Town of The Pas

Environment Act Proposal for the Wastewater Treatment Lagoon Upgrade with Sludge Land Application

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March 2018

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ACKNOWLEDGMENTS

To prepare this report various sources of information were investigated and researched. JR Cousin Consultants Ltd. (JRCC) wishes to thank the Town of The Pas who contributed to the data and content of this study. In addition, we wish to commend the Town for their fortitude in addressing the need for a long-term solution to wastewater treatment for the residents in the service area.

REMARKS

JR Cousin Consultants Ltd. has conducted this environment act proposal in accordance with generally accepted professional engineering principles and practices for the purpose of identifying conditions that may have an environmental impact on the site. The findings and recommendations reached in this report are based on information made available to JRCC during the investigation and conditions at the time of the site investigation. Conclusions derived in this report are intended to reduce, but not wholly eliminate the uncertainty regarding potential environmental concerns on the site, and recognizes reasonable limitations with regards to time, accuracy, work scope and cost. It is possible that environmental conditions may change from the date of this report. If conditions appear different from those encountered and expressed in this report, JRCC should be informed so that mitigation recommendations can be reviewed and adjusted as required. Historical data and information obtained from personal communication used in this report, are assumed to be correct, however JRCC has not conducted further investigations into the accuracy of this data. JRCC has produced this report for the use of the client, and takes no responsibility for any third party decisions or actions based on information contained in this report.

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Appendix A

Status of Titles

Appendix B

Table 1: The Pas Lagoon - Population, Hydraulic and Organic Loading Projections to Design Year 20

Wildlife and Ecosystem Protection Branch Email Correspondence, Manitoba Sustainable Development, August 29, 2017

Historic Resources Branch Memorandum, Manitoba Sport, Culture and Heritage, September 1, 2017

Appendix C

Sludge Assessment Report, Assiniboine Injections Ltd., May 2016

Appendix D

Title Page

Plan 1: Existing Lagoon Site Plan

Plan 2: Proposed Lagoon Upgrade with Setbacks and Discharge Route

Plan 3: Proposed Lagoon Upgrade Layout Plan

Plan 4: SAGR Cell Details

Plan 5: Wastewater Treatment Process Diagram

Plan 6: Treatment Building Overall Layout

Plan 7: Fence, Silt Fence, Pipe Trench, and Swale Details

Plan 8: Carrot River Valley Agricultural Land

Environment Act Proposal Form

Manitoba
Sustainable Development

Name of the development:	The Pas - Wastewater Treatment Lagoon Upgrade w Sludge Land Application
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):	Class 2 Development - Wastewater Treatment Lagoon
Legal name of the applicant:	Town of The Pas
Mailing address of the applicant:	81 Edwards Ave, Box 870
Contact Person:	Mr. Sam Mirza-Agha
City: The Pas	Province: Manitoba Postal Code: R9A 1K8
Phone Number: (204) 627-1100	Fax: (204) 623-5506 email: sam@townofthepas.ca
Location of the development:	Town of The Pas
Contact Person:	Mr. Sam Mirza-Agha
Street Address:	
Legal Description:	NW 2-56-26 WPM
City/Town: The Pas	Province: Manitoba Postal Code: R9A 1K8
Phone Number: (204) 627-1100	Fax: (204) 623-5506 email: sam@townofthepas.ca

Name of proponent contact person for purposes of the environmental assessment:	Jason Cousin, P.Eng
Phone: (204) 489-0474 Fax: (204) 489-0489	Mailing address: JR Cousin Consultants Ltd. 91 A Scurfield Blvd. Winnipeg, Manitoba, R3Y 1G4
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Webpage address: www.jrcc.ca	
Date: March 15/18	Signature of proponent, or corporate principal of corporate proponent: Printed name: Jason Cousin

PRINT RESET

EXECUTIVE SUMMARY

General

The Town of The Pas is proposing to upgrade the existing wastewater treatment lagoon and land apply sludge from the lagoon. An Environment Act Licence is required from Manitoba Sustainable Development for the construction and operation of the upgraded lagoon. JR Cousin Consultants Ltd. (JRCC) was retained for the engineering services.

Description

The existing The Pas wastewater treatment lagoon is in need of upgrading, as the existing aerated lagoon is exceeding the licence requirements for hydraulic capacity and Manitoba Sustainable Development has expressed concerns over the facility meeting effluent quality guidelines. The proposed upgrade will include constructing six Submerged Attached Growth Reactor (SAGR) cells, an aeration building, a baffle curtain in the existing lagoon cell, an Alum dosing system, and potentially a UV disinfection system. These works are required to achieve the organic and hydraulic loading capacities required in the upgraded lagoon site to design year 20. The SAGR cells will be constructed to the east of the existing lagoon aeration cell in a currently forested area. The upgraded lagoon will continue to utilize continuous discharge to Grace Lake. Sludge from the existing lagoon and adjacent dewatering cell will be removed and land applied on agricultural land in the nearby Carrot River Valley.

Population Contributing Effluent

The projected year 20 population used for sizing The Pas lagoon upgrade consisted of: the residential population in the Town of The Pas (7,816 people), the bussed in students at the six schools (145 equivalent people), the OCN Timberland trailer park (292 people) and the surrounding rural residents in the RM of Kelsey (1,697 people).

Lagoon Loading

The total projected year 20 organic loading to the lagoon would be approximately 669.5 kg BOD_5/day, which considers average daily loading from the community and a peak daily load of septage from the surrounding rural residents (i.e. seven septic tank pump outs per day) and a local commercial facility (Berscheid Meats).

The projected year 20 hydraulic load to the lagoon would be approximately 9,431 m^3/day, from all sources described above.

Sludge Survey

A sludge survey of the existing aeration cell and sludge dewatering cell indicated that there was an accumulation of approximately 34,270 m^3 in the lagoon, with sludge thickness ranging from 1.2 m to 3.3 m. Samples of sludge analyzed by the laboratory indicated that sludge from the dewatering cell generally has higher nutrient and metal concentrations than sludge in the aeration cell.

Sludge Application

Based on the sludge accumulation, it is proposed that sludge be removed from the aeration cell and dewatering cell and be hauled to agricultural fields in the surrounding Carrot River Valley for disposal.

Lagoon Upgrade Design

The six SAGR cells would each have a footprint area of 1,826 m^2 and an operating depth of 2.4 m. The cells would be lined with a synthetic HDPE liner for containment of effluent and would be filled with clean granular material and covered with a mulch or peat layer to provide insulation. A chain link fence would be constructed around the cells and would tie into the existing lagoon fence. Three 100 hp blowers would supply air for the SAGR cells. An Alum dosing system would provide phosphorus reduction, and a there will be area for installation of a potential UV disinfection system.

A building would be constructed to house the SAGR blowers, potential UV units and the alum dosing system, which would have a footprint area of 188 m^2 and would have a mechanical room and an electrical room. A baffle curtain would be installed across the middle of the existing lagoon cell to promote more consistent flow through the lagoon.

Potential Concerns and Mitigation Measures

From discussions with the Town and a review of the current site operations, the potential concerns identified with the upgrade of the wastewater treatment lagoon and associated mitigation measures include:

Potential Concern	Mitigation Measure
Emissions from construction equipment	The construction contractor will maintain heavy equipment to meet provincial and local emission standards
Dust generation	Dust suppression methods (i.e. wetting) will be utilized if dry and windy conditions are a nuisance to nearby residents
Contamination of surface and groundwater from lagoon discharge and seepage	Lagoon effluent will be treated to the requirements of the Environment Act Licence during operation. The lagoon effluent will be tested regularly during operation, to ensure effluent quality guidelines are met. The SAGR cells will be lined with a synthetic HDPE liner to contain liquid in the cells
Soil erosion after construction works	Disturbed areas will be seeded with grass to reduce erosion. Silt fencing will be installed along the adjacent drainage route to prevent silt from reaching surface waters.
Spills or leaks during construction	Contractor to have emergency spill kit on site. Hazardous materials and fuel to be handled in accordance with all federal and provincial regulations
Leaks from the effluent piping	The effluent piping will be inspected and tested after installation to ensure there are no leaks
Impacts to Wildlife	The tree clearing works would be conducted outside of the typical bird nesting season in the spring
Noise impacts from construction works	Construction works will be limited to daylight hours only

Potential Concern	Mitigation Measure
Public Health and safety	Construction workers will be required to adhere to the safety program which will include utilizing personal protective equipment while on site. Access to the construction site will be limited. Warning signs will be utilized at the entrance to the site to prevent unauthorized entry.
Heritage or Historic Resources	If any significant historic or heritage resource is discovered during the construction works, the works will temporarily cease and provincial and federal authorities will be notified.

Schedule and Approvals

The Town of The Pas would like to begin the lagoon upgrading works in 2018, after receipt of an Environment Act Licence and funding is obtained. The works may be phased and therefore may occur over several years. No additional approvals, licences or permits are expected for the works, beyond the Environment Act Licence from Manitoba Sustainable Development.

1.0 INTRODUCTION AND BACKGROUND

The development described herein is for the upgrading and operation of The Pas wastewater treatment lagoon for the Town of The Pas, Manitoba.

1.1 Introduction

The Town of The Pas has prepared this Environment Act Proposal (EAP) to satisfy the requirements of Manitoba Sustainable Development, for the upgrading of the existing wastewater treatment lagoon. An Environment Act Licence is required from Manitoba Sustainable Development for the proposed works. JR Cousin Consultants Ltd. (JRCC) was retained for the related engineering services.

1.2 Contact Information

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1.3 Background Information

The Town of The Pas is located approximately 630 km northwest of Winnipeg, Manitoba along PTH 10. The existing lagoon is located at NW 2-56-26 WPM, approximately 1.0 km east of The Pas (see Plan 1 in Appendix D). The service population currently utilizing the wastewater treatment lagoon includes the residential and commercial populations within The Pas, some Opaskwayak Cree Nation (OCN) residents, and rural residents from the RM of Kelsey. The residents within The Pas and OCN are currently serviced with a gravity sewer collection system while rural residents are serviced via septage hauling. The lagoon facility is reported to be exceeding the licence requirements for hydraulic capacity and Manitoba Sustainable Development has expressed concerns over the facility meeting effluent quality guidelines. With the growing population of the area, an upgrade to the Town of The Pas lagoon is required.

The Pas wastewater treatment lagoon was constructed in stages, beginning with the initial lagoon construction, aeration system, and chlorine contact chamber in 1970. The most recent upgrade was completed in 1996/1997 when the aeration system was replaced and the sludge was placed in a new sludge dewatering cell. The original 58 aeration diffusers were replaced with 102 aeration diffusers. The

aerated lagoon discharges through two-300 mm pipes into a chlorine contact chamber. The chlorine contact chamber is a 1,270 mm diameter, 37 m long pipe. After the chlorine contact chamber, effluent is discharged through a 53 m long, 300 m diameter pipe to a drainage ditch, where effluent and surface runoff collected by lagoon perimeter ditch travels 900 m to Grace Lake.

The lagoon is currently being operated under the Environment Act Licence No. 2209 S1, issued in 1996. Under this licence, the maximum daily flow is not to exceed a 30 day average of 5,188 m^3/day during the winter months and 7,125 m^3/day during the summer months. The maximum liquid limit in the aerated lagoon cell is 4.5 m. The licence also includes a 30 day average organic loading limit of 578 kg BOD_5/day during the winter months and 1,020 kg BOD_5/day during the summer months. The lagoon is currently surrounded by forested land and sludge drying beds.

1.4 Description of Previous Studies

The need to upgrade and expand the Town of The Pas lagoon was identified in the *Town of The Pas Wastewater Assessment* Study by AECOM Canada Ltd. in 2010. The AECOM study recommended constructing a sequencing batch reactor plant at the existing lagoon site, using the existing cell as storage. The Town was not interested in constructing a mechanical sewage treatment plant at that time.

