET NUMBER

C-0001

Project Management Initials: ____ Designer: ____ Checked: ____ Approved: ____ ANSI D 864mm x 559mm



PLAN

Scale 1:750

0 18.75 37.5 m

1:750

AECOM

PROJECT

LOWE FARM
SEWAGE LAGOON
EXPANSION

CLIENT

RM of Morris
Box 518
207 Main Street N
Morris, Manitoba R0G 1K0

CONSULTANT

AECOM
99 Commerce Drive
Winnipeg, Manitoba, R3P 0Y7
204.477.5381 tel 204.284.2040 fax
www.aecom.com

REGISTRATION

PROVINCE OF MANITOBA
ORIGINAL SIGNED BY
P.R. BARSALOU
FEB. 10 / 2016
REGISTERED PROFESSIONAL ENGINEER

APEGM
Certificate of Authorization
AECOM Canada Ltd.
No. 4671 Date: FEB. 10 / 2016
Original dated on:

ISSUE/REVISION

C	22/02/2016	ISSUED FOR TENDER REV. 1
B	10/02/2016	ISSUED FOR TENDER
A	14/12/2015	ISSUED FOR PUBLIC MEETING
I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER

60447253

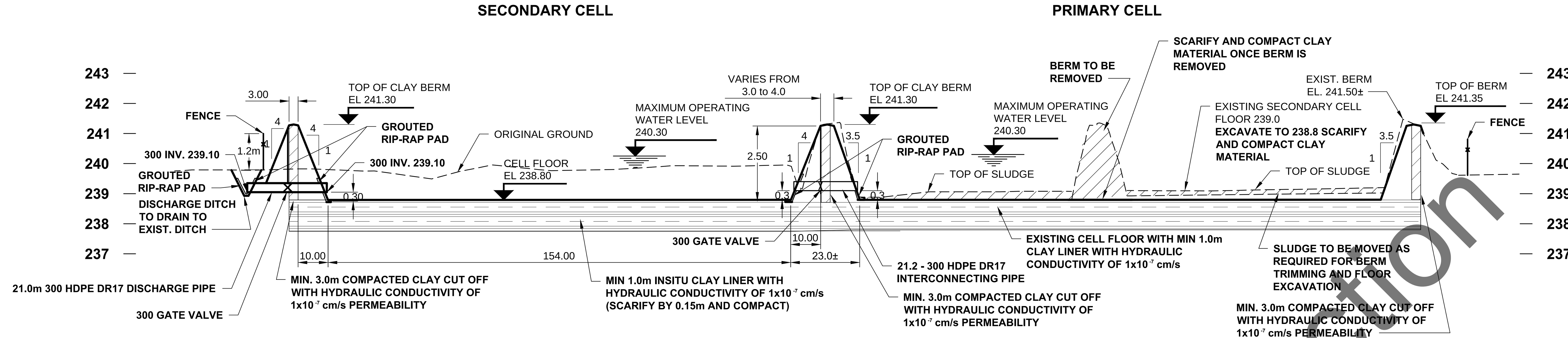
SHEET TITLE

EXISTING SITE PLAN
AND SURVEY DATA

SHEET NUMBER

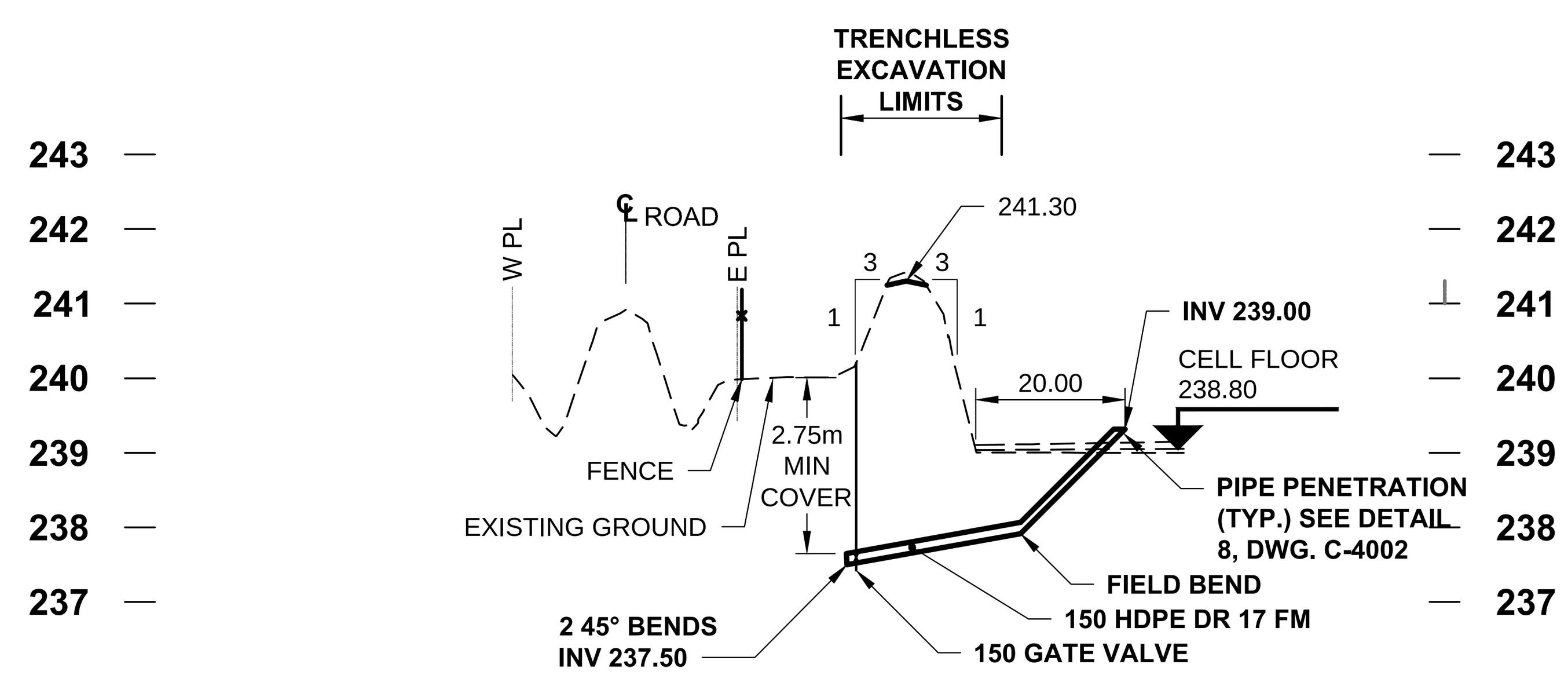
C-0002

Last saved by: LACOSTEG(2016-02-22) Last Plotted: 2016-02-22
Filename: P:\60447253\900-WORK\910-CAD\20-SHEETS\C\60447253-SHT-00-C-0001.DWG