The lagoon expansion options were discussed in the *Town of The Pas Lagoon Expansion Feasibility Study,* by JRCC in 2017. The recommendations for lagoon expansion included constructing six Submerged Attached Growth Reactors (SAGR), installing an alum addition system with a recycle line, installing a baffle curtain in the aeration cell, and removing sludge in the aeration cell.

1.5 Project Description

The Town of The Pas is in need of an Environment Act Licence for the upgrading and continued operation of The Pas wastewater treatment lagoon. Due to the hydraulic capacity issues and disinfection concerns of the existing lagoon, the upgrade is being proposed adjacent to the existing lagoon, to the east of the aerated lagoon cell. This upgrade will include the construction of six SAGR cells, a baffle curtain in the existing aeration cell, a blower building, an effluent recycle line, an alum dosing system and an option for a UV disinfection system.

Due to the age of the lagoon, sludge accumulation in the aerated cell will be removed, and hauled offsite for agricultural disposal. Based on the sludge survey and calculations, it is estimated that approximately 54,461 m^3 of sludge will be removed from the cells and land applied. A suitable agricultural field in the nearby Carrot River Valley, meeting the provincial setback requirements, would be utilized for the sludge application.

The lagoon upgrading is planned to be completed as a single project, however should funding not all be available, the upgrade may be forced to split into two separate phases. The phases would be as follows:

- Phase 1: Construct the proposed building with room for a UV disinfection system, phosphorus reduction systems and the SAGR blowers, but not installing the SAGR equipment in the building at this time.

- Phase 2: Construction the SAGR cells and complete the lagoon cell upgrades, including the baffle curtain, install the SAGR equipment in the building, removing sludge from the cell and disposing of sludge on agricultural fields.

2.0 DESCRIPTION OF THE DEVELOPMENT

For each heading there is an information request from the Environment Act Proposal Form. These requests are repeated herein in italics followed by the pertaining response.

2.1 Land Title/Location

Certificate of Title showing the owner(s) and legal description of the land upon which the development will be constructed; or, in the case of highways, rail lines, electrical transmission lines, or pipelines, a map or maps at a scale no less than 1:50,000 showing the location of the proposed development:

The existing Town of The Pas wastewater treatment lagoon and proposed upgrade is located on NW 2-56-26 WPM, within the Town limits. Location of the existing lagoon layout is included on Plans 1 and 2 of Appendix D. The Town currently owns the land parcel utilized for the existing lagoon cells and the proposed development area to the east. Copies of the current Status of Titles (No. 1483316/3 and No. 1483338/3) for this land parcel are attached in Appendix A.

The lands to be designated for the sludge application will be privately owned agricultural fields. The Town of the Pas will prepare a land use agreement(s) with the land owner(s), outlining the acceptable land use and agricultural requirements, based on the licence requirements.

2.2 Owner of Land and Mineral Rights

Owner of land upon which the development is intended to be constructed, and of mineral rights beneath the land, if different from surface owner:

Based upon the status of titles for the proposed lagoon upgrade area, all mines and minerals are excluded from the surface land title as set forth in the original grant from the Crown.

2.3 Existing Land Use

Existing land use on the site and on land adjoining it, as well as changes that will be made in such land use for the purposes of the development:

The land surrounding the existing lagoon cell is currently forested land with no designated land use. There is a low lying wetland area to the southeast, which drains to Grace Lake and is currently used as the lagoon discharge route.

The lagoon development area would be cleared of trees and soil would be excavated for construction of the lagoon SAGR cell dikes, blower building and drainage ditching, as part of the proposed lagoon upgrade.

The lands to be utilized for sludge application are currently being used for agricultural. While the exact location of the land parcel has not been identified, the Carrot River Valley area is typically used for growing wheat, canola and barley.

2.4 Land Use Designation/Zoning Designation

Land use designation for the site and adjoining land as identified in a development plan adopted under The Planning Act or The City of Winnipeg Act, and the zoning designation as identified in a zoning by-law, if applicable:

The lagoon site is zoned as Limited Development, based on zoning designations in the Town of The Pas. The agricultural lands proposed for sludge application would be zoned Agricultural General.

2.5 Description of Development

Description of proposed development and schedule for stages of the development, including proposed dates for planning, design, construction, commissioning, operation, and decommissioning and/or termination of operation (if known), identifying major components and activities of the development as applicable (e.g. access road, airstrip, processing facility, waste disposal area, etc.).

2.5.1 Project Schedule

The lagoon upgrading works are proposed to begin in 2018, upon receipt of the Environment Act Licence, with site works beginning upon availability of funding. It is proposed that the lagoon upgrade would occur as a single project, however based on availability of funding may be completed in two separate phases. The construction works could be ongoing over several years.

Commissioning and operation of the lagoon SAGR cells would begin upon completion of construction and after approval for use is obtained from Manitoba Sustainable Development. The proposed lagoon upgrade would be designed for a 20 year lifespan. The existing lagoon aeration cell would continue to be utilized in the lagoon operation. The lagoon would continue to operate during the construction works, with limited service interruptions.

The sludge land application would occur after crops have been removed from the fields in the late summer or fall.

2.5.2 Lagoon Site Setbacks and Characteristics

The location of The Pas lagoon upgrade was chosen based on proximity to the existing lagoon cell, the existing infrastructure, surrounding residential lots, proximity to adjacent property boundaries, land ownership, existing land use, soil conditions, topography and availability of land.

The Manitoba Sustainable Development guidelines for the location of a wastewater treatment lagoon (*Design Objectives for Standard Sewage Lagoons, Province of Manitoba, Environmental Management*, July, 1985 and *Information Bulletin – Design Objectives for Wastewater Treatment Lagoon*, Manitoba Conservation, 2014) are outlined in the following table. A description of the proposed upgrade site in relation to each of the guidelines is also provided in the table.

Table A: Location of Proposed Lagoon Upgrade Site in Relation to Provincial Guidelines

Manitoba Sustainable Development Guideline	Proposed Relation to Site
Lagoons must be located a minimum of 460 m from the nearest center of population.	The proposed SAGR cells are located beyond the 460 m setback from the nearest community (The Pas).
Lagoons must be located a minimum of 300 m from any residence. (Measured from the outer toe of the nearest dike).	The proposed SAGR cells are located beyond the 300 m setback from the nearest residence.
Consideration should be given to sites in which prevailing winds are in the direction of uninhabited areas.	The prevailing winds are typically from the north and west. The existing and proposed lagoon cells are located east of the community.
Sites with an unobstructed wind sweep across the lagoon are preferred.	The existing and proposed lagoon cells are surrounded by forested land.
Areas that are habitually flooded shall be avoided and locations receiving significant amounts of runoff water are discouraged.	The lagoon site is located adjacent to a low lying wetland and approximately 700 m from Grace Lake. The dikes of the proposed SAGR cells will be constructed to an elevation above the 100 year flood elevation from Grace Lake. A perimeter ditch will also be located around the toe of the SAGR cells to divert runoff water away from the cells.
Sewage lagoons are to be designed and constructed such that the interior surface of the proposed lagoon is underlain by at least one metre of soil having a hydraulic conductivity of 1×10^{-7} cm/sec or less. In areas sensitive to groundwater contamination or without suitable soils, a flexible synthetic liner may be utilized.	The proposed SAGR cells will be constructed with a synthetic geomembrane liner for containment of liquids, which will meet provincial requirements.

The lagoon site is located adjacent to low lying wetlands, however no past flooding at the lagoon site has been reported by the Town. As all other specified setback distances and site requirements have been met, there are no expected concerns for the location of the proposed lagoon SAGR cells. Typically the setback requirements are more of a concern with a facultative lagoon, rather than with an aerated lagoon, due to the potential for odours in a facultative lagoon. Plan 2 in Appendix D, shows the minimum setback distance requirements for the existing lagoon and proposed lagoon upgrade to the nearby residences and the community.

2.5.3 Lagoon Discharge Route

The existing lagoon drainage route is to the southeast of the existing lagoon aeration cell, through a drainage ditch that flows into a wetland area and into Grace Lake (see Plan 2 in Appendix D).

2.5.4 Lagoon Access

The existing lagoon is accessed from Hayes Avenue, and this access road will continue to be utilized for regular maintenance vehicles and septic truck hauling. This access road is maintained by the Town of The Pas public works department.

2.6 Population Contributing Effluent

Population data was obtained from Statistics Canada and from information provided by the Town of The Pas and the Opaskwayak Cree Nation (OCN). The service population currently utilizing The Pas lagoon includes residential and commercial populations from within the Town of The Pas, bussed-in-students, a portion of the OCN residential population, the rural residents in the RM of Kelsey and Berscheid Meats Industry.

2.6.1 Town of The Pas

Based upon the most recent census data available, the Town of The Pas had a 2016 population of 5,369 people and a 2011 population of 5,513 people, which is an average annual population decline of - 0.5%. From a review of historical population data, the population has been continually declining for the past 20 years. However, from discussions with the Town, there are several housing developments being planned for the Town over the next 20 years, which is expected to increase the population by 2,447 people. Therefore, a design year 20 population of 7,816 people in the Town of The Pas was utilized for sizing the proposed lagoon upgrade development.

2.6.2 Bussed in Students

The Town of The Pas has six schools (Kelsey Community School, Ecole Opasquia School, Ecole Scott Bateman Middle School, Mary Duncan School, Margaret Barbour Collegiate Institute, and Kelsey Learning Centre), which service both the Town of The Pas and the surrounding RM of Kelsey. Based on discussions with the Kelsey School Division, 435 students are bussed into The Pas schools. Of those 435 bussed in Students, 356 are bussed in from the RM of Kelsey, and 79 are bussed in from other communities. The population of bussed in students would have an assumed occupancy of one-third of the population, based on the amount of time spent at school, and would therefore represent a current equivalent population of 145 people (435/3). The population of the bussed in students to the school is estimated to have no population growth over the next 20 years, therefore a design year 20 equivalent population of 145 people will be utilized in sizing the lagoon upgrade development.

2.6.3 Opaskwayak Cree Nation

The Town of The Pas accepts wastewater from the Timberland trailer park (OCN Reserve Parcel 21A). There are currently 45 tenants at an assumed density of four people per residence for a current population of 180 people. From discussions with OCN, it was estimated that the trailer park would be further developed over the next 20 years with an estimated increase in population

of 112 people. Therefore, the design year 20 population from the trailer park is projected to be 292 people, which was utilized in sizing the lagoon upgrade development.

2.6.4 RM of Kelsey

The rural residents in the RM of Kelsey would also be included in the service population for the lagoon upgrade. Statistics Canada (2016) reported a population for the RM of 2,424 people in 2016, which includes populations of Cranberry Portage and Wanless. It was estimated that approximately 70% of the census population is serviced by The Pas lagoon. Therefore, the rural population serviced by the lagoon is approximately 1,697 people. This rural population would be considered for truck hauling septage and holding tank wastewater to the lagoon. The RM indicated that approximately 55 people utilize holding tanks, while the remainder (1,642 people) utilize septic systems. Census data for the past twenty years indicated that the RM has experienced an average population decline of - 0.6% per year. Therefore, no growth rate was assumed for the RM. The projected service population in design year 20 for the rural population in the RM will be 1,697 people, which was utilized in sizing the lagoon upgrade development.

2.6.5 Berscheid Meats Industry

Berscheid Meats is a local industry located in the RM of Kelsey that has two facilities, including a meat processing plant. These facilities will continue to contribute industrial wastewater to The Pas wastewater treatment lagoon, and will be included in sizing the lagoon upgrade development. No additional population was assumed for these facilities.

2.6.6 Population Summary Table

The current and projected populations for the service area have been included in the summary table below and in the attached Table 1 in Appendix B.

Contributing Population	Current Population	Year 20 Population
Town of The Pas	5,369	7,816
Bussed in Students	145	145
OCN Trailer Park	180	292
RM of Kelsey (rural)	1,697	1,697

2.7 Wastewater Production

The Pas wastewater treatment lagoon currently receives wastewater influent from a gravity wastewater collection system in the Town of The Pas, and from truck hauled septage from the RM of Kelsey. Truck hauled wastewater from holding tanks in the RM are also received at the lagoon.

2.7.1 Organic Loading

The organic loading calculation is based upon the organics in typical residential wastewater and septage, measured as the Biochemical Oxygen Demand (BOD). A typical value of 0.076 kg BOD_5/person/day is utilized for communities with gravity sewer systems and for

holding tank systems. Based on the populations connected to the gravity sewer system and rural holding tanks, the daily organic loading rate is projected to be 631.4 kg BOD_5/day, in design year 20.

Truck hauled septage from rural residents in the surrounding RM and from Berscheid Meats is considered as additional organic loading to the lagoon, as it will typically impact the peak daily Biochemical Oxygen Demand (BOD) loading.

Using a rural housing population density of 2.7 people/household (Statistics Canada, 2016) for rural residents in the RM of Kelsey, and assuming each septic tank is 4,500 L and is pumped out annually, each septic tank pump out generates approximately 5.3 kg BOD_5. The tank loading is based on 200 L/person/year of septage solids at 0.007 kg BOD_5/L and 0.00038 kg BOD_5/L of liquid septage. Therefore, the BOD production from each septic tank is (200 x 2.7 x 0.007) + (4,500 -(200 x 2.7)) x 0.00038 = 5.3 kg BOD_5/tank.

Based on the 2010 AECOM *Wastewater Assessment Study*, a sample of wastewater from Berscheid Meats was tested and determined to have a BOD_5 of 660 mg/L. Based on the hydraulic loading of 1.5 m^3/d, the design organic load would be 0.99 kg BOD_5/day.

Septage is typically permitted to be hauled to the lagoon over the time period of 135 days, as specified by Manitoba Sustainable Development in recent Environment Act Licences. Within the 135 day hauling period, it is likely the majority of the hauling will occur during the normal Monday to Friday work week resulting in only 96 days effluent is hauled to the lagoon. Based on the rural populations contributing septic loading to The Pas lagoon, a housing density of 2.7 people/household, and 96 hauling days, an average of 6.3 tanks would need to be pumped out and hauled to the lagoon daily from the RM of Kelsey. Since only full tanks will be pumped out, the projected organic load would be based on seven tank pump outs daily, resulting in a truck haul organic load of 37.1 kg BOD_5/day. With the daily contribution of 0.99 kg BOD_5/day from Berscheid Meats, the overall truck hauled organic loading in design year 20 would be 38.1 kg BOD_5/day.

Therefore, the total daily organic loading to the lagoon is estimated to be 669.5 kg BOD_5/day (631.4 + 38.1 kg BOD_5/day) in design year 20.

2.7.2 Hydraulic Loading

The hydraulic loading to The Pas lagoon consists of water usage, infiltration, septic and holding tank hauling. The hydraulic loading to The Pas wastewater treatment lagoon was determined from a review of the lagoon effluent flow, and water use records, as provided by the Town.

From a review of the water use records for 2013 and 2014, the average per capita water usage recorded was 928 L/person/day. The per capita water plant usage is higher than typical flow rates, as the Town uses bleeders on water service lines to prevent freezing during winter months. Infiltration rates were determined by comparing the water usage to the lagoon discharge rates over the same time period (2013 and 2014). The average per capita infiltration

rate was determined to be 209 L/person/day. Therefore, the overall per capita hydraulic load from the residential population, bussed in students and OCN trailer park was estimated to be 1,137 L/person/day. Based on the projected populations, the overall hydraulic flow from the piped collection system in design year 20 would be 9,220 m^3/day.

The daily hydraulic loading from rural residents included septic tank hauling, which is estimated to be 31.5 m^3/day (7 tanks x 4,500 L/tank). The hydraulic loading from holding tank effluent from the RM of Kelsey and Berscheid Meats, was estimated to be 14.7 m^3/day.

The overall projected hydraulic loading to the lagoon in design year 20 would be approximately 9,431 m^3/day. Table 1 attached in Appendix B, shows the current and projected year 20 hydraulic loadings to the lagoon.

2.7.2.1 Peak Loading

From a review of sewage effluent flow data for the peak months and discussions with the Town, a peak monthly loading of 1.5 times the average flow was assumed. This would result in a maximum monthly peak flow of 14,146 m^3/day, in design year 20. The maximum seven day peak flow was 2.16 times the average flow, which would be a weekly peak flow of 20,371 m^3/day. The daily peaking factor of 3.04 was calculated, based on recorded values, which would result in a peak day flow of 28,670 m^3/day.

2.7.3 Wastewater Production Summary Table

The current and projected organic and hydraulic loadings for the service area have been included in the summary table below and in Table 1 of Appendix B.

Contributing Wastewater Load	Current Daily Load	Year 20 Daily Load
Organic Loading (kg BOD_5/day)	482.4	669.5
Hydraulic Loading (m^3/day)	6,630	9,431

2.8 Sludge Survey and Sludge Application

A sludge survey was completed by Assiniboine Injections Ltd on The Pas lagoon aeration cell on May 16, 2016. The measurements were obtained by sampling off a boat in the cell. The sludge survey shows a sludge depth ranging from 1.2 m to 3.3 m deep with an average sludge depth of 2.1 m, determined from 51 sampling locations in the aeration cell. The thickest accumulation was on the west side of the lagoon where the influent pipes are located. Assiniboine Injections estimated the volume of the sludge to be 51,015 m^3 in the aeration cell, however based on the dimensions of the lagoon cell and average sludge depth determined by Assiniboine Injections, JRCC calculated a sludge volume of 34,270 m^3 in the lagoon aeration cells, with consideration of the inner slopes. A survey was not conducted in the sludge dewatering cell, however it was estimated that the cell contains approximately 15,240 m^3, based on the lagoon record drawings and the site observations.

Samples were taken from the lagoon cell and the sludge dewatering cell and sent to ALS Environmental for laboratory testing. The tables below, presents selected key parameters for each of the cells. See Appendix B for the sludge assessment report completed by Assiniboine Injections Ltd. and detailed ALS test results.

2.8.1 Sludge Removal

Due to the accumulation of sludge in the lagoon, sludge removal will be conducted to improve treatment efficiency and increase hydraulic capacity in the aerated cell. Sludge from the adjacent dewatering cell would also be removed. From discussions with the Town of The Pas, the preferred method of sludge removal and disposal will be dredging the cell floors and pumping the sludge into tanker trucks. The trucks will haul the sludge solids to agricultural fields in the Carrot River Valley for disposal. The nearest agricultural field in the Carrot River Valley is located approximately 3.7 km from the lagoon site.

2.8.2 Sludge Application

2.8.2.1 Methodology

The preferred method for the application of sludge would be land application/injection with tilling to incorporate into the soils. In this way there would be beneficial re-use of nutrients on agricultural fields, which would minimize the requirements for synthetic fertilizers.

After hauling to the proposed land application site, the trucks or other heavy equipment will then surface apply or inject sludge to the fields at the approved loading rates. If applied to the surface, the fields will then be tilled to incorporate the sludge into the soil.

Land application of sludge from municipal sewage lagoons in Manitoba must comply with the requirements of the Manitoba Nutrient Management Regulation 62/2008, under The Water Protection Act. Guidelines for sludge removal and disposal are also described in *The Environmental Requirements for Treatment and Disposal of Biosolids in Manitoba* by Mike Van Den Bosch, P. Eng., Municipal and Industrial Approvals, Manitoba Environment (undated).

2.8.2.2 Nutrient Management Zone

The detailed soil survey report of the Pasquia Map Area (No. 11) was reviewed for information on agricultural capability classification. However, no classification of the soils was available for the land parcels proposed for land application of sludge. Instead the description of the proposed lands indicates that the soils are fair to excellent for the growing of grain, hay and pasture crops. While no specific classification for the land parcels can be related to the *Nutrient Management Regulation (62/2008),* it can be estimated that the lands would be located in

Nutrient Management Zones N1 – N3, given the description and the active agricultural land use in the area.

With a Nutrient Management Zone designation of N1, the residual concentration of nitrate nitrogen within the top 0.6 m of soil at the end of the growing season, at any place within the application area, shall be no greater than 157.1 kg/ha.

2.8.2.3 Land Application Rates

Land Application Rates – Nitrogen

The document *Environmental Requirements for Treatment and Disposal of Biosolids in Manitoba* indicates that the amount of plant available nitrogen (PAN) added to the land from all sources should not exceed 100 kg/ha during any given year when sludge is applied. The document defines plant available nitrogen as:

PAN = 20% of the organic nitrogen-N + 100% of the ammonia-N + 100 % of the nitrate-N

The following table provides calculations on the PAN for the sludge in the primary and dewatering cells.

Table 2.3 – Land Application Rates - Nitrogen

Parameter	Unit	Primary Cell	Dewatering Cell
Sludge Volume	m^3	34,270	15,240
Sludge Volume for calculations (+10%)	m^3	37,697	16,764
Total Solids (measured)	%	6.86	7.14
Dry Tonnes Biosolids Available	tonne	2586	1197
Estimated Sludge Volume Removed (7% solids)	m^3	36,943	17,099
Total Nitrogen by LECO	mg/kg	13,700	15,100
Available Nitrate-N	mg/kg	<4.0	<4.0
Available Ammonium-N	mg/kg	2630	490
Total Organic Nitrogen	%	0.73	1.38
Total Organic Nitrogen	mg/kg	7,300	13,800
Plant Available Nitrogen (PAN)	mg/kg	4823	3251
Plant Available Nitrogen (PAN)	kg/tonne	4.823	3.251
Total PAN From Sludge	kg	12472	3891
Land Required at 100 kg PAN/ha	**ha**	**105.8**	**38.9**
Sludge Application Rate	**dry tonnes/ha**	**24**	**31**

Based on the PAN from the primary cell, sludge can be applied at a rate of 24 tonnes/ha, on a minimum of 105.8 ha of land. Based on experience, sludge is

typically removed from a lagoon at solids concentration of approximately 7%, therefore a volume of 36,943 m^3 of sludge is assumed to be removed and be applied at an application rate of 349 m^3/ha.

Based on the PAN from the sludge dewatering cell, sludge can be applied at a rate of 31 tonnes/ha, on a minimum of 38.9 ha of land. Based on a typical sludge solids concentration of approximately 7%, a volume of 17,099 m^3 of sludge would be removed and be applied at a maximum application rate of 439 m^3/ha.

Land Application Rates - Phosphorus

The following table shows the phosphorus loading rates based on the application rate determined above for PAN.

Table 2.4 – Land Application Rates - Phosphorus

Parameter	Unit	Primary Cell	Dewatering Cell
Available Phosphate-P	mg/kg	160	190
Available Phosphate-P	kg/tonne	0.160	0.190
P_2O_5 Equivalent (2.3 x P)	kg/tonne	0.368	0.437
Available P_2O_5* (50% available)	kg/tonne	0.184	0.219
P_2O_5 Crop Removal (for canola)	kg/ha	37	37
Land Area Required	ha	12.9	7.1
Sludge Application Rate (Calculated based on PAN)	dry tonne/ha	201.1	169.3

*Note: According to the *Process Design Manual Land Application of Sewage Sludge and Domestic Septage* by the United States EPA, 1995 the majority of P in sewage sludge is present as inorganic compounds and approximately 50% is available for plant uptake as the P normally applied in commercial fertilizers.