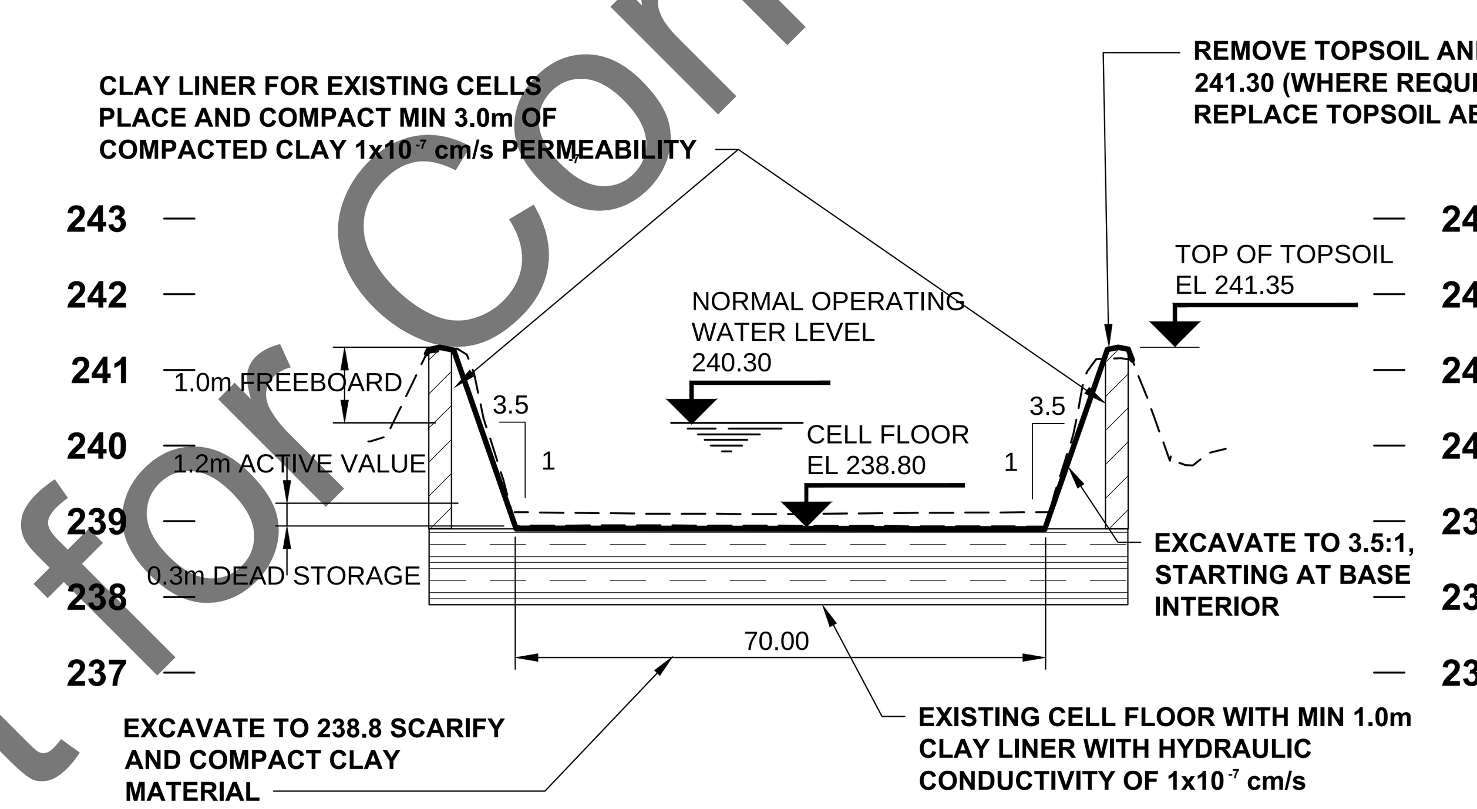
A | SECTION

H=1:1000
V=1:100



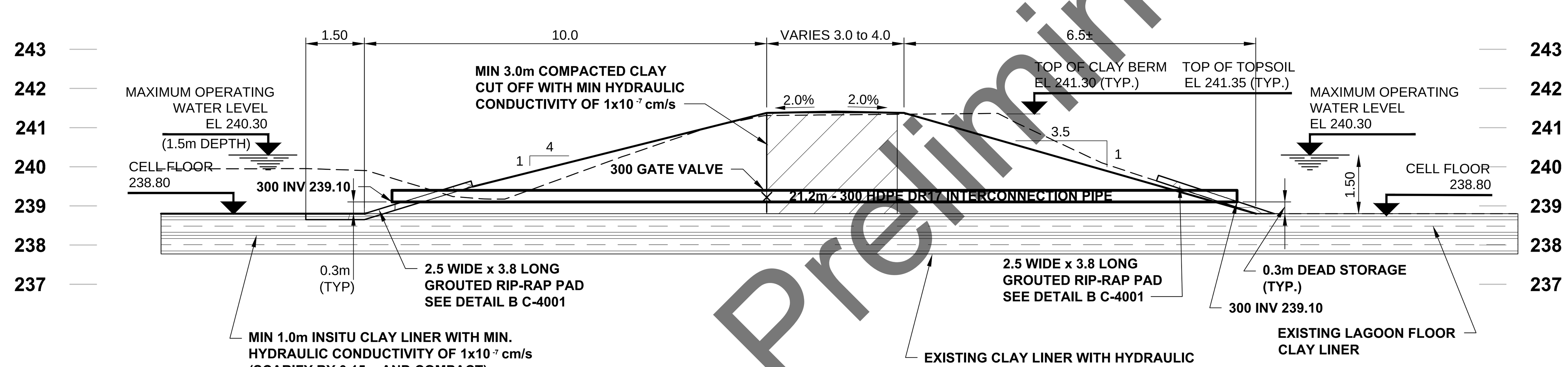
D | SECTION

H=1:1000
V=1:100



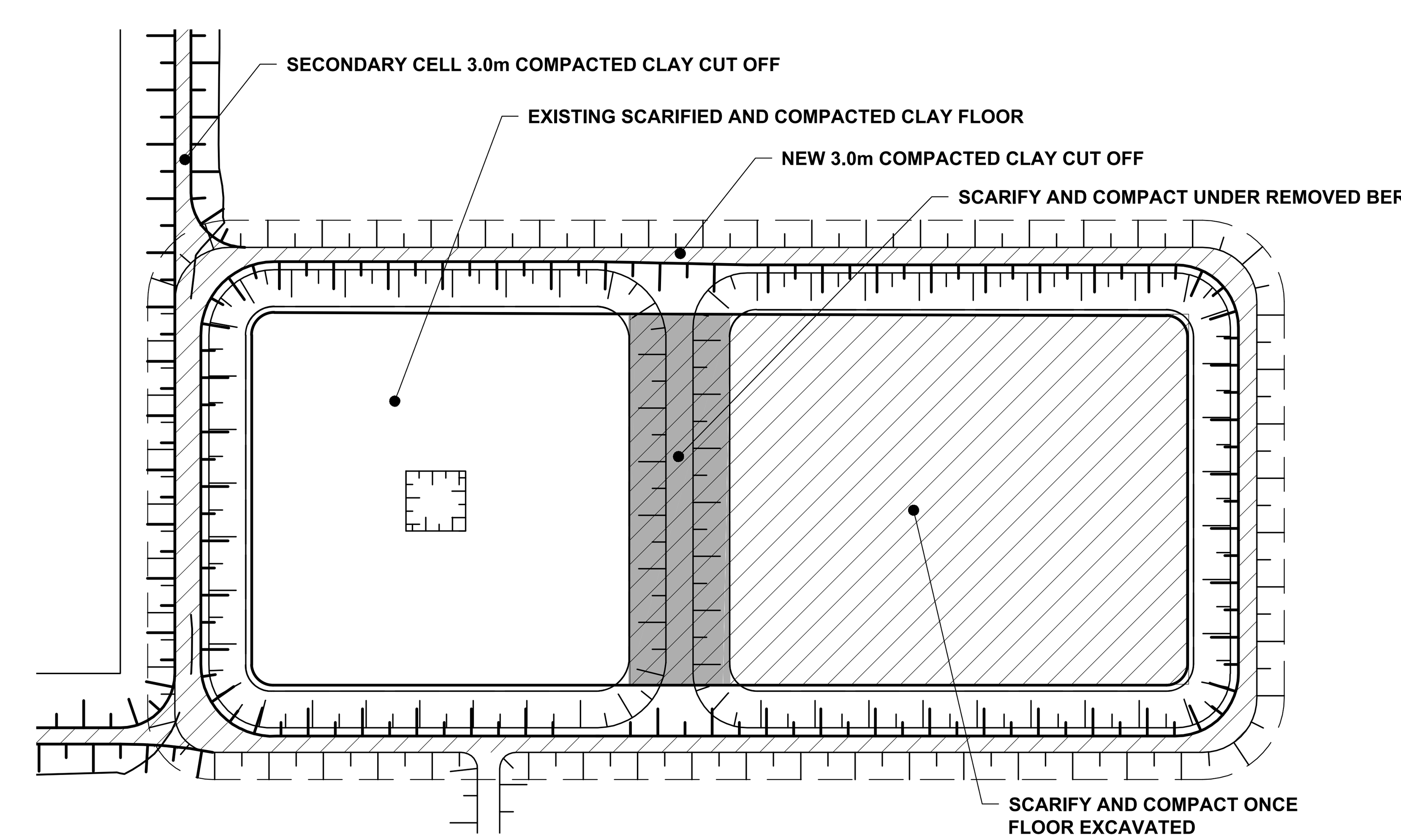
B | EXISTING BERM REMOVAL

H=1:1000
V=1:100



C | 300 INTERCONNECTING PIPE SECTION

1:100



CLAY LINER PLAN

Scale NTS

AECOM

PROJECT

LOWE FARM SEWAGE LAGOON EXPANSION

CLIENT

RM of Morris
Box 518
207 Main Street N
Morris, Manitoba R0G 1K0

CONSULTANT

AECOM
99 Commerce Drive
Winnipeg, Manitoba, R3P 0Y7
204.477.5381 tel 204.284.2040 fax
www.aecom.com

REGISTRATION

PROVINCE OF MANITOBA — REGISTERED PROFESSIONAL ENGINEER — ORIGINAL SIGNED BY P.R. BARSALOU — FEB. 10 / 2016

APEGM Certificate of Authorization
AECOM Canada Ltd.
No. 4671 Date: Original dated on: FEB. 10 / 2016

ISSUE/REVISION

I/R	DATE	DESCRIPTION
C	22/02/2016	ISSUED FOR TENDER REV. 1
B	10/02/2016	ISSUED FOR TENDER
A	14/12/2015	ISSUED FOR PUBLIC MEETING

KEY PLAN

PROJECT NUMBER

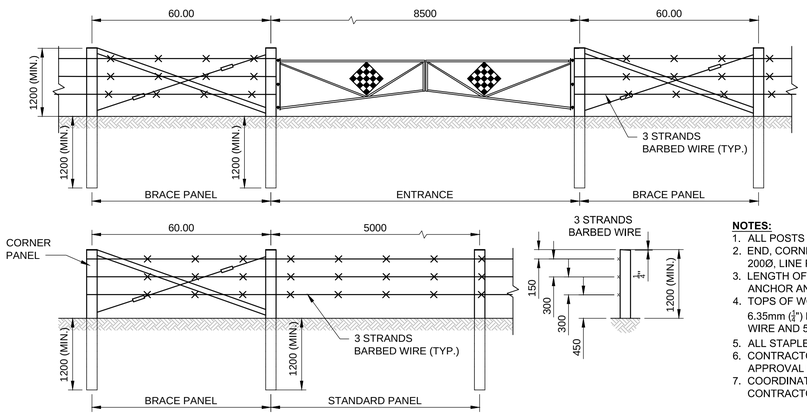
60447253

SHEET TITLE

TYPICAL CROSS SECTIONS

SHEET NUMBER

C-3001

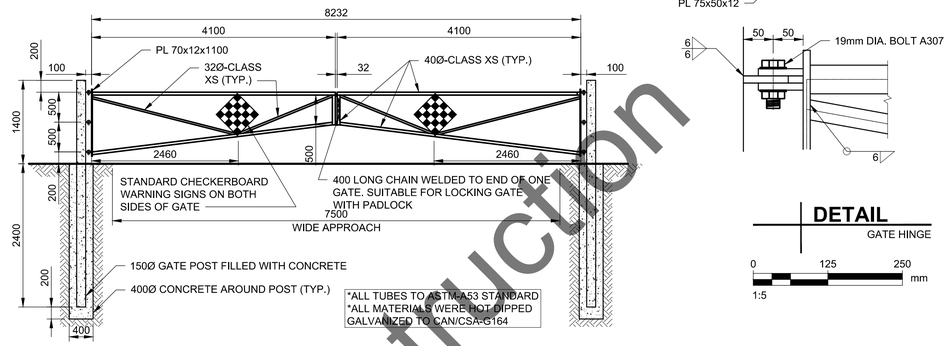


NOTES:

1. ALL POSTS TO BE PRESSURE TREATED LUMBER.
2. END, CORNER, ANCHOR, AND GATE POSTS TO BE 200Ø, LINE POSTS 150Ø.
3. LENGTH OF POSTS: LINE POST 2400 MIN., CORNER, ANCHOR AND GATE POSTS.
4. TOPS OF WOODEN POSTS TO BE SAWN OFF WITH 6.35mm (¼") PITCH, HIGH SIDE TO BE NEXT TO THE WIRE AND 50 ABOVE IT.
5. ALL STAPLES TO BE 44.50mm (1 ¾").
6. CONTRACTOR TO PROVIDE SHOP DRAWING FOR APPROVAL PRIOR TO CONSTRUCTION.
7. COORDINATE FENCE INSTALLATION WITH LAGOON CONTRACTORS.