The allowable phosphorus application rate is determined based on the background phosphorus levels in the soils as per the following:

- If soil test phosphorus levels are 120 mg/L or less: phosphorus may be applied at two times the applicable phosphorus removal rate
- If soil test phosphorus levels are 120 - 180 mg/L, phosphorus may be applied at the applicable phosphorus removal rate.

The phosphorus removal rate is determined by the type of crop to be planted in the field. A chart with typical removal rates is available in the *Manitoba Soil Fertility Guide*, 2007. Phosphorus removal rates vary from 16 kg/ha to 85 kg/ha depending on the crop type. A crop removal rate of 37 kg/ha of P_2O_5 was used for calculations based on the low end of uptake for a 35 bu/A canola crop which ranges between 37 - 45 kg/ha.

Laboratory analysis of soils from the proposed agricultural fields for land application will be conducted during the design phase of the project. The soil samples will be a composite sample obtained from different portions of the field, in upper 150 mm of soil. Additional sampling will be required to confirm clay soils to a depth of 1.5 m below the surface to provide a barrier to groundwater. Assuming the background phosphorus concentration is between 120 mg/L and 180 mg/L, this would allow phosphorus to be applied at the crop removal rate or 37 kg/ha of available P_2O_5 (for canola). Based on the phosphorus application rate determined based on the N limits, Phosphorus would not be a limiting factor for the sludge application rate.

Land Application Rates - Heavy Metals

The sludge application rates also cannot exceed heavy metal concentrations recommended by Canadian Soil Quality Guidelines.

Table 2.5 – Land Application Rates - Metals

Metal	Primary Cell		Dewatering Cell		Cumulative Rate Allowed by Regulation (kg/ha)
	mg/kg	Metal Loading Rate Based on 21 dry tonnes/ha (kg/ha)	mg/kg	Metal Loading Rate Based on 31 dry tonnes/ha (kg/ha)	
Arsenic (As)	6.22	0.131	5.74	0.178	21.6
Cadmium (Cd)	0.9	0.019	4.17	0.129	2.5
Chromium (Cr)	24.3	0.510	59.5	1.844	115.2
Copper (Cu)	313	6.573	441	13.671	113.4
Lead (Pb)	22.9	0.481	129	3.999	126
Mercury (Hg)	0.924	0.019	2.43	0.075	11.9
Nickel (Ni)	26.4	0.554	31.6	0.979	90
Zinc (Zn)	368	7.728	522	16.182	360

Background soil metal concentrations have not yet been determined and cumulative levels (background soils and sludge levels) would need to be below the regulated values as described in the above table. The metal concentrations in the sludge are significantly lower than the allowable rates and it is not anticipated that the metal concentrations will affect the allowable sludge application rate. This will be confirmed prior to land application.

The analysis for background metal concentrations will include soluble ions such as Ca, Mg, Na, Cl, K and S, along with conductivity, to confirm that the receiving fields are not at risk for salinization. Due to the limited application of sludge, it is not expected that any significant salinization will occur.

2.8.2.4 Setbacks and Regulations

The Environmental Requirements for Treatment and Disposal of Biosolids in Manitoba document and recent Environment Act Licences issued for similar municipal sludge land application projects were reviewed. The following setbacks to various items would be required for land applications:

- Land (for application) must be a minimum of 75 m from any occupied residence (other than owner of land where sludge is to be applied).
- Land (for application) must be a minimum of 400 m from a residential area.
- Land (for application) must:
    - be a minimum of 15 m from first order waterway, 30 m from second order waterway and 50 m from a groundwater well
    - be a minimum of 100 m from an identifiable boundary of an aquifer, which is exposed to the ground surface
    - not be subject to flooding
    - not be frozen
    - not be classified as N4 as per the Nutrient Management Regulation
    - not have depth of clay or clay till less than 1.5 m between the soil surface and the water table.

All the above setbacks can be met by the proposed lands for sludge application.

The following additional requirements would also apply:

- Surface slope must be less than 5%.
- Soil pH must be greater than 6.0, prior to sludge application.
- There must be a written agreement between the landowner and the Town of The Pas.
- Cattle not permitted to pasture on land for three years from the date of sludge application.
- Nitrate-Nitrogen concentrations must not exceed 100 kg/ha in the upper 60 cm of soil, prior to nutrient application.
- Sodium bicarbonate extractable phosphorus as P must not exceed 60 ppm in the upper 15 cm of the soil, prior to nutrient application.
- One of the following crops must be planted at the commencement of the next growing season, following sludge application, and only these crops permitted to be grown for a period of three years from date of sludge application:
    - a cereal crop
    - a forage crop
    - an oil seed crop
    - field peas
    - lentils.

All the above setbacks and requirements will be met by the proposed lands for sludge application and the restrictions will be discussed in the land use agreement.

2.8.3 Summary of Land Requirements

As discussed in the preceding sections the nitrogen application rate will be the limiting factor in the sludge application and a minimum of 164 ha of land will be required for sludge application. Sludge solids would be applied at a rate between 21 kg/ha and 31 kg/ha, depending on which cell the sludge originates from.

2.9 Existing and Proposed Lagoon Capacity

The existing lagoon treatment capacity is based on the efficiency of aeration and the retention time in the cell. The existing lagoon treats the BOD using one partial mix aeration cell. The Environment Act Licence (No. 2209 S1) issued to operate the lagoon after the 1996 upgrades limited the lagoon to an organic capacity of 510 kg BOD_5/day at a flow rate of 3,563 m^3 per day and a useable lagoon volume of 82,030 m^3. The Town currently operates 1 blower instead of 2 as originally intended, leaving the remaining on standby, with 102 aeration diffusers. Based on record drawings, the lagoon aeration cell has a maximum operating depth of 4.5 m and a total depth of 6.0 m. The inner slopes varying from 4H:1V to 3.5 H:1V.

Sludge in the lagoon cell currently occupies approximately 40% of the volume of the cell, which reduces the usable volume of the cell to 51,701 m^3, resulting in a hydraulic retention time of approximately 8.6 days. The hydraulic retention time using year 2036 design flows is 5.5 days. Removing all of the sludge in the cell would increase the retention time for year 2036 design flows by approximately 3.7 days to 9.2 days.

Based on effluent test results provided by the Town, the lagoon currently treats BOD to a level acceptable for discharge as specified in their licence, despite having significantly less hydraulic capacity than the original design. While future organic loading will exceed the loading specified in the current lagoon licence, the aeration system was designed to accommodate a much higher BOD loading and is sufficient to accommodate future loading. The Town has the ability to operate a second blower as was originally intended, to treat BOD, therefore the aeration system was designed to accommodate a much higher BOD loading and is sufficient to accommodate future loading. Removing the sludge in the lagoon will provide more hydraulic retention time in design year 20 than the cell currently has.

2.10 Geotechnical Information

Geotechnical information was obtained from a review of Driller Well Logs and reconnaissance soil survey mapping (Report No. 11 and No. 22) from the area of the proposed lagoon upgrade and the sludge application area.

Lagoon Upgrade Area

The driller well logs indicated the soil profile consisted of surficial till down to approximately 36 m below the surface. Below this was clay, till and limestone bedrock. Groundwater levels were recorded at depths of 2.4 m to 6.7 m below the surface.

The soil survey mapping indicated that the general area of lagoon upgrade consisted of Chitek Series loamy and stony till with imperfect drainage, Dering Series loamy and stony till with poor drainage and surficial peat, and Westray Series loamy and stony till, which is well drained.

Sludge Land Application Area

The driller well logs indicated the soil profile consisted of surficial silty clay till down to approximately 30 m below the surface. Below this was till and limestone bedrock. Groundwater levels were recorded at depths of 1.2 m and 8.2 m below the surface.

The soil survey mapping indicated that the general area estimated for the land application of sludge consisted of Le Pas Series (modal and drained phase), which have a texture of silty clay and clay, with poor drainage.

2.11 Review of Regulatory Requirements

2.11.1 Effluent Quality Requirements

Any new or expanding wastewater treatment lagoons are required to meet the Manitoba *Water Quality Standards, Objectives and Guidelines - Tier 1 Water Quality Standards* at a minimum, along with the Federal *Wastewater Systems Effluent Regulations*, for discharged effluent. The effluent requirements for the RM wastewater treatment lagoon, at a minimum, would include:

- Fecal coliforms of 200/100 ml or less, or E. coli of 200/100 ml or less
- BOD of 25 mg/L or less
- CBOD of 25 mg/L or less
- TSS of 25 mg/L or less
- Total residual chlorine of 0.02 mg/L or less
- Un-ionized ammonia (as N) of 1.25 mg/L or less, at 15ºC
- 1 mg/L Total Phosphorus or demonstrated nutrient reduction strategy.

2.11.2 CBOD Treatment

The existing lagoon treats the CBOD using one partial mix aeration cell. Based on effluent test results provided by the Town, the lagoon currently treats BOD to a level acceptable for discharge as specified in their licence. However, single cell lagoons can be prone to short circuiting, where dead zones of no or minimal flow develop from wind or density currents. When dead zones develop, the effective volume of the cell is reduced and retention time is lowered. Therefore, installing a baffle curtain in the cell will effectively split the lagoon cell into two cells, allowing for

more consistent flow through the lagoon, and resulting in more efficient treatment and higher CBOD removal.

2.11.3 Nutrient Management Plan

The Manitoba *Water Quality Standards, Objectives, and Guidelines*, 2011, outline the nutrient reduction requirements for effluent in all new, expanding or modified wastewater treatment facilities. The guidelines include province wide standards for biological reduction, suspended solids reduction, phosphorus reduction and where site-specific conditions warrant, nitrogen reduction. The Federal *Wastewater Systems Effluent Regulations*, 2012, outline the limits on un-ionized ammonia concentration in the effluent.

Phosphorus

The current licence does not include a phosphorus limit and the current lagoon does not provide any specific treatment for phosphorus reduction. Manitoba Sustainable Development has indicated in preliminary discussions that the effluent limit for total phosphorus is likely to be 1 mg/L based on a 30 day rolling average and weekly sampling. From a review of various methods for reducing phosphorus, the most feasible method for the Town of The Pas would be the addition of alum. A recycle stream of treated effluent from the lagoon would be injected with alum and pumped back into the gravity sewer upstream of the lagoon to allow mixing in the cell. A baffle curtain installed in the cell will act to separate the portion of the cell dosed with alum and allow for chemical precipitation, with phosphorus settling out of the liquid.

Ammonia

High concentrations of un-ionized ammonia can have an impact on the health of fish species in receiving waters, therefore the un-ionized ammonia levels would meet the minimum Federal limit of 1.25 mg/L. The unionized ammonia concentration in effluent is dependent on pH and temperature, and therefore can vary drastically throughout the year. Un-ionized ammonia concentrations will be reduced with the utilization of Submerged Attached Growth Reactors (SAGR), which are designed to provided nitrification in cold climates. The SAGR is essentially a clean aggregate media bed with evenly distributed wastewater flow across the width of the cell, and a horizontal collection chamber at the back end of the system. Aeration throughout the floor of the SAGR provides aerobic conditions that are required for nitrification and the clean granular material would provide a surface for the nitrifying bacteria to grow. The gravel bed is covered with a layer of insulation to prevent freezing. For the Town of The Pas lagoon, the SAGR would be constructed at the outlet of the lagoon cell. Six SAGR cells would be operated in parallel to provide ammonia reduction. Piping to each cell would be individually valved to allow any cell to be isolated for ease of maintenance. The SAGR cells would have a constant operating level of 2.4 m.

Based on the average daily flow from the lagoon, and values total ammonia (as N) obtained from a review of similar lagoon licences, it is estimated that The Pas lagoon SAGR cells will be able to meet an average effluent total ammonia limit of 1.4 mg/L during the summer and 5.0 mg/L in the winter.

2.11.4 Disinfection

The lagoon currently chlorinates effluent with chlorine gas, but does not dechlorinate, which can have an impact on aquatic species from potential effluent toxicity. The Pas Lagoon will potentially include a UV disinfection system to reduce coliform levels to within the regulated requirements, if levels cannot be controlled with treatment from the proposed SAGR cells. In addition, the chlorination system currently being utilized will be decommissioned.

2.12 Upgrade Design

2.12.1 SAGR Cell Design

It is proposed that the Town of The Pas Lagoon will be upgraded with six SAGR cells located at the outlet of the lagoon. The cells will be located to the east of the existing aerated cell and will be operated in parallel with valves on the pipes going to each of the cells, for isolation of each cell during maintenance. The SAGR cells would each have a footprint area of 1,826 m^2 and a constant operating level of 2.4 m. The chambers would be constructed using an HDPE geomembrane liner with vertical walls for containment of liquid. An earthen dike will surround the perimeter to support the walls and prevent surface runoff from entering the cells. The cells would be filled with clean granular material and covered with a mulch or peat layer to provide insulation in the winter months. A chain link fence would be installed around the perimeter of the SAGR cells to prevent unauthorized entry.

Air supply for the SAGR system would be provided by three 100 hp positive displacement blowers with two duty and one standby. The blowers would also be capable of operating at high pressures intermittently for diffuser and piping purging. A building would be required to house the blowers near the SAGR cells, because the existing blower building does not have space for the additional blowers. The blowers would be controlled with variable frequency drives to provide an efficient operation of the equipment. During the initial years of operation when the system demand is below the Year 20 design requirements, the operator would be able to reduce the blower operating speed, minimizing the power consumption.

2.12.1 Building Design

A new building is required for the alum addition system, potential UV units and SAGR blowers. The building will have a 188 m^2 footprint and would be divided into a mechanical room and an electrical room with a desk area for the SCADA system. The building would have a lab counter with a sink to obtain sewage sampled and a workbench for equipment maintenance. The building would have a potable water holding tank for domestic water and a sewage holding tank for wastewater.

2.13 Summary of Selected Design Criteria

A summary of design parameters used in sizing the proposed lagoon upgrade include:

- A 20 year design period
- A total service population of 8,253 people on the piped collection and holding tank systems

- A total service population of 1,697 people from the surrounding rural areas
- A daily average hydraulic loading rate of 9,431 m3/day
- A daily peak organic loading rate of 669.5 kg BOD5/day
- A maximum aerated cell operating depth of 4.5 m.

2.14 Decommissioning

The Town of The Pas is proposing to continue operating the existing aerated cell and proposed SAGR cells over the next 20 years, as the hydraulic and organic capacities allow. Lagoon decommissioning will be considered and examined by the Town of The Pas after design year 20 has passed, or at the time a new replacement lagoon is proposed.

Decommissioning would typically require a decommissioning plan submitted to Manitoba Sustainable Development, discussing the removal of liquid and sludge, possible leveling of lagoon dikes, site grading and seeding, and discussion of future land use. The existing forcemain piping in the existing primary cell will be capped and abandoned in place after redirecting the pipes is completed.

2.15 Lagoon Maintenance

Maintenance of the upgraded lagoon will include:

- check flows regularly
- test effluent regularly (as required)
- check air flow into lagoon regularly
- maintain and repair pumps and blowers as required
- check levels of alum regularly and maintain a stock
- check and clean UV bulbs regularly
- maintain grass cover on dikes to a height of no more than 0.3 m in height
- remove aquatic vegetation growing on interior slopes of lagoon cells
- maintain a program to prevent and remove burrowing animals
- monitor liquid level of lagoon cell regularly
- check and maintain surface insulation of SAGR cells
- maintain records of discharge events and effluent quality testing.

3.0 POTENTIAL ENVIRONMENTAL IMPACTS

The biophysical and socioeconomic environment as related to the development, and potential impacts of the development on the environment.

3.1 Releases to Air, Water, Land

3.1.1 Air

In general, nuisance odours occur in facultative lagoons that are improperly sized and organically overloaded. Odours are also generated under anaerobic conditions, which are common at the bottom of facultative lagoons. The Pas lagoon would be aerated, therefore anaerobic conditions would not be present, and the aerobic treatment in the lagoon would eliminate the risk of odour concerns in the community.

The application of sludge onto agricultural land also has the potential to create an odour nuisance to nearby residents, depending on atmospheric conditions at a time of application.

3.1.2 Water

Pollutants that may be released into surface and ground water during the operation of the lagoon include: coliforms, organic wastes, suspended solids, nutrients and other materials that are typically disposed of into the sewer collection system in a residential community. Pollutants in the wastewater produced by the service population are expected to be residential in nature.

Pollutants that have a potential to be released into the surface or ground water during the lagoon upgrading construction activities, include petroleum hydrocarbons (PHCs) from heavy equipment and sediments from soil erosion.

Pollutants potentially released from the application of sludge from the lagoon include coliforms, nutrients, organic wastes, suspended solids and metals.

Surface Water

Surface water may be impacted if the wastewater is not sufficiently treated and is subsequently released from the lagoon into a nearby surface water body. Effluent discharged from the lagoon would flow directly into the marsh area to the east prior to reaching Grace Lake. There is also potential to impact surface waters via sedimentation or equipment leaks/spills during construction works.

The effluent discharge from the lagoon should not cause or contribute to flooding in the immediate area of release. There is no potential to impact the navigation of surface waters as a result of the lagoon upgrade project, as there are no navigable bodies of water in the discharge route.

Surface water may be impacted by application of sludge to agricultural land if there are flooding conditions or significant amounts of precipitation shortly after the sludge application, which would encourage surface flows of water carrying contaminants from the land applied fields to a nearby body of surface water.

Groundwater

There is a potential for groundwater impacts if wastewater leaks/seeps through the SAGR cell liner into the groundwater below or from the effluent return line. There is also a potential for groundwater impacts from equipment leaks or fuel spills during construction.

There is a potential for groundwater impacts from the application and incorporation of sludge onto agricultural land, if the groundwater levels are high at the time of application and if the soil conditions are permeable, to freely allow downward movement of surface liquids.

3.1.3 Land

The landscape would be altered by the removal of forest and the construction of the SAGR cells and perimeter ditching. Disturbed land areas can be impacted through soil erosion if not covered or re-vegetated.

Pollutants that may be released to the land during construction activities are typically petroleum hydrocarbons (PHCs) from equipment leaks, or re-fuelling incidences.

The agricultural lands utilized for sludge application would be impacted by the incorporation of sludge material into the upper 0.15 m of soil.

3.2 Wildlife

The existing lagoon site is located in the "Mid-Boreal Lowland" Ecoregion of Canada. Characteristic wildlife includes moose, black bear, wolf, lynx, and snowshoe hare. Bird species include duck, goose, pelican, sandhill crane and ruffed grouse.

The typical concern on any construction project is that wildlife species would be displaced through the construction works. This can occur from removal of native wildlife habitat. The Manitoba Sustainable Development Wildlife and Ecosystem Protection Branch was contacted regarding the proposed lagoon upgrade development project and they indicated that there were no occurrences of species at risk at the proposed site in the database. Refer to the August 29, 2017 email, attached in Appendix B.

3.3 Fisheries

The typical concerns for impacts to fish and fish habitat are from sediments released during construction and from untreated lagoon effluent discharging into a body of surface water utilized by fish species. These impacts could include the reduction of water quality or physical disturbances that would create an unfavourable environment for fish or fish eggs.

3.4 Forestry

The proposed development area would be cleared of trees for the construction of the SAGR cells, however the area is not utilized for commercial forestry.

3.5 Vegetation

Characteristic vegetation in the "Mid-Boreal Lowland" Ecoregion is classified as being a subhumid mid-boreal ecoclimate, with extensive wetlands. The native landscape is characterized by tamarack and black spruce in low lying wet areas and trembling aspen and balsam poplar with white and black spruce and balsam fir in drier areas.

Forest vegetation will be removed over an area of 2.2 hectares as part of the site clearing works. Manitoba Sustainable Development Wildlife and Ecosystem Protection Branch were contacted regarding occurrences of rare or endangered species in their database around the proposed lagoon development site. The Branch indicated that there were no occurrences of any species at risk at the proposed site in the provincial database. Refer to Manitoba Sustainable Development Wildlife and Ecosystem Protection Branch email correspondence dated August 29, 2017, attached in Appendix B.

3.6 Noise Impacts

There is a potential for noise impacts in the immediate area of lagoon development due to the heavy equipment utilized during the construction works. Other than maintenance vehicles (for lagoon maintenance or mowing grass) and septic hauling trucks, the operation of the lagoon itself, will not have a significant potential for noise impacts. The additional blowers for the SAGR cells will be the only additional source of noise on the site during operation of the lagoon.

3.7 Health and Safety

As the lagoon effluent will be monitored in accordance to the provincial Environment Act Licence, there are not expected to be any impacts to human health and safety from the discharge of lagoon effluent. There is a potential for impacts to health and safety from improper application of sludge.

There is a potential for impacts to the health and safety of workers and the public during the construction works, as heavy equipment will be utilized on site.

3.8 Heritage Resources

The RM was not aware of any historic or heritage resources located at the proposed lagoon upgrade development site. The Manitoba Historic Resources Branch was contacted regarding the proposed site. The Historic Resources Branch indicated that they have no concerns with the project at this time. Refer to the Manitoba Historic Resources Branch September 1, 2017 Memorandum, attached in Appendix B.

3.9 Socio-Economic Implications

The heavy equipment traffic in the vicinity of the construction works would increase temporarily during the construction works. The construction related economic activity should have a positive economic impact on the nearby Town of The Pas. In addition, the increased wastewater treatment capacity should encourage continued growth in the service area.

3.10 Aesthetics

The lagoon upgrade is not expected to have adverse impacts on the general aesthetics of the area, as the lagoon SAGR cell construction would occur adjacent to the existing lagoon cell, on land that is not accessible to the general public and is surrounded by forest land. Disturbed areas of the site including the outer SAGR slopes and ditching will be seeded with grass to increase the aesthetics of the development.

4.0 MANAGEMENT PRACTICE

Proposed environmental management practices to be employed to prevent or mitigate adverse implications from the impacts identified above.

4.1 Mitigation of Impacts to Air

To reduce the potential for odour nuisance to nearby residents, the lagoon cell will have sufficient aeration to treat the projected year 20 organic loadings from the service population. Although significant odours from the lagoon are not expected, the lagoon cells are located beyond the minimum setback distances of 300 metres from the nearest resident and 460 metres from the residential community. To reduce impacts from land application of sludge, the setback distances to residences described in Section 2.8.2.4 above would be adhered to.

Emissions from construction equipment and transport vehicles will be controlled through regular maintenance by the construction contractor, and will meet all provincial and local standards. Dust suppression methods (i.e. water spraying) will be utilized at the construction site if dry conditions create excessive dust through construction activities and transport, which becomes a nuisance to nearby residents. Due to the setback distance from residences, it is unlikely that dust will have any impact on the community or nearby residents.

4.2 Mitigation of Impacts to Water

Surface Water

Impacts to surface waters from discharge of lagoon effluent are not expected, as the lagoon effluent would be treated to the Provincial and Federal Standards and in accordance with the Environment Act Licence during operation. The lagoon effluent will be tested regularly during operation, in accordance with the licence. To reduce impacts on surface waters from land application of sludge, application would not occur during times of flooding or frozen ground conditions, and the minimum setback distances from a surface water body described in Section 2.8.2.4 above would be adhered to.

Siltation in surrounding water bodies from erosion of any excess material stockpiles would be prevented by either covering any bare soil stockpiles or seeding with grass. Silt fencing would be installed along the drainage route to prevent silt from reaching Grace Lake. This siltation control should remain in place until grass growth is established. The dike tops, dike slopes and ditch slopes would be seeded with grass to help control erosion and sediment entry into the surrounding drainage route and marsh areas. Disturbance of the soils adjacent to the marsh areas and discharge route would be minimized during construction.