2 | 3 STRAND BARBED WIRE FENCE DETAIL (BY OTHERS)

Scale 1:50



3 | ACCESS GATE DETAIL (BY OTHERS)

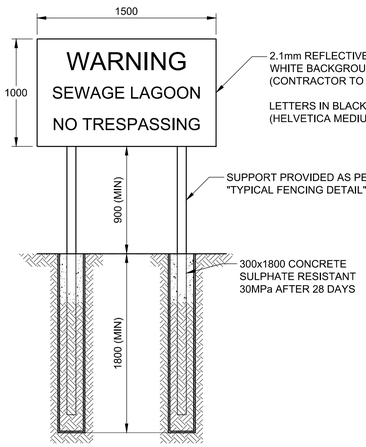
Scale 1:50

DETAIL

GATE HINGE

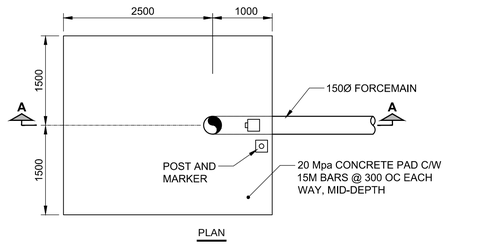
0 125 250 mm

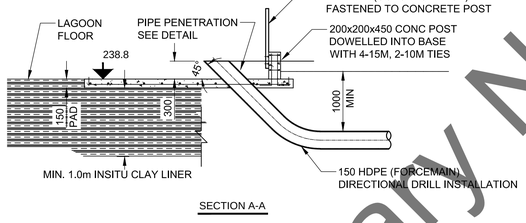
1:5



4 | WARNING SIGN DETAIL

Scale NTS

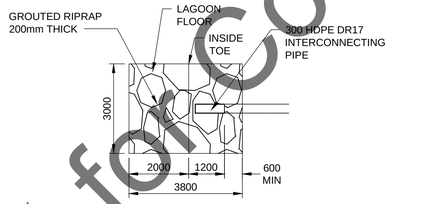




SECTION A-A

1 | FORCEMAIN INLET DETAIL

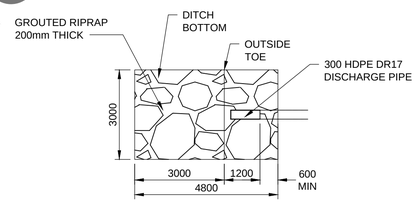
Scale 1:50



B | GROUTED RIPRAP PAD DETAIL

NOTE: FOR INTERCONNECTION PIPES

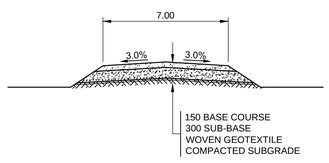
Scale 1:100



C | GROUTED RIPRAP PAD DETAIL

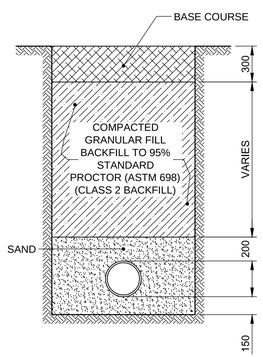
NOTE: FOR DISCHARGE PAD

Scale 1:100



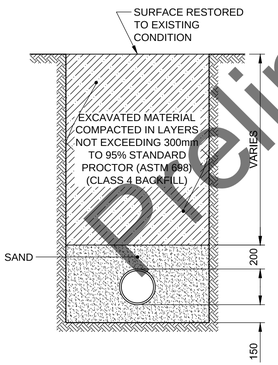
A | TYPICAL ROAD SECTION

Scale NTS



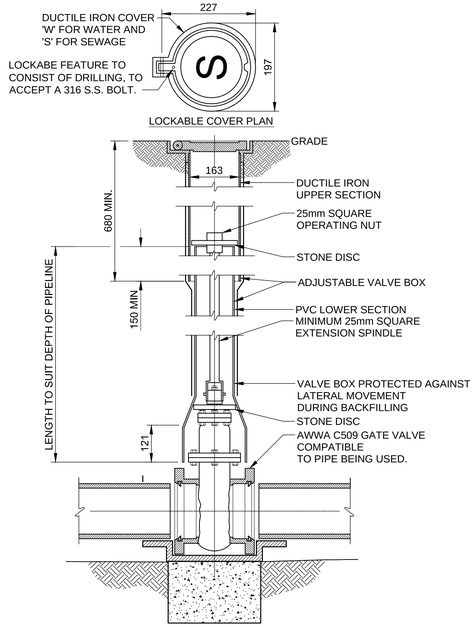
5 | PIPE TRENCH DETAIL UNDER ROAD

Scale NTS



6 | PIPE TRENCH DETAIL IN FIELD AREA

Scale NTS



NOTE: VALVE WAS SUPPORTED WITH 300x300x200 CONCRETE BLOCK.

7 | GATE VALVE DETAIL

Scale NTS

AECOM

PROJECT

LOWE FARM
SEWAGE LAGOON
EXPANSION

CLIENT

RM of Morris
Box 518
207 Main Street N
Morris, Manitoba R0G 1K0

CONSULTANT

AECOM
99 Commerce Drive
Winnipeg, Manitoba, R3P 0Y7
204.477.5381 tel 204.284.2040 fax
www.aecom.com

REGISTRATION

PROVINCE OF MANITOBA
ORIGINAL SIGNED BY
P.R. BARSALOU
FEB. 10 / 2016
REGISTERED PROFESSIONAL ENGINEER

APEGM
Certificate of Authorization
AECOM Canada Ltd.
Original dated on:
No. 4671 Date: FEB. 10 / 2016

ISSUE/REVISION

C	22/02/2016	ISSUED FOR TENDER REV. 1
B	10/02/2016	ISSUED FOR TENDER
A	14/12/2015	ISSUED FOR PUBLIC MEETING
I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER

60447253

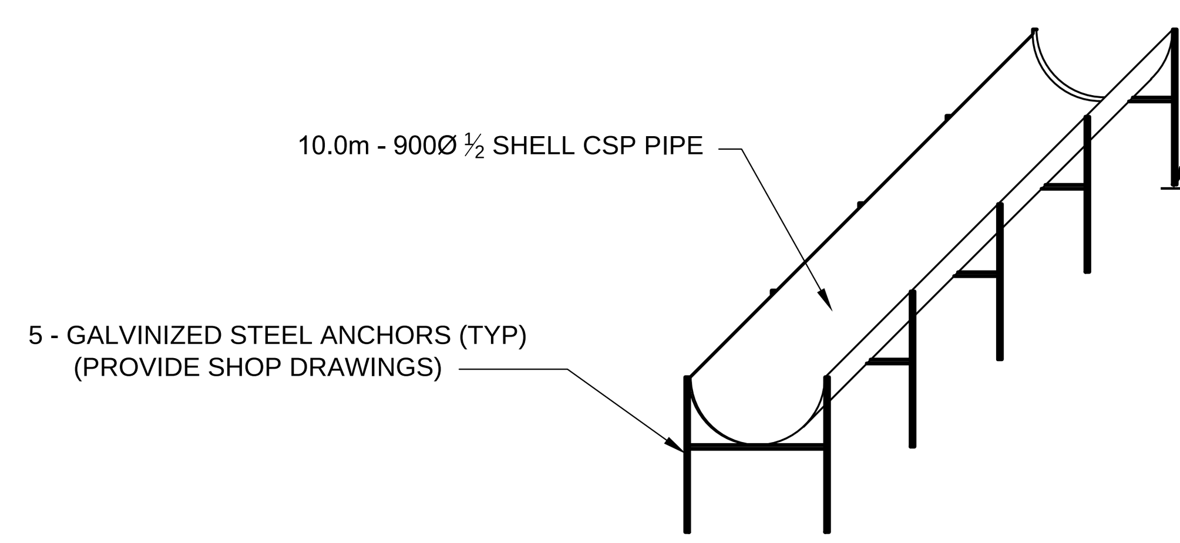
SHEET TITLE

TYPICAL DETAILS

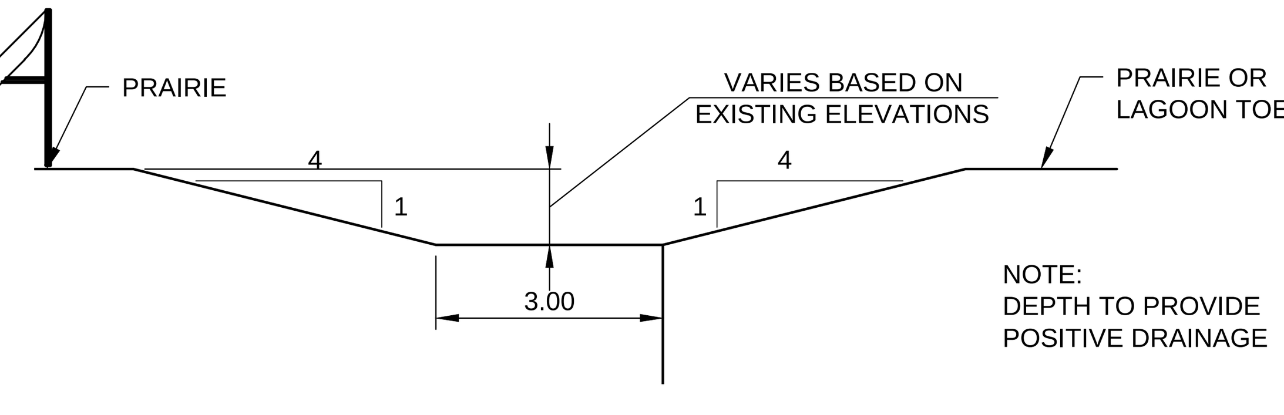
SHEET NUMBER

C-4001

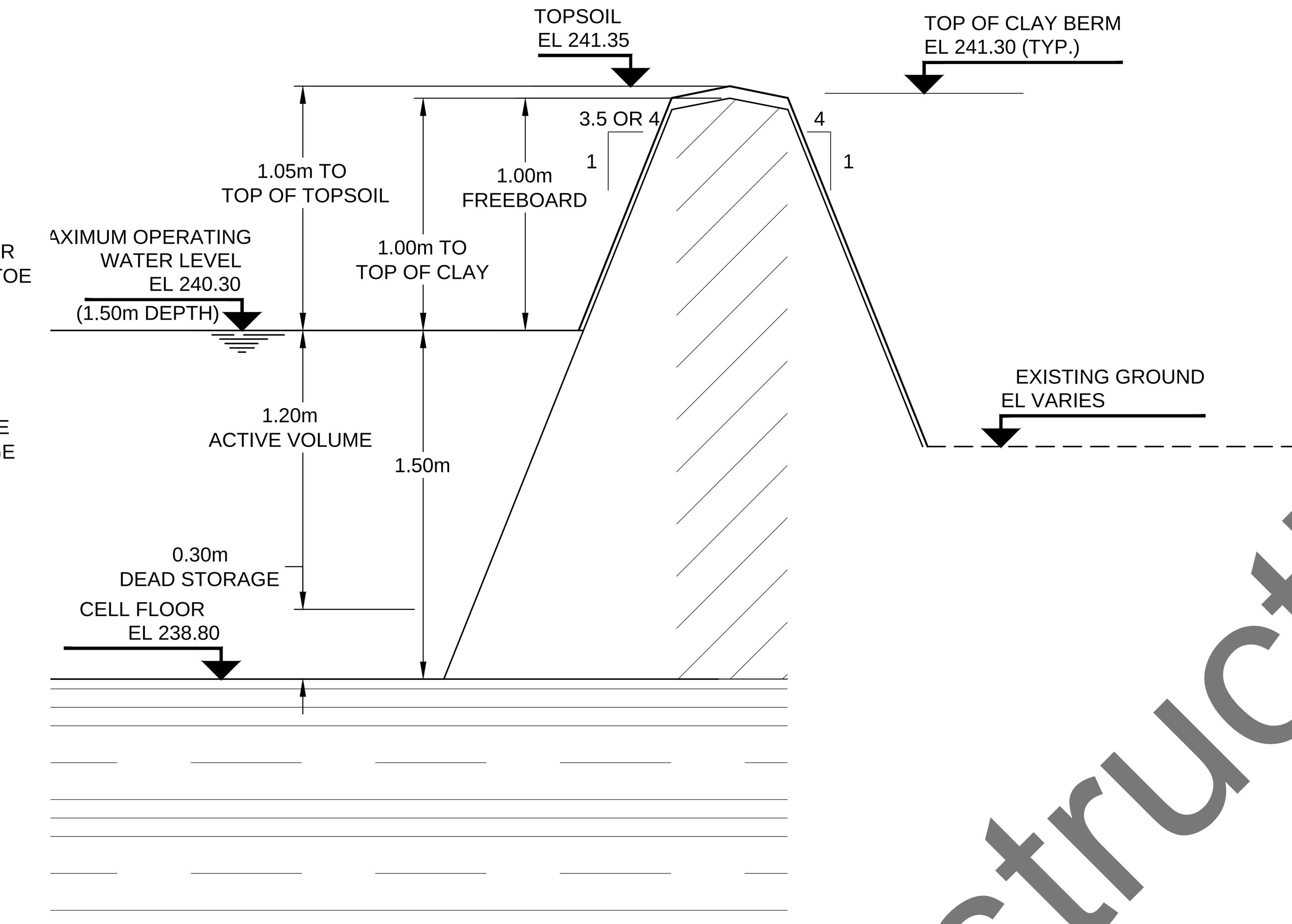
Project Management Initials: Designer: Checked: Approved: ANSI D 864mm x 559mm
Last saved by: LACOSTEG(2016-02-22) Last Plotted: 2016-02-22
Filename: P:\60447253\900-WORK\910-CAD\20-SHEETS\C\60447253-SHT-00-C-0001.DWG
Printed on ___% Post-Consumer Recycled Content Paper



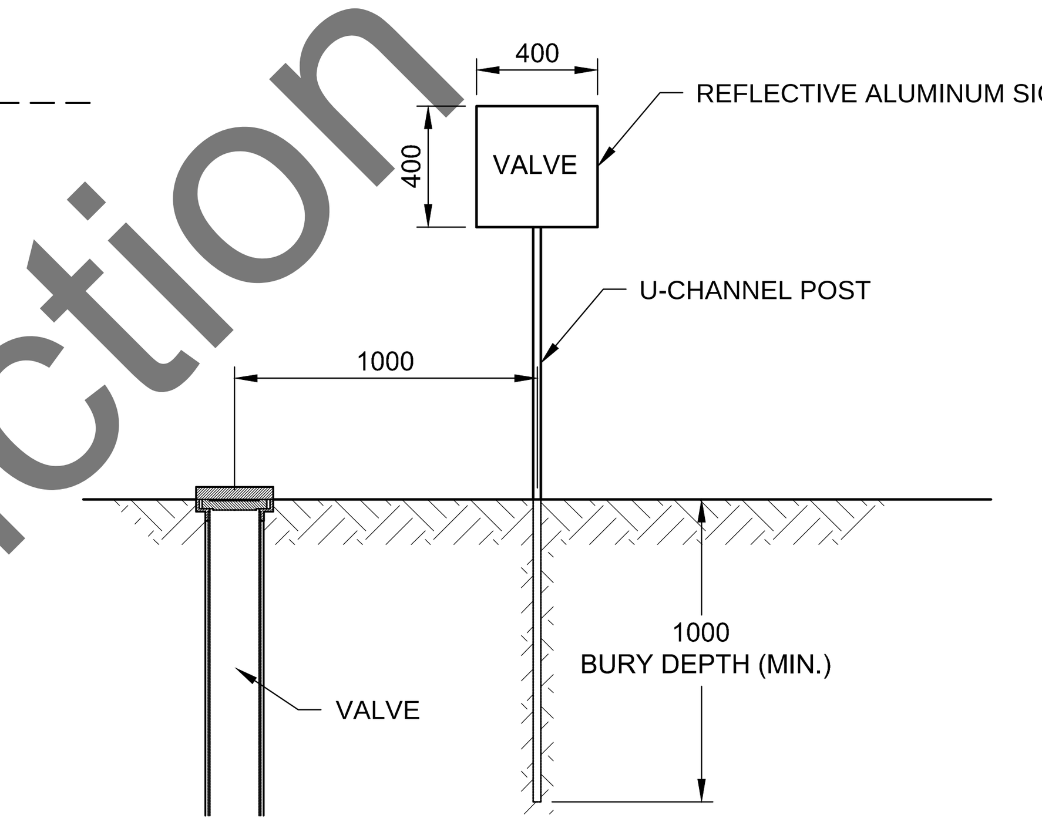
3 TRUCK DUMP SECTION
Scale NTS



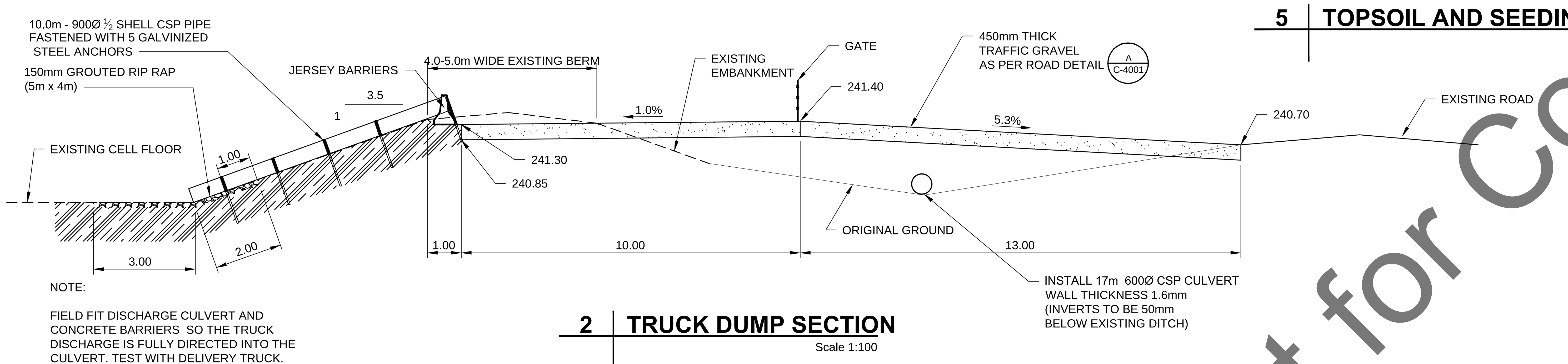
4 TYPICAL DITCH DETAIL
Scale 1:100



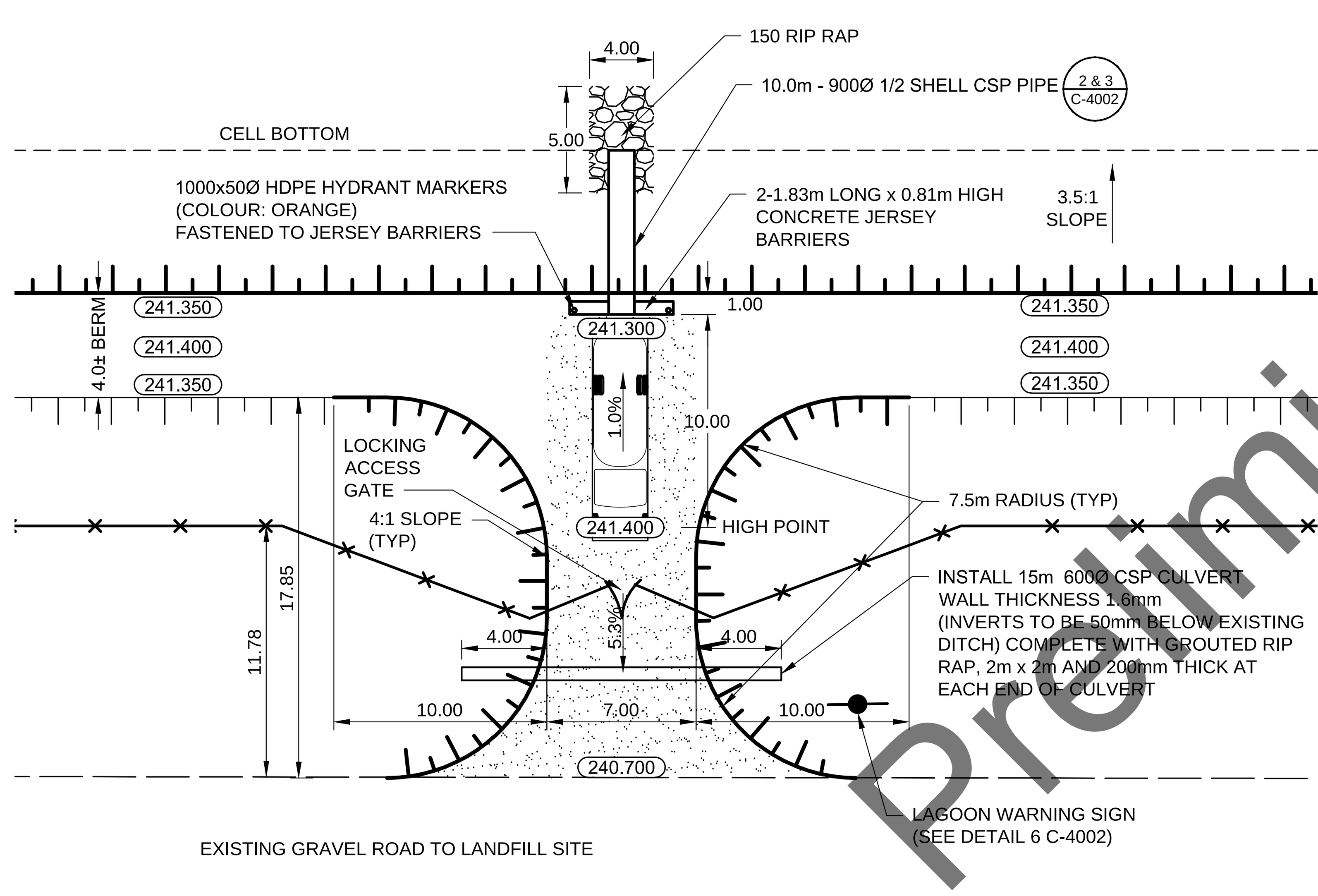
5 TOPSOIL AND SEEDING DETAIL
Scale H:250 V:25