To minimize impacts from construction equipment on surface waters, the construction specifications should outline to the contractor the requirements for handling and storage of fuels and hazardous materials during construction, as per federal and provincial regulations. The specification should state wording similar to the following:

- Diesel or gasoline should be stored in double walled tanks or have containment dikes around fuel containers for volumes greater than 68.2 L (15 gallons) or in compliance with provincial regulations
- Clean up material should be available at the site, consisting of a minimum of 25 kg of suitable commercial sorbent, 30 m^2 of 6 mil PVC, and an empty fuel barrel for spill collection and disposal
- Fuel storage and hazardous material areas established for project construction should be located a minimum of 100 m from a water body, and comply with provincial regulations
- Waste hazardous materials from construction activities and equipment must be properly collected and disposed of in compliance with provincial regulations
- Hazardous material handling and storage are to follow all provincial and federal regulations including WHMIS and spill containment requirements
- In the event of spills or leaks of fuels and hazardous materials, the contractor or operator should notify the project engineer and provincial authorities.

The specifications should state that when working near water with construction equipment:

- Construction equipment is to be properly maintained to prevent leaks and spills of fuels, lubricants, hydraulic fluids or coolants
- There can be no re-fueling or servicing of construction equipment within 100 m of a water body.

Groundwater

Seepage of effluent from the lagoon SAGR cells is unlikely to affect groundwater as the cells would utilize an HDPE synthetic liner for containment of liquid, which would meet the requirements of Manitoba Sustainable Development. Leaks from the effluent return line would be prevented by inspecting and testing the section of piping after installation. To reduce impacts on groundwater from land application of sludge, application would not occur on soils classified as N4 and not in areas where depth of surface soil is less than 1.5 m from the water table, and beyond the minimum setback distance to an identifiable aquifer boundary, as identified in Section 2.8.2.4 above.

Mitigation of potential impacts to groundwater during the lagoon construction activities from fuel handling, equipment leaks or fuel spills, would follow the same procedures as described above for surface waters.

4.3 Mitigation of Impacts to Land

As the proposed SAGR cells would be lined with a HDPE synthetic liner, seepage to the surrounding land is expected to be negligible. To minimize the potential for the release of PHCs into the soil, the mitigation measures described in Section 4.2 above outlining fuel handling procedures should be followed.

To minimize the potential for soil erosion, disturbed areas of the development, including the outside slopes of the dikes and ditching would be seeded with grass. To minimize impacts on lands utilized for sludge application, only agricultural lands designated as N1 – N3 would be utilized for application.

4.4 Mitigation of Impacts to Wildlife

To minimize the potential for impacts to migratory bird species, the clearing works would be conducted outside of the typical bird nesting season in the spring. If the contractor or engineer discovers a sensitive wildlife habitat area during construction, the local wildlife officer will be contacted for advice on how to proceed.

4.5 Mitigation of Impacts to Fisheries

The construction works will be conducted a considerable distance from the nearest water body with fish species (i.e. Grace Lake) and the discharge route will need to pass through a marsh area prior to reaching Grace Lake, therefore potential impacts to fish species are expected to be minimal. In addition, lagoon discharge would be tested regularly to ensure the treated effluent requirements of the Environment Act Licence are met, which includes tests for toxicity to aquatic species. As the proposed upgrades to the lagoon are intended to provide better quality effluent, it is unlikely that fish species would be impacted by the upgraded lagoon.

4.6 Mitigation of Impacts to Vegetation

To minimize the potential for impacts to vegetation, the area of development will be clearly marked during the site clearing works to ensure that vegetation beyond the boundaries of the site would remain undisturbed.

4.7 Mitigation of Noise Impacts

To minimize the potential for noise impacts, construction equipment and transport vehicles should have mufflers working properly, and construction activities should be limited to daylight hours only. All minimum setback requirements to residences will be met, which should minimize noise impacts during construction activities. The additional blowers for the SAGR cells will be enclosed in a building, which will reduce noise levels to the surrounding environment.

4.8 Mitigation of Impacts to Health and Safety

To minimize impacts to health and safety of workers and the public, the construction contractor is to have a safety program in place, in accordance with all federal and provincial health and safety regulations. During construction, site access will be limited to the construction crew only and warning signs will be posted at the entrance to the construction site. Personal protective equipment will be worn in accordance with the contractor's safety program.

Impacts to health and safety from sludge application will be reduced through adhering to the application requirements described in Section 2.8.2.4 above, which includes not allowing cattle on pasture land for 3 years after the date of application and only applying the permitted crops after application.

4.9 Mitigation of Impacts to Heritage Resources

If any significant historic or heritage resources are discovered in the course of excavation or construction, the works are to temporarily cease and an investigation of the site is to be conducted by the Town of The Pas, Manitoba Historic Resources Branch and any other provincial and federal authority, as may be required.

5.0 RESIDUAL AND CUMULATIVE EFFECTS

Residual environmental effects remaining after the application of mitigation measures, to the extent possible expressed in quantitative terms relative to baseline conditions

No negative residual effects are anticipated through the construction and operation of the upgraded wastewater treatment lagoon, due to the mitigation measures described above. Positive residual effects are expected from the properly sized wastewater treatment system that will allow for expansion of the service area in the future.

No negative cumulative effects are anticipated from other construction works in the area. With the addition of SAGR cells and expansion of the service area, the overall volume of effluent discharged is expected to be greater on a daily basis, however it is not expected that this will have a significant impact on Grace Lake.

6.0 MONITORING AND FOLLOW-UP

Proposed follow-up activities that will be required at any stage of development (eg. Monitoring, inspection, surveillance, audit, etc.)

Monitoring of the lagoon operation is to be conducted by a trained lagoon operator, who is to ensure the lagoon is operated under the requirements of the Environment Act licence. The operator is to:

- maintain mechanical components of the treatment system
- maintain lagoon property and fencing in accordance with Environment Act Licence
- ensure liquid levels in the lagoon cells are maintained within the required limits
- conduct regular sampling of lagoon effluent during operation
- ensure water quality parameters as described in the Environment Act licence are met
- maintain records of effluent quality monitoring for reporting to Manitoba Sustainable Development and Environment Canada (if requested).

If there are any concerns with the operation of the lagoon, the owner is to contact the local environment officer to discuss mitigation options. The construction contractor is to ensure that grass growth occurs on disturbed areas of the development, after the construction activities are completed.

7.0 FUNDING AND APPROVALS

Name and address of any Government Agency or program (federal, provincial or otherwise) from which a grant or loan of capital funds have been requested (where applicable). Other federal, provincial or municipal approvals, licences, permits, authorizations, etc. known to be required for the proposed development, and the status of the project's application or approval.

A portion of the project is being funded by the Town of The Pas, however additional funding from federal or provincial authorities will be sought for the works. No additional approvals, licences or permits are required for the lagoon upgrade and operation. The lagoon owner will also be responsible for registering the lagoon upgrades with Environment Canada and providing annual monitoring reports to Environment Canada under the *Federal Wastewater Systems Effluent Regulations*.

8.0 PUBLIC CONSULTATION

Results of any public consultations undertaken or to be undertaken in conjunction with project planning.

Public consultation by the Town of The Pas was conducted on October 25, 2017 in an open house format to discuss the proposed project. No significant public comments were received. Additional public comments will also be received by Manitoba Sustainable Development through the public registry during the Environmental Act Proposal review period.

9.0 CONCLUSION

Based on the design of the project and the implementation of the mitigation measures, identified in Section 4.0 above, no significant negative environmental impacts are anticipated.

The proponent would like to complete the requirements of the Environment Act Proposal as soon as possible so that the lagoon upgrading can begin in a timely fashion.

JR Cousin Consultants Ltd. requests that a draft copy of the Environment Act Licence be forwarded for review prior to the issue of the final licence.

APPENDIX

Appendix A

Status of Titles

Appendix B

Table 1: The Pas Lagoon - Population, Hydraulic and Organic Loading Projections to Design Year 20

Wildlife and Ecosystem Protection Branch Email Correspondence, Manitoba Sustainable Development, August 29, 2017

Historic Resources Branch Memorandum, Manitoba Sport, Culture and Heritage, September 1, 2017

Appendix C

Sludge Assessment Report, Assiniboine Injections Ltd., May 2016

Appendix D

Title Page

Plan 1: Existing Lagoon Site Plan

Plan 2: Proposed Lagoon Upgrade with Setbacks and Discharge Route

Plan 3: Proposed Lagoon Upgrade Layout Plan

Plan 4: SAGR Cell Details

Plan 5: Wastewater Treatment Process Diagram

Plan 6: Treatment Building Overall Layout

Plan 7: Fence, Pipe Trench, Silt Fence and Swale Details

Plan 8: Carrot River Valley Agricultural Land

Appendix A

Status of Titles

STATUS OF TITLE

Title Number	**1483316/3**
Title Status	**Accepted**
Client File	xxxx

The Property Registry
A Service Provider for the Province of Manitoba

1. REGISTERED OWNERS, TENANCY AND LAND DESCRIPTION

THE TOWN OF THE PAS

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON
IN THE FOLLOWING DESCRIBED LAND:

PARCEL 1
W1/2 2-56-26 WPM
EXC 1STLY: RLY RIGHT-OF-WAY PLANS 443 PLTO (N DIV)
AND 456 PLTO (N DIV)
2NDLY: POWER TRANSMISSION LINE PLAN 5548 PLTO (N DIV)
AND 3RDLY: ALL MINES, MINERALS AND SPECIAL RESERVATIONS
AS RESERVED IN THE ORIGINAL GRANT FROM TH CROWN

PARCEL 2
SE 1/4 2-56-26 WPM
EXC ALL MINES, MINERALS AND SPECIAL RESERVATIONS
AS RESERVED IN THE ORIGINAL GRANT FROM THE CROWN

The land in this title is, unless the contrary is expressly declared, deemed to be subject to the reservations and restrictions set out in section 58 of *The Real Property Act.*

2. ACTIVE INSTRUMENTS

Instrument Type:	**Caveat**
Registration Number:	**83-2716N/3**
Instrument Status:	**Accepted**
Registration Date:	1983-04-22
From/By:	THE MANITOBA HYDRO-ELECTRIC BOARD
To:	
Amount:	
Notes:	AFF'S - PT W 1/2
Description:	No description

3. ADDRESSES FOR SERVICE

THE TOWN OF THE PAS
BOX 870
THE PAS MB
R9A 1K8

4. TITLE NOTES

No title notes

5. LAND TITLES DISTRICT

Portage

6. DUPLICATE TITLE INFORMATION

Duplicate Produced for: HOLD FOR PROD OF DUPL CT NO(S)
E37843

7. FROM TITLE NUMBERS

E37843/3 All

8. REAL PROPERTY APPLICATION / CROWN GRANT NUMBERS

No real property application or grant information

9. ORIGINATING INSTRUMENTS

Instrument Type: **Request Electronic Title Conversion**
Registration Number: **1001082/3**

Registration Date: 1997-02-04
From/By: PORTAGE LAND TITLES OFFICE CONVERSION
To:
Amount:

10. LAND INDEX

NW 2-56-26W
EXC RLY 443, 456 (NDIV), TRANL LINE 5548NDIV, EXC RES

SE 2-56-26W
EXC RES

SW 2-56-26W
EXC RLY 443, 456 (NDIV), TRANL LINE 5548NDIV, EXC RES

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM OF TITLE NUMBER 1483316/3

STATUS OF TITLE

Title Number **1483338/3**
Title Status **Accepted**
Client File xxxx

The Property Registry
A Service Provider for the Province of Manitoba

1. REGISTERED OWNERS, TENANCY AND LAND DESCRIPTION

THE TOWN OF THE PAS

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON
IN THE FOLLOWING DESCRIBED LAND:

NE 1/4 2-56-26 WPM
EXC 1STLY: THE LAND COVERED BY THE WATERS OF GRACE LAKE
AS SHOWN ON TOWNSHIP DIAGRAM DATED APRIL 12, 1912
AND 2NDLY: ALL MINES, MINERALS AND SPECIAL RESERVATIONS
AS RESERVED IN THE ORIGINAL GRANT FROM THE CROWN

The land in this title is, unless the contrary is expressly declared, deemed to be subject to the reservations and restrictions set out in section 58 of *The Real Property Act.*

2. ACTIVE INSTRUMENTS

No active instruments

3. ADDRESSES FOR SERVICE

THE TOWN OF THE PAS
BOX 870
THE PAS MB
R9A 1K8

4. TITLE NOTES

No title notes

5. LAND TITLES DISTRICT

Portage

6. DUPLICATE TITLE INFORMATION

Duplicate Produced for: HOLD FOR PROD OF DUPL CT NO(S)
E37844

7. FROM TITLE NUMBERS

E37844/3 All

8. REAL PROPERTY APPLICATION / CROWN GRANT NUMBERS

No real property application or grant information

9. ORIGINATING INSTRUMENTS

Instrument Type:	**Request Electronic Title Conversion**
Registration Number:	**1001082/3**
Registration Date:	1997-02-04
From/By:	PORTAGE LAND TITLES OFFICE CONVERSION
To:	
Amount:	

10. LAND INDEX

NE 2-56-26W
EXC GRACE LAKE EXC RES

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM OF TITLE NUMBER 1483338/3

Appendix B

Table 1: The Pas Lagoon - Population, Hydraulic and Organic Loading Projections to Design Year 20

Wildlife and Ecosystem Protection Branch Email Correspondence, Manitoba Sustainable Development, August 29, 2017

Historic Resources Branch Memorandum, Manitoba Sport, Culture and Heritage, September 1, 2017

Table 1: The Pas Lagoon - Population, Hydraulic and Organic Loading Projections to Design Year 20

TABLE 1 - THE PAS LAGOON

POPULATION AND WASTEWATER LOADING PROJECTIONS TO DESIGN YEAR 20

Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 8	Col 9	Col 10	Col 11	Col 12	Col 13	Col 14	Col 15	Col 16	Col 17	Col 18	Col 19
Calendar Year	Project Year	Population								Organic Loading				Hydraulic Loading			
		Town of the Pas	Bussed-in Students		OCN Trailer Park	Total Equivalent Population on Gravity Sewer System	RM of Kelsey Rural Population	Population on Holding Tanks	Daily Septic Tank Loads	Daily Per Capita BOD_5 Loading (piped)	Berscheid Meats Daily BOD_5 Loading	Daily BOD_5 Loading (Rural Septic Hauling)	Total Daily BOD_5 Loading	Daily Per Capita Hydraulic Loading (piped)	Daily Hydraulic Loading (Septic Tanks)	Daily Hydraulic Loading (Holding Tanks)	Daily Hydraulic Loading
		1.8% growth/year	Total Students	Equivalent Population	2.5% growth/year				(Loads/day)	(kg/person/day)	(kg/day)	(kg/day)	(kg/day)	(L/person/day)	(m^3/day)	(m^3/day)	(m^3/day)
2017	0	5,466	435	145	180	5,791	1,697	55	7	0.076	0.99	37.1	482.4	1,137	31.5	14.7	6,630
2018	1	5,565	435	145	184	5,894	1,697	55	7	0.076	0.99	37.1	490.2	1,137	31.5	14.7	6,748
2019	2	5,665	435	145	189	5,999	1,697	55	7	0.076	0.99	37.1	498.2	1,137	31.5	14.7	6,867
2020	3	5,767	435	145	194	6,106	1,697	55	7	0.076	0.99	37.1	506.3	1,137	31.5	14.7	6,988
2021	4	5,871	435	145	198	6,215	1,697	55	7	0.076	0.99	37.1	514.6	1,137	31.5	14.7	7,112
2022	5	5,977	435	145	203	6,325	1,697	55	7	0.076	0.99	37.1	523.0	1,137	31.5	14.7	7,238
2023	6	6,085	435	145	208	6,438	1,697	55	7	0.076	0.99	37.1	531.6	1,137	31.5	14.7	7,366
2024	7	6,195	435	145	213	6,553	1,697	55	7	0.076	0.99	37.1	540.3	1,137	31.5	14.7	7,497
2025	8	6,307	435	145	219	6,670	1,697	55	7	0.076	0.99	37.1	549.2	1,137	31.5	14.7	7,630
2026	9	6,420	435	145	224	6,789	1,697	55	7	0.076	0.99	37.1	558.3	1,137	31.5	14.7	7,766
2027	10	6,536	435	145	229	6,911	1,697	55	7	0.076	0.99	37.1	567.5	1,137	31.5	14.7	7,904
2028	11	6,654	435	145	235	7,034	1,697	55	7	0.076	0.99	37.1	576.9	1,137	31.5	14.7	8,044
2029	12	6,774	435	145	241	7,160	1,697	55	7	0.076	0.99	37.1	586.4	1,137	31.5	14.7	8,187
2030	13	6,897	435	145	247	7,288	1,697	55	7	0.076	0.99	37.1	596.2	1,137	31.5	14.7	8,333
2031	14	7,021	435	145	253	7,419	1,697	55	7	0.076	0.99	37.1	606.1	1,137	31.5	14.7	8,481
2032	15	7,148	435	145	259	7,552	1,697	55	7	0.076	0.99	37.1	616.2	1,137	31.5	14.7	8,632
2033	16	7,277	435	145	265	7,687	1,697	55	7	0.076	0.99	37.1	626.5	1,137	31.5	14.7	8,786
2034	17	7,408	435	145	272	7,825	1,697	55	7	0.076	0.99	37.1	637.0	1,137	31.5	14.7	8,943
2035	18	7,542	435	145	278	7,965	1,697	55	7	0.076	0.99	37.1	647.6	1,137	31.5	14.7	9,103
2036	19	7,678	435	145	285	8,108	1,697	55	7	0.076	0.99	37.1	658.5	1,137	31.5	14.7	9,265
2037	20	7,816	435	145	292	8,254	1,697	55	7	0.076	0.99	37.1	669.5	1,137	31.5	14.7	9,431

Wildlife and Ecosystem Protection Branch Email Correspondence, Manitoba Sustainable Development, August 29, 2017

Oswald Wohlgemut

From: Friesen, Chris (SD) [Chris.Friesen@gov.mb.ca]
Sent: Tuesday, August 29, 2017 9:36 AM
To: 'Oswald Wohlgemut'
Subject: RE: Species at Risk - The Pas Lagoon Upgrade

Oswald

Thank you for your information request. I completed a search of the Manitoba Conservation Data Centre's rare species database and found no occurrences at this time for your area of interest.

The information provided in this letter is based on existing data known to the Manitoba Conservation Data Centre at the time of the request. These data are dependent on the research and observations of CDC staff and others who have shared their data, and reflect our current state of knowledge. **An absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present**; in many areas, comprehensive surveys have never been completed. Therefore, this information should be regarded neither as a final statement on the occurrence of any species of concern, nor as a substitute for on-site surveys for species as part of environmental assessments.

Because the Manitoba CDC's Biotics database is continually updated and because information requests are evaluated by type of action, any given response is only appropriate for its respective request. Please contact the Manitoba CDC for an update on this natural heritage information if more than six months pass before it is utilized.

Third party requests for products wholly or partially derived from Biotics must be approved by the Manitoba CDC before information is released. Once approved, the primary user will identify the Manitoba CDC as data contributors on any map or publication using Biotics data, as follows as: Data developed by the Manitoba Conservation Data Centre; Wildlife & Fisheries Branch, Manitoba Sustainable Development.

This letter is for information purposes only - it does not constitute consent or approval of the proposed project or activity, nor does it negate the need for any permits or approvals required by the Province of Manitoba.

We would be interested in receiving a copy of the results of any field surveys that you may undertake, to update our database with the most current knowledge of the area.

If you have any questions or require further information please contact me directly at (204) 945-7747.

Chris Friesen
Coordinator
Manitoba Conservation Data Centre
204-945-7747
chris.friesen@gov.mb.ca
http://www.manitoba.ca/conservation/cdc/

From: Oswald Wohlgemut [mailto:owohlgemut@jrcc.ca]
Sent: August-15-17 1:43 PM
To: Friesen, Chris (SD) <Chris.Friesen@gov.mb.ca>
Subject: Species at Risk - The Pas Lagoon Upgrade

Hello Chris,

J.R. Cousin Consultants is conducting an Environment Act Proposal on behalf of the Town of the Pas for the upgrading of the existing wastewater treatment lagoon (see attached plan). The area for development is forested land to the east of the existing lagoon cell, and west of Grace lake. The upgrading works will include constructing six SAGR cells over an area of 2.2 ha.

Please provide information on any at risk wildlife and plant species that are known to exist in the location outlined above, as well as any registered habitat areas, or known migrating bird species as we would like to include that information in the Environment Act Proposal.

Please let us know if you have any questions.

Regards,

Oswald Wohlgemut, M.Sc.
Environmental Scientist

J.R. Cousin Consultants Ltd.
Phone: (204) 489-0474
Fax: (204) 489-0487
www.jrcc.ca

Historic Resources Branch Memorandum, Manitoba Sport, Culture and Heritage, September 1, 2017

Manitoba
Sport, Culture and Heritage

Memorandum

DATE: 2017-09-01

TO: **Oswald Wohlgemut**
Environmental Scientist
J.R. Cousin Consultants Ltd.
owohlgemut@jrcc.ca

FROM: **Christina Nesbitt**
Impact Assessment Archaeologist
Historic Resources Branch
Main Floor – 213 Notre Dame Avenue
Winnipeg, Manitoba, R3B 1N3

PHONE: (204) 945-8145
FAX: (204) 948-2384
E-MAIL: Christina.nesbitt@gov.mb.ca

SUBJECT: **Water Treatment Lagoon**
The Pas, East of the Exiting Lagoon, West of Grace Lake
HRB File AAS-17-12180

Further to your memo requesting a heritage screening for the above development (Planned Area), the Historic Resources Branch (HRB) has examined the applicable 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 above noted address, phone number, or e-mail.

Archaeological Assessment Services Unit

Appendix C

Sludge Assessment Report, Assiniboine Injections Ltd., May 2016

ASSINIBOINE INJECTIONS LTD.

BOX 160 NOTRE DAME, MB ROG 1M0 PH: 248-2559 FAX: 248-2799 SHOP: 749-2123

Bill To:
THE PAS

INVOICE: 2016010
DATE: 31-May-16

GST # 890844434

	ACRES	RATE	COST
MEASURE SLUDGE QUANTITY OF PRIMARY CELL			$4,000.00
SLUDGE SAMPLING OF PRIMARY CELL			
SLUDGE SAMPLING IN DRYING BED			

SUBTOTAL	$4,000.00
GST 5%	$200.00
PST 8%	
TOTAL	$4,200.00

Make cheques payable to Assiniboine Injections Ltd

THANK YOU FOR YOUR BUSINESS!

Assiniboine Injections Ltd.

Box 160 177 Notre Dame Ave Notre Dame de Lourdes, MB R0G-1M0
PH: 204-248-2559 FAX: 204-248-2799 EMAIL: info@lagooncleaning.com

DATE: MAY 31, 2016
TOWN: THE PAS

As requested, Assiniboine Injections Ltd completed our biosolids survey of cell# primary and secondary. This survey was completed on MAY 16, 2016.

Methodology

The cells were surveyed using a grid pattern.
Measurements are obtained by going out on a boat and probing the bottom with a measuring pole. The depth is determined by top of sludge blanket to base of lagoon.