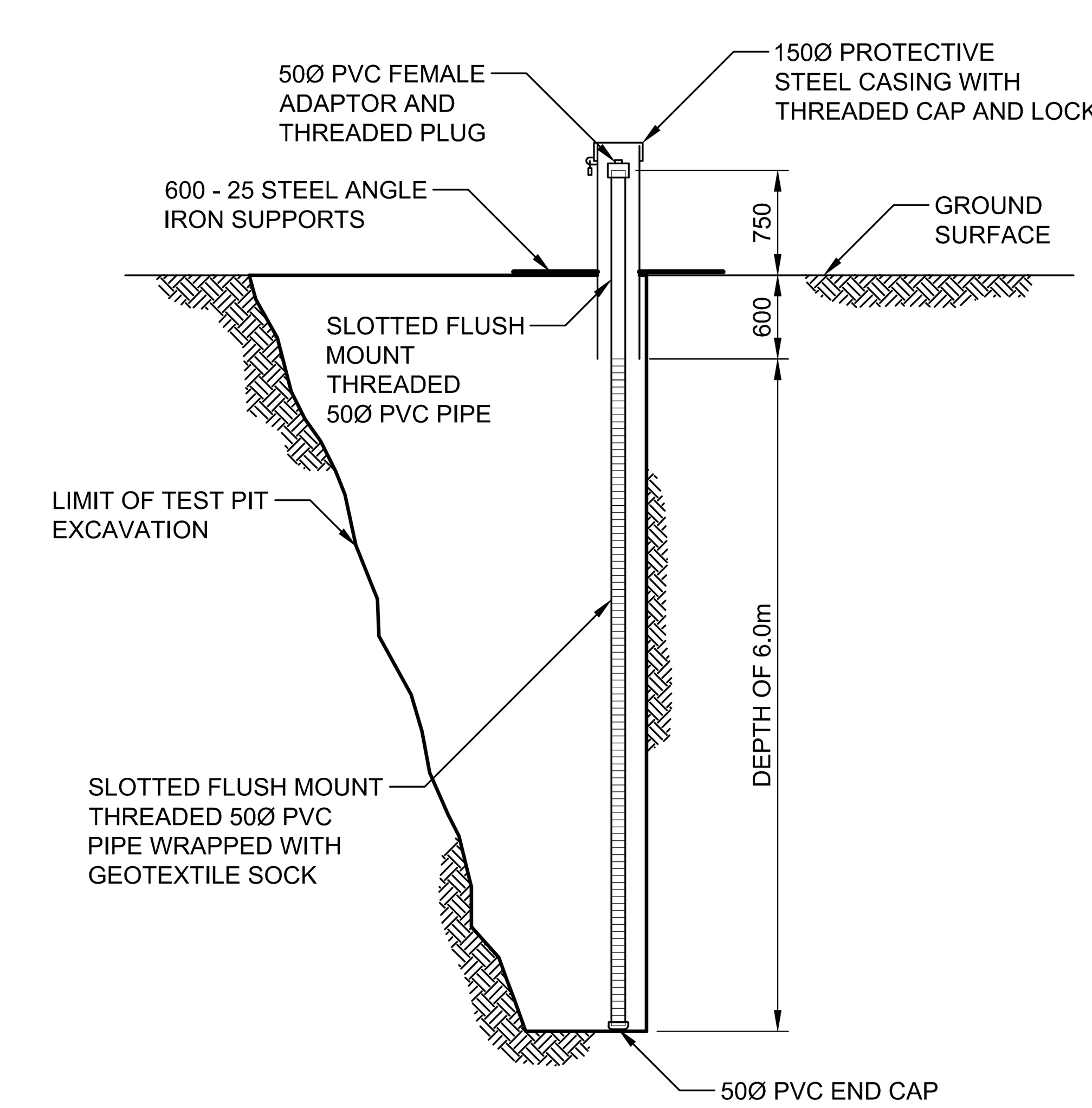
6 VALVE MARKER POST
Scale 1:25



2 TRUCK DUMP SECTION
Scale 1:100



1 TRUCK DUMP DETAIL
Scale 1:250



7 MONITORING WELL DETAIL
Scale NTS

AECOM

PROJECT

LOWE FARM SEWAGE LAGOON EXPANSION

CLIENT

RM of Morris
Box 518
207 Main Street N
Morris, Manitoba R0G 1K0

CONSULTANT

AECOM
99 Commerce Drive
Winnipeg, Manitoba, R3P 0Y7
204.477.5381 tel 204.284.2040 fax
www.aecom.com

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
C	22/02/2016	ISSUED FOR TENDER REV. 1
B	10/02/2016	ISSUED FOR TENDER
A	14/12/2015	ISSUED FOR PUBLIC MEETING

KEY PLAN

PROJECT NUMBER

60447253

SHEET TITLE

TYPICAL DETAILS (2)

SHEET NUMBER

C-4002

ANSI D 864mm x 559mm
Approved: Checked: Designer: Project Management Initials:
Last saved by: LACOSTEG(2016-02-22) Last Plotted: 2016-02-22
Filename: P:\60447253\900-WORK\910-CAD\20-SHEETS\C\60447253-SHT-00-C-0001.DWG
Printed on ___% Post-Consumer Recycled Content Paper

Appendix D

Geotechnical Assessment

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

Memorandum

To	Paul Barsalou, P.Eng	Page	1
CC			
Subject	Lowe Farm Sewage Lagoon Expansion – Existing Lagoon Stability		
From	Omer Eissa, P.Eng		
Date	February 4, 2016	Project Number	60447253

1. Introduction

The Rural Municipality of Morris (RM) is planning an expansion cell at the Lowe Farm Sewage Lagoon in Lowe Farm, Manitoba. The existing sewage lagoon facility is located northeast of the community of Lowe Farm as shown on Drawing 01 in Appendix A. The facility consists of two existing cells. It is understood that the two existing cells will be merged into one large cell by removing the existing dike separating the cells and a new cell will be constructed directly to the north of the existing cells.

The purpose of this memorandum is to provide a geotechnical assessment of the existing lagoon slopes and to identify any upgrades or changes to the existing slopes if required.

2. Stability Analysis

The existing lagoon geometry was modelled based on the survey data presented on Drawings C-0001 and C-0002 attached in Appendix A. Based on the elevations shown on the drawings, the crest of the existing lagoon dikes vary in elevation from 241.30 to 241.40 m. The minimum existing ground elevation outside of the existing lagoon cell is at elevation 240.0 m and the clay floor elevation within the cell is at 238.75 m.

A preliminary slope stability assessment was carried out on the existing 3.0H:1V dike slopes to investigate stability of the 3H:1V dike slopes in the long-term, short-term and rapid drawdown conditions. The analysis was performed using GeoStudio 2007 software package. The soil stratigraphy and parameters assigned to the subsoil and fill material in the analysis were based on available test results, correlation with soil index properties and knowledge of local conditions and are presented in Table 01. This exercise utilized the test holes advanced by AECOM in December 2014 with the assumption that the lagoon dikes were constructed using material from the base of the cells. Test hole logs and description of the subsurface conditions are provided in a separate technical memorandum submitted by AECOM dated February 11, 2015. The location of the test holes is presented on Drawing 01 in Appendix A.

Table 01 - Soil Strength Parameters for Slope Stability Analysis

Material	Unit Weight (kN/m^3)	Cohesion (kPa)	Angle of Internal Friction (°)
Clay (Fill)	18	5	17
Silty Clay (Native soil)	17	5	17

Groundwater was assumed at elevation 238.75 m corresponding to the cell floor elevation.Target factor of safety (FS) of 1.5 for the long-term, 1.3 for the short-term, and 1.3 for rapid drawdown condition are considered adequate for the existing cell dikes. These objective factors of safety are consistent with acceptable design practice.

Analysis results are presented in Table 2 below. Graphical illustrations of the analysis results are attached in Appendix B. Based on the analysis, 3H:1V slopes for the 2.6 m high cell dikes would satisfy the minimum required factor of safety. It is understood that the existing 3H:1V slopes show no evidence of slope instability or performance issues during the functional life of the facility. Based on the analysis results it is recommended that the existing dikes be maintained at 3H:1V slopes unless otherwise required for operational purposes.

Table 02 – Analysis Results

Analysis Case	Calculated Factor of Safety	Target Factor of Safety	Figure #
Long-Term	1.94	1.50	Figure 01
Short-Term	1.76	1.30	Figure 02
Rapid Drawdown	1.46	1.30	Figure 03

Should you have any questions or require any additional information, please contact the undersigned.

Respectfully submitted,

Omer Eissa, P.Eng
Geotechnical Engineer

Zeyad Shukri, M.Sc., P.Eng.
Senior Geotechnical Engineer

Enclosed;

Appendix A - Figures:

- Drawing 01: Lowe Farm Lagoon Test Hole Location Plan
- Sheet C-0001: Lowe Farm Sewage Lagoon Expansion - Overall Site Plan
- Sheet C-0002: Lowe Farm Sewage Lagoon Expansion – Typical Cross Sections

Appendix B - Stability Analysis Results:

- Figure 01: Long-Term Stability Analysis
- Figure 02: Short-Term Stability Analysis
- Figure 03: Rapid Drawdown Stability Analysis

Appendix A
Figures

Last saved by: MAHEC (2016-02-04) Last Plotted: 2013-04-22
Filename: P:\60447253\900-WORK\920-929 (GIS-GRAPHICS)\B\G001_60447253_01V1_TESTHOLELOCATIONPLAN.MXD

Project Management Initials: Designer: Checked: Approved:

ANSI A 215.9mm x 279.4mm

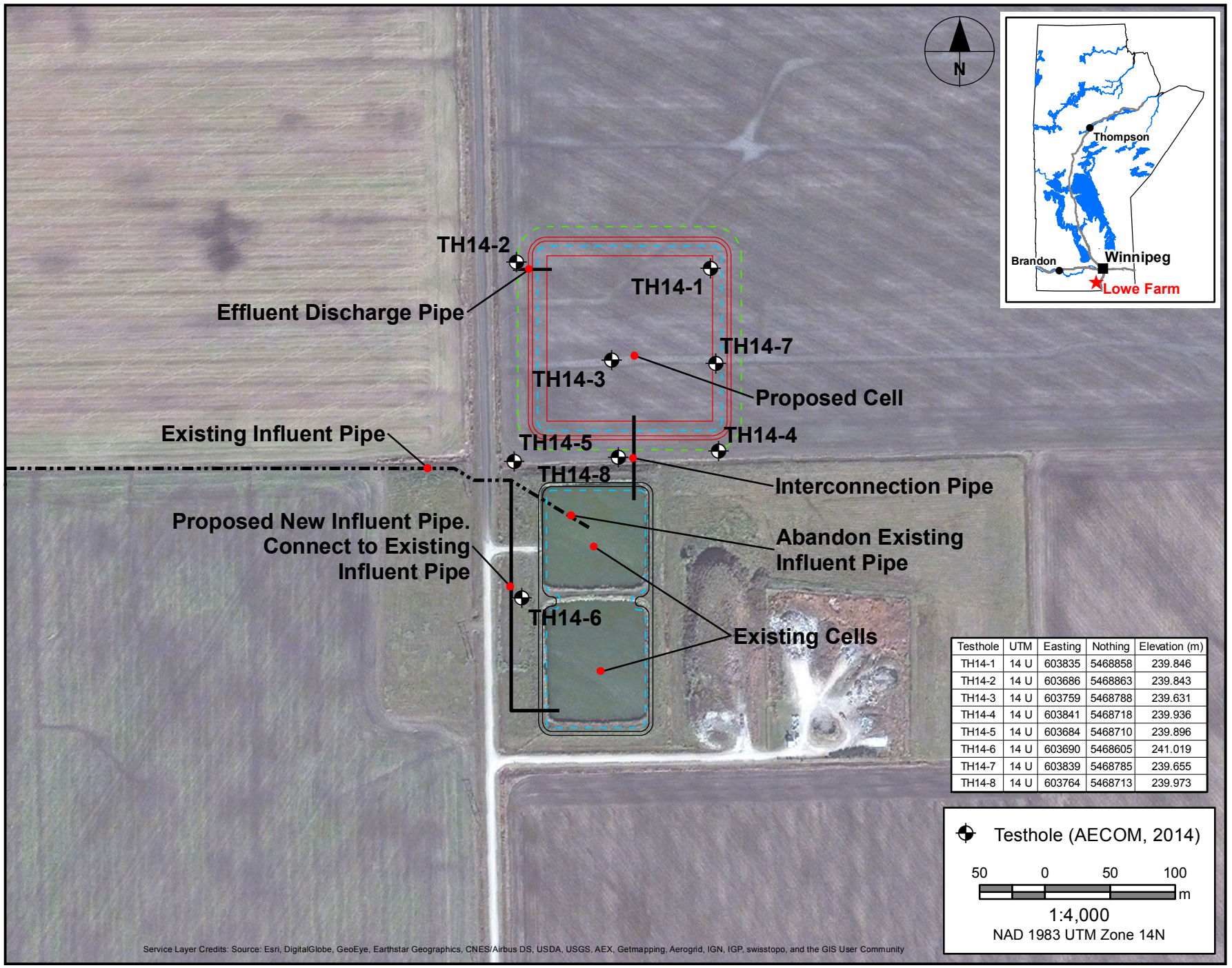
Rural Municipality of Morris

Lowe Farm Lagoon

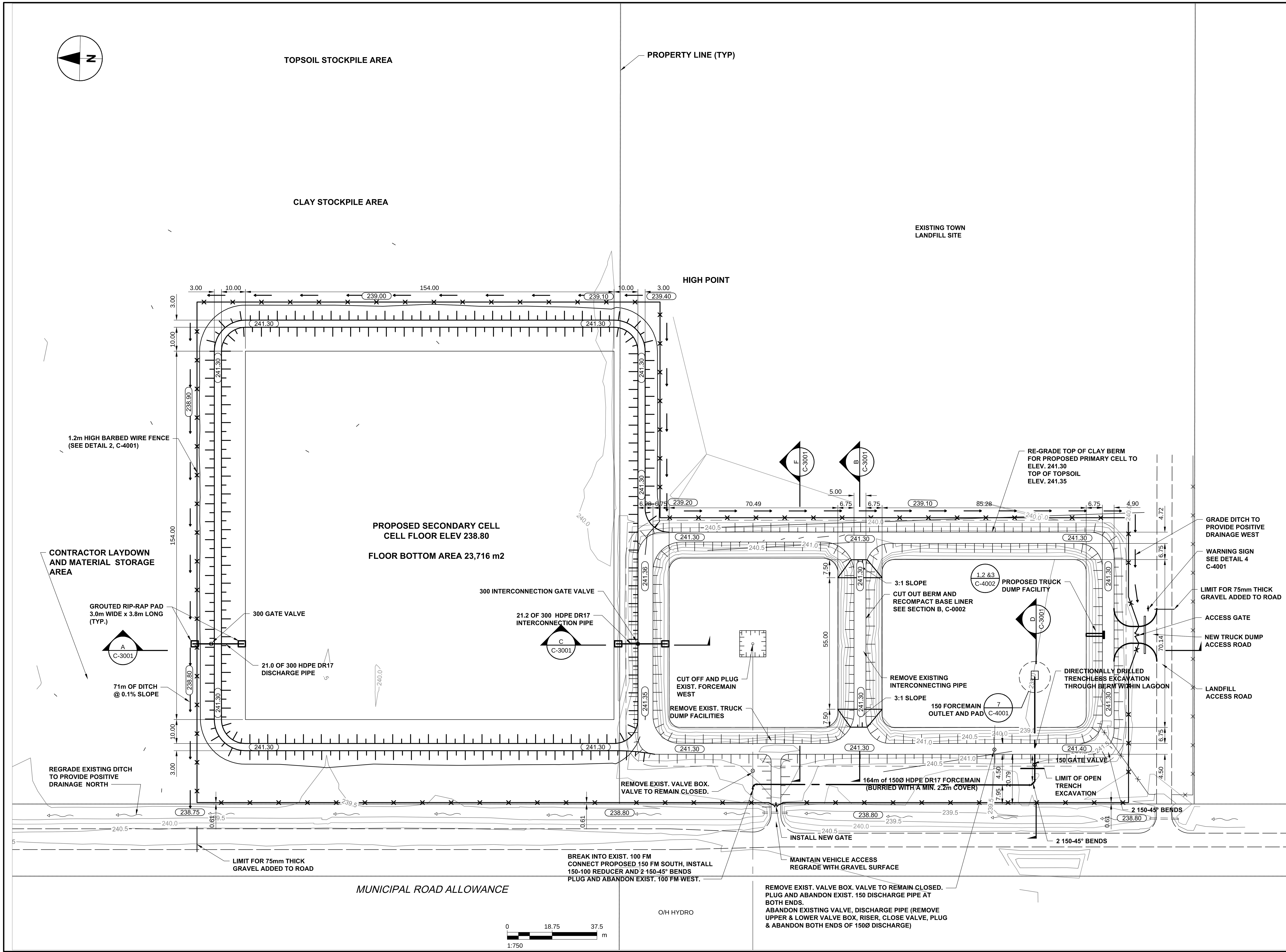
Test Hole Location Plan

Drawing: 01

AECOM



Testhole	UTM	Easting	Nothing	Elevation (m)
TH14-1	14 U	603835	5468858	239.846
TH14-2	14 U	603686	5468863	239.843
TH14-3	14 U	603759	5468788	239.631
TH14-4	14 U	603841	5468718	239.936
TH14-5	14 U	603684	5468710	239.896
TH14-6	14 U	603690	5468605	241.019
TH14-7	14 U	603839	5468785	239.655
TH14-8	14 U	603764	5468713	239.973



AECOM

PROJECT

LOWE FARM SEWAGE LAGOON EXPANSION

CLIENT

RM of Morris
Box 518
207 Main Street N
Morris, Manitoba R0G 1K0

CONSULTANT

AECOM
99 Commerce Drive
Winnipeg, Manitoba, R3P 0Y7
204.477.5381 tel 204.284.2040 fax
www.aecom.com

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
B	29/01/2016	ISSUED FOR TENDER
A	14/12/2015	ISSUED FOR PUBLIC MEETING

KEY PLAN

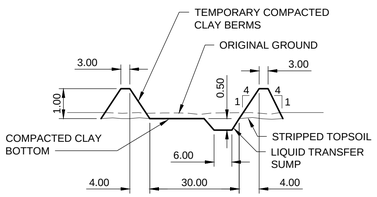
PROJECT NUMBER
60447253

SHEET TITLE
OVERALL SITE PLAN

SHEET NUMBER
C-0001

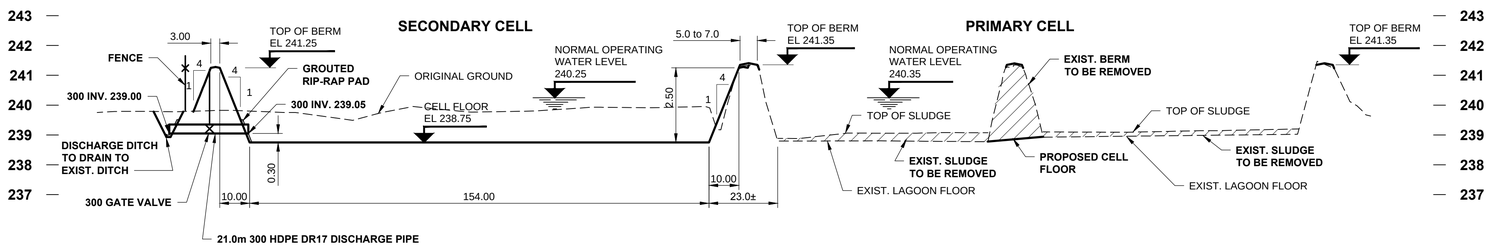
ANSI D 864mm x 559mm
Project Management Initials: Designer: Checked: Approved:
Last saved by: DURANDA(2016-01-28) Last Plotted: 2016-02-01
Filename: P:\60447253\900-WORK\910-CAD\20-SHEETS\C\60447253-SHT-00-C-0001.DWG

Printed on ___% Post-Consumer Recycled Content Paper



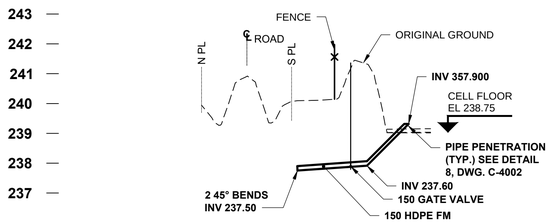
E | SECTION
TEMPORARY SLUDGE DEWATERING CELL

0 25 50 m H=1:1000 V=1:100
0 2.5 5



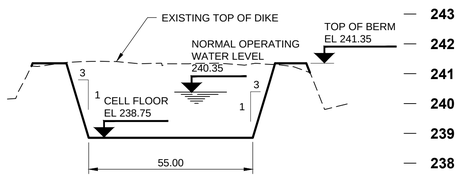
A | SECTION

0 25 50 m H=1:1000 V=1:100
0 2.5 5



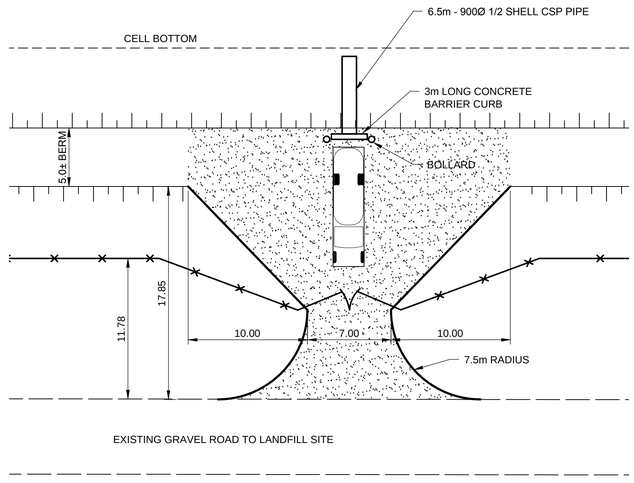
D | SECTION

0 25 50 m H=1:1000 V=1:100
0 2.5 5

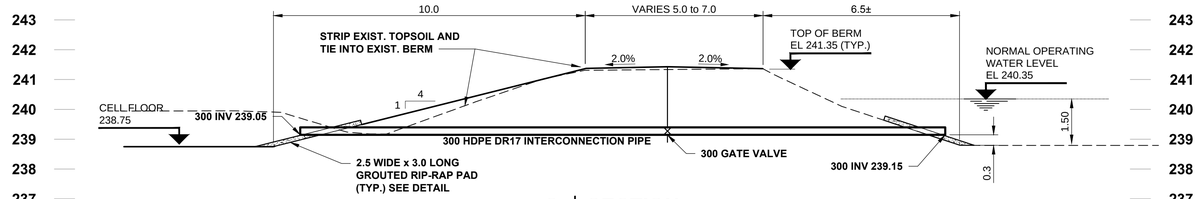


B | SECTION

0 25 50 m H=1:1000 V=1:100
0 2.5 5



1 | TRUCK DUMP DETAIL
Scale 1:250



C | SECTION
250 INTERCONNECTION PIPING.

0 2500 5000 mm
1:100

AECOM

PROJECT

LOWE FARM SEWAGE LAGOON EXPANSION

CLIENT

RM of Morris
Box 518
207 Main Street N
Morris, Manitoba R0G 1K0

CONSULTANT

AECOM
99 Commerce Drive
Winnipeg, Manitoba, R3P 0Y7
204.477.5381 tel 204.284.2040 fax
www.aecom.com

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	14/12/2015	ISSUED FOR PUBLIC MEETING

KEY PLAN

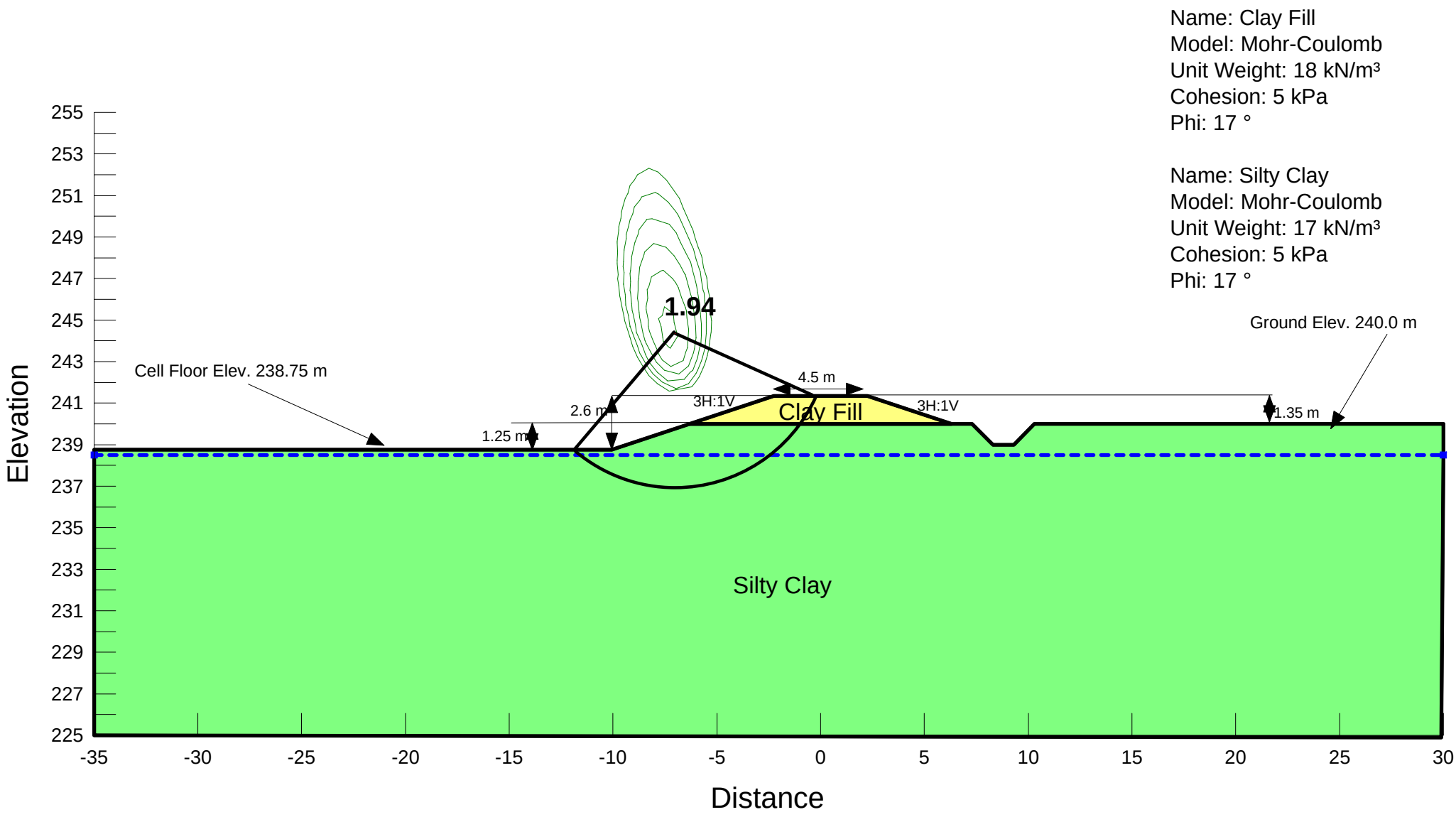
PROJECT NUMBER
60447253

SHEET TITLE
TYPICAL CROSS SECTIONS

SHEET NUMBER
C-0002

Appendix B
Stability Analysis Results

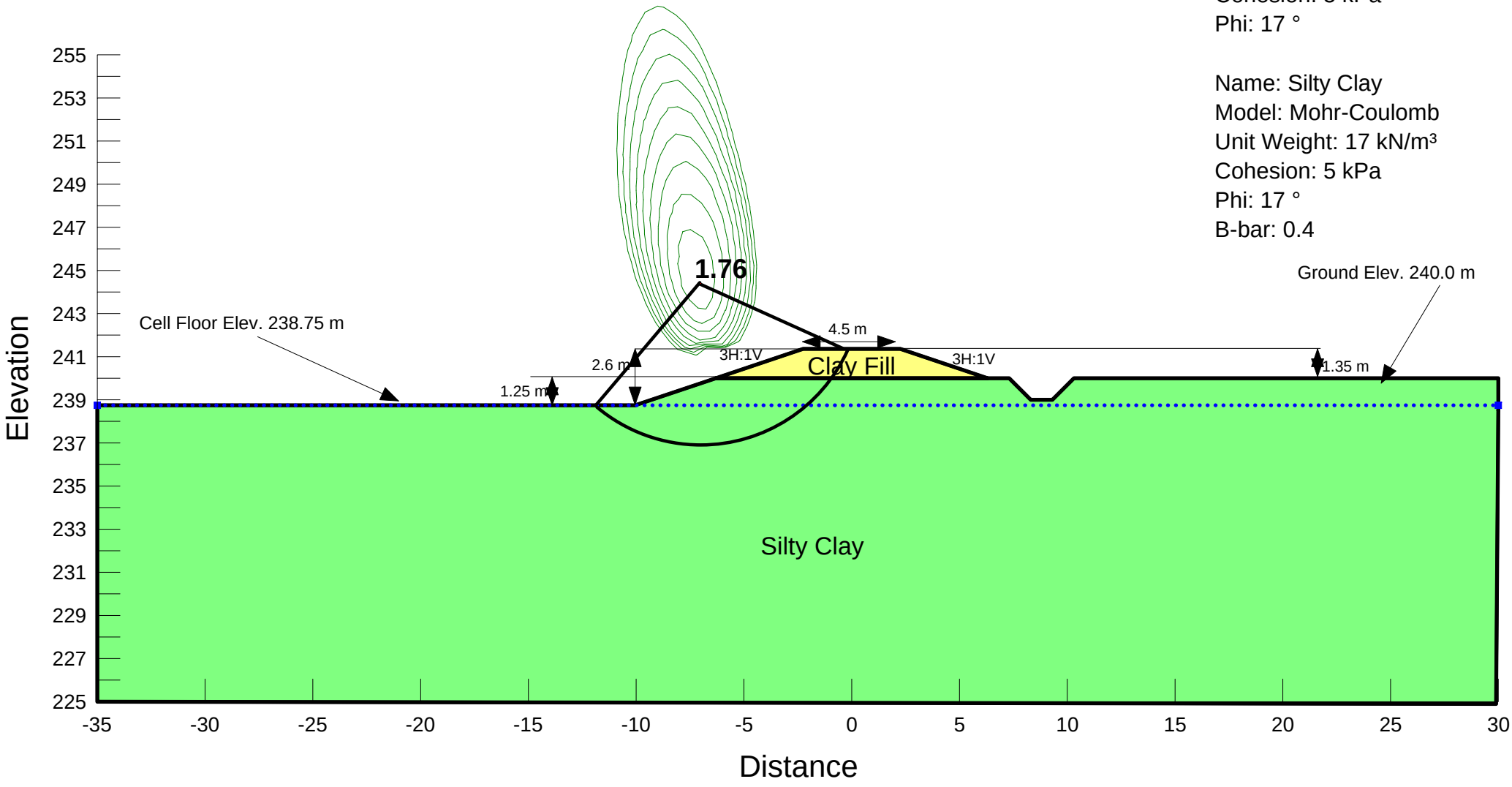
Description: Lowe Farm - Existing Lagoon Stability
Analysis: 3H:1V Long-Term Analysis
Figure 01



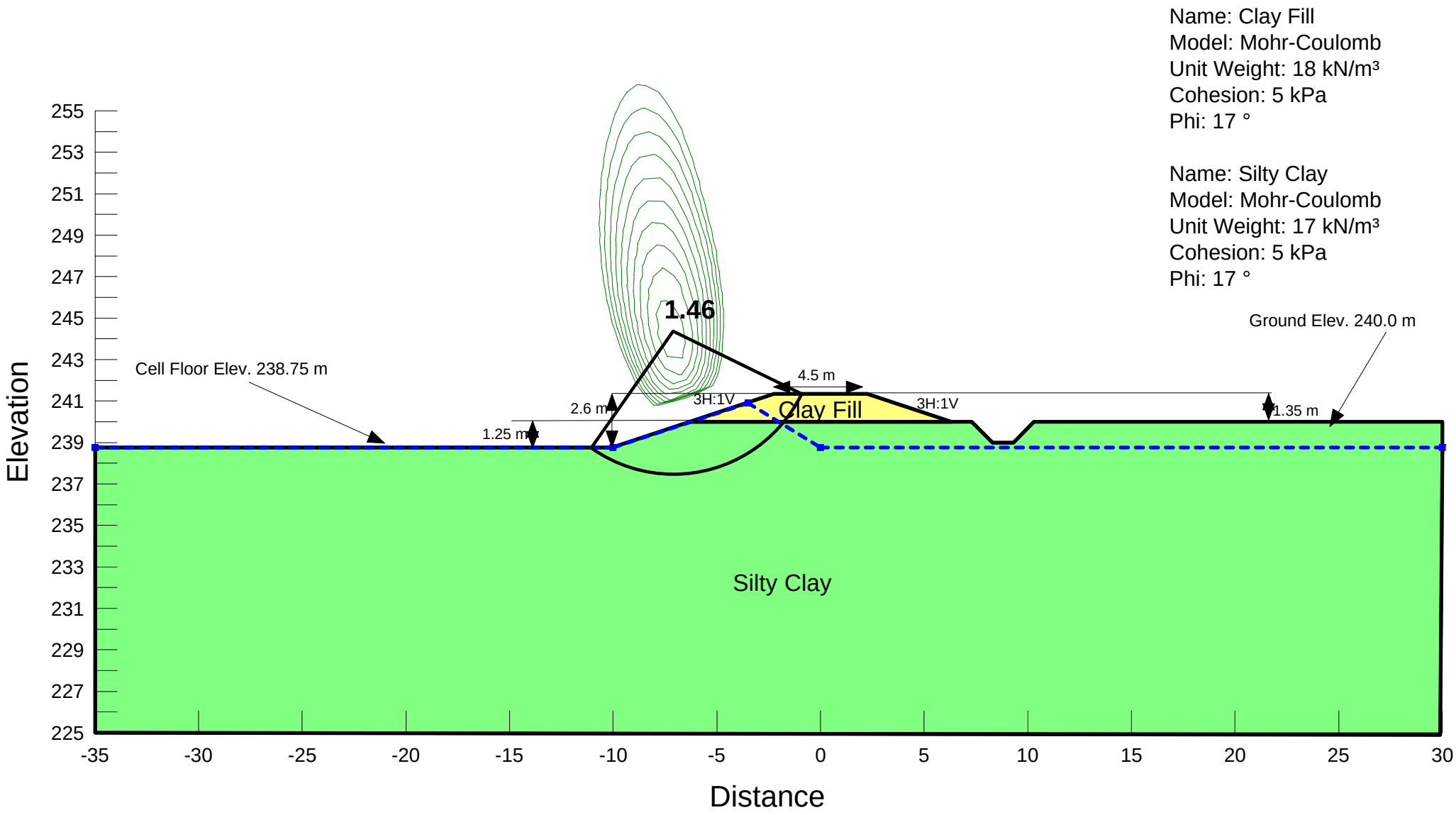
Description: Lowe Farm - Existing Lagoon Stability
Analysis: 3H:1V Short-Term Analysis
Figure #: 02

Name: Clay Fill
Model: Mohr-Coulomb
Unit Weight: 18 kN/m³
Cohesion: 5 kPa
Phi: 17 °

Name: Silty Clay
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 17 °
B-bar: 0.4



Description: Lowe Farm - Existing Lagoon Stability
Analysis: 3H:1V Rapid Drawdown Analysis
Figure #: 03



Appendix E

Site Photographs

Appendix C: Site Photographs

Photograph 1 ↑
Looking north along the west berm towards the proposed secondary lagoon cell.

Photograph 2 ↑
Looking south from the west berm towards the existing primary and secondary lagoon cells.

Photograph 3 ↑
Looking south along the east berm at existing lagoon.

Photograph 4 ↑
Looking west from east berm towards the existing secondary lagoon cell.

Photograph 5 ↑
Looking north along west berm at existing lagoon.

Photograph 6 ↑
Looking west along middle berm of existing lagoon.

Photograph 7 ↑
Existing truck dump located along the western berm of the existing primary lagoon cell.

Photograph 8 ↑
Existing effluent discharge pipe located along the western berm of the existing secondary lagoon cell.

Photograph 9 ↑
Looking west towards the existing effluent discharge drainage route.

Photograph 10 ↑
Looking north along the effluent discharge ditch.

Photograph 11 ↑
Looking southeast towards the proposed secondary lagoon cell.

Photograph 12 ↑
Looking southwest towards the proposed secondary lagoon cell.

Photograph 13 ↑
Looking south towards the proposed secondary lagoon cell.

Photograph 14 ↑
Looking north towards the proposed secondary lagoon cell.

Appendix F

Heritage Resources Branch Response

Cusitar, Kristiina

From: +WPG574 - HRB Archaeology (TCHSCP) <HRB.archaeology@gov.mb.ca>
Sent: Thursday, November 26, 2015 3:52 PM
To: Cusitar, Kristiina
Subject: RE: Heritage Resources Screening Request-Lowe Farm Lagoon Expansion

Hi Kristiina,

Further to your memo requesting a heritage screening for the above lagoon expansion in Lowe Farm, Manitoba (Planned Area), the Historic Resources Branch (HRB) has examined the applicabe areas proposed for development in conjunction with the Branch's records for areas of potential concern, and can advise you that HRB has no concerns with the project at this time.

However, pleased be advised that if any heritage resources are encountered in association with the Planned Area during development, the Developer is required to notify HRB and HRB may require that a heritage resource management strategy be implemented to mitigate the effects of development on the heritage resources.

If you have any questions or comments, please feel free to contact the undersigned at the noted address, phone number, or e-mail.

Christina Nesbitt
Impact Assessment Archaeologist
Historic Resources Branch
Main Floor - 213 Notre Dame Avenue, Winnipeg, MB R3B 1N3
Phone (204) 945-8145; Fax (204) 948-2384
E-mail: Christina.Nesbitt@gov.mb.ca

Manitoba
Tourism, Culture, Heritage, Sport and Consumer Protection

From: Cusitar, Kristiina [mailto:Kristiina.Cusitar@aecom.com]
Sent: October-28-15 10:11 AM
To: +WPG574 - HRB Archaeology (TCHSCP)
Subject: Heritage Resources Screening Request-Lowe Farm Lagoon Expansion

Good Morning!

I am currently working on an EAP for the expansion of the existing lagoon in Lowe Farm, Manitoba. Various options were looked at but it was determined that the location immediately north of the existing lagoon would meet the design/soil requirements. A new secondary cell will be constructed immediately north of the existing lagoon and the two existing lagoon cells will be combined into one large primary cell. The existing influent pipe will be abandoned in place and a new influent pipe will be installed towards the south end of the existing lagoon cell . Please find attached a map and a couple of figures showing the location and the proposed works.

I would like to request a heritage screening of the above described project to determine if there are any potential heritage resources that may be affected by the project and to determine if a Heritage Resources Impact Assessment is required.

If you required additional information, please call me at 204-928-7475.

Thank you for your time,

Kristiina Cusitar, C.E.T., EP (SAR)
Environmental Assessor, Environment
D 1.204.928.7475 Cisco 3997475
kristiina.cusitar@aecom.com

AECOM
99 Commerce Drive, Winnipeg, MB R3P 0Y7
T 1.204.477.5381 F 1.204.284.2040
www.aecom.com

Twitter I Facebook I LinkedIn I Google+