Please find maps of cells, grid locations, indicating depth to sludge and depth to bottom of cell.

Cell Sludge Volume

CELL	SLUDGE VOLUME
PRIMARY CELL	51015 M3

Thank you for allowing us to help you with this project. Please let me know if we can be of any more help with your biosolids management requirements. We look forward to working with you in the future.

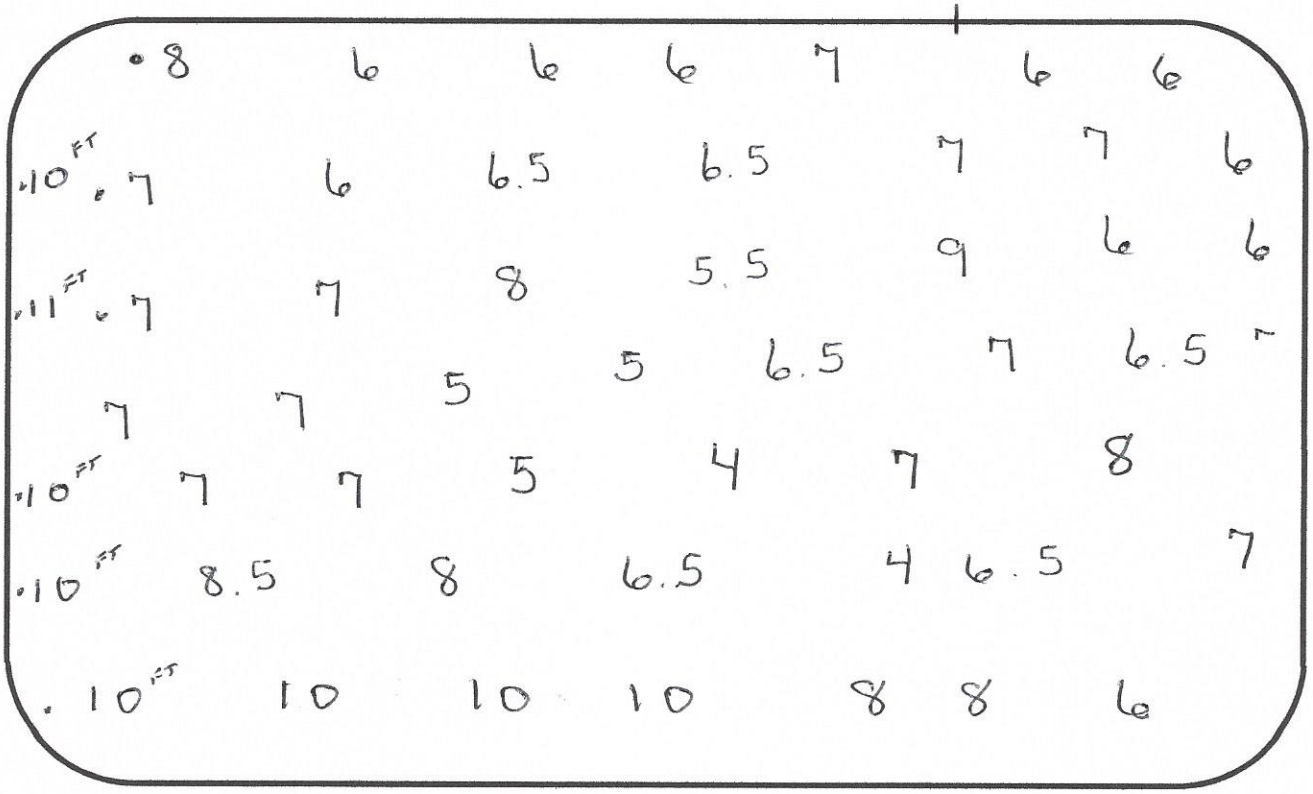
Yours Truly,
Assiniboine Injections Ltd

Assiniboine Injections Ltd.

Box 160 177 Notre Dame Ave Notre Dame de Lourdes, MB R0G-1M0
PH: 204-248-2559 FAX: 204-248-2799 EMAIL: info@lagooncleaning.com

Project No. 1 Survey Date: MAY 16, 16 Survey Crew: Jeff
Client: City of THE PAS Lagoon Id: Primary Lagoon Dimensions: 373FT X 690FT
Avg. Sludge Depth: 7 FEET Samples Taken: Yes

N



Assiniboine Injections Ltd. (Notre Dame De Lourdes)
ATTN: JEFF JAMAULT
Box 160
126 Notre Dame Ave W.
Notre Dame De Lourdes MB R0G 1M0

Date Received: 17-MAY-16
Report Date: 31-MAY-16 10:48 (MT)
Version: FINAL

Client Phone: 204-248-2559

Certificate of Analysis

Lab Work Order #: L1770066
Project P.O. #: NOT SUBMITTED
Job Reference: THE PAS MB
C of C Numbers:
Legal Site Desc:

Hua Wo
Chemistry Laboratory Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1770066-1 THE PAS CELL 1							
Sampled By: NOEL BOISVOF on 16-MAY-16 @ 14:30							
Matrix: WW							
Miscellaneous Parameters							
Available Phosphate-P	160		1.0	mg/kg	27-MAY-16	27-MAY-16	R3466227
Mercury (Hg)	0.924	DLHC	0.010	mg/kg	24-MAY-16	25-MAY-16	R3465984
% Moisture	91.6		0.10	%	20-MAY-16	20-MAY-16	R3462382
Total Nitrogen by LECO	1.37		0.020	%	24-MAY-16	24-MAY-16	R3463446
Total Solids and Total Volatile Solids							
Total Solids	6.68		0.10	%	24-MAY-16	24-MAY-16	R3463414
Total Volatile Solids (dry basis)	31.6		0.10	%	24-MAY-16	24-MAY-16	R3463414
pH and EC (1:2 Soil:Water Extraction)							
Conductivity (1:2)	1.78		0.050	dS m-1	27-MAY-16	27-MAY-16	R3466010
pH (1:2 soil:water)	7.72		0.10	pH	27-MAY-16	27-MAY-16	R3466010
Metals in Soil by CRC ICPMS							
Aluminum (Al)	24300		50	mg/kg	24-MAY-16	27-MAY-16	R3466663
Antimony (Sb)	1.15		0.10	mg/kg	24-MAY-16	27-MAY-16	R3466663
Arsenic (As)	6.22		0.10	mg/kg	24-MAY-16	27-MAY-16	R3466663
Barium (Ba)	358		0.50	mg/kg	24-MAY-16	27-MAY-16	R3466663
Beryllium (Be)	0.46		0.10	mg/kg	24-MAY-16	27-MAY-16	R3466663
Boron (B)	6.9		5.0	mg/kg	24-MAY-16	27-MAY-16	R3466663
Bismuth (Bi)	12.8		0.20	mg/kg	24-MAY-16	27-MAY-16	R3466663
Cadmium (Cd)	0.899		0.020	mg/kg	24-MAY-16	27-MAY-16	R3466663
Calcium (Ca)	42100		50	mg/kg	24-MAY-16	27-MAY-16	R3466663
Chromium (Cr)	24.3		0.50	mg/kg	24-MAY-16	27-MAY-16	R3466663
Cobalt (Co)	5.10		0.10	mg/kg	24-MAY-16	27-MAY-16	R3466663
Copper (Cu)	313		0.50	mg/kg	24-MAY-16	27-MAY-16	R3466663
Iron (Fe)	14400		50	mg/kg	24-MAY-16	27-MAY-16	R3466663
Lead (Pb)	22.9		0.50	mg/kg	24-MAY-16	27-MAY-16	R3466663
Lithium (Li)	14.5		2.0	mg/kg	24-MAY-16	27-MAY-16	R3466663
Magnesium (Mg)	23400		20	mg/kg	24-MAY-16	27-MAY-16	R3466663
Manganese (Mn)	245		1.0	mg/kg	24-MAY-16	27-MAY-16	R3466663
Molybdenum (Mo)	19.8		0.10	mg/kg	24-MAY-16	27-MAY-16	R3466663
Nickel (Ni)	26.4		0.50	mg/kg	24-MAY-16	27-MAY-16	R3466663
Phosphorus (P)	8630		50	mg/kg	24-MAY-16	27-MAY-16	R3466663
Potassium (K)	1620		100	mg/kg	24-MAY-16	27-MAY-16	R3466663
Selenium (Se)	2.00		0.20	mg/kg	24-MAY-16	27-MAY-16	R3466663
Silver (Ag)	3.64		0.10	mg/kg	24-MAY-16	27-MAY-16	R3466663
Sodium (Na)	630		50	mg/kg	24-MAY-16	27-MAY-16	R3466663
Strontium (Sr)	104		0.50	mg/kg	24-MAY-16	27-MAY-16	R3466663
Thallium (Tl)	0.147		0.050	mg/kg	24-MAY-16	27-MAY-16	R3466663
Tin (Sn)	11.1		2.0	mg/kg	24-MAY-16	27-MAY-16	R3466663
Titanium (Ti)	91.5		1.0	mg/kg	24-MAY-16	27-MAY-16	R3466663
Uranium (U)	3.23		0.050	mg/kg	24-MAY-16	27-MAY-16	R3466663
Vanadium (V)	21.9		0.20	mg/kg	24-MAY-16	27-MAY-16	R3466663
Zinc (Zn)	368		2.0	mg/kg	24-MAY-16	27-MAY-16	R3466663
Zirconium (Zr)	13.1		1.0	mg/kg	24-MAY-16	27-MAY-16	R3466663
Total Organic Nitrogen - Soil							
Available Ammonium-N							
Available Ammonium-N	2630	DLHC	14	mg/kg	20-MAY-16	20-MAY-16	R3463139
Note: Done as Rec'd, back calc to dry							
Nitrogen, Total Organic - calculation							
Total Organic Nitrogen	0.726		0.020	%		26-MAY-16	
Total Kjeldahl Nitrogen							
Total Kjeldahl Nitrogen	0.99	DLHC	0.30	%	26-MAY-16	26-MAY-16	R3465663
Available N, P and K							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1770066-1 THE PAS CELL 1							
Sampled By: NOEL BOISVOF on 16-MAY-16 @ 14:30							
Matrix: WW							
Available Nitrate-N							
Available Nitrate-N	<4.0	NSSM	4.0	mg/kg	27-MAY-16	27-MAY-16	R3467354
Plant Available Phosphorus and Potassium							
Available Phosphate-P	34.5		2.0	mg/kg	30-MAY-16	30-MAY-16	R3467973
Available Potassium	295		20	mg/kg	30-MAY-16	30-MAY-16	R3467973
L1770066-2 THE PAS DRY BED							
Sampled By: NOEL BOISVOF on 16-MAY-16 @ 14:30							
Matrix: WW							
Miscellaneous Parameters							
Available Phosphate-P	190		1.0	mg/kg	27-MAY-16	27-MAY-16	R3466227
Mercury (Hg)	2.43	DLHC	0.025	mg/kg	24-MAY-16	25-MAY-16	R3465984
% Moisture	93.1		0.10	%	20-MAY-16	20-MAY-16	R3462382
Total Nitrogen by LECO	1.51		0.020	%	24-MAY-16	24-MAY-16	R3463446
Total Solids and Total Volatile Solids							
Total Solids	7.14		0.10	%	24-MAY-16	24-MAY-16	R3463414
Total Volatile Solids (dry basis)	30.6		0.10	%	24-MAY-16	24-MAY-16	R3463414
pH and EC (1:2 Soil:Water Extraction)							
Conductivity (1:2)	1.35		0.050	dS m-1	27-MAY-16	27-MAY-16	R3466010
pH (1:2 soil:water)	7.67		0.10	pH	27-MAY-16	27-MAY-16	R3466010
Metals in Soil by CRC ICPMS							
Aluminum (Al)	13700		50	mg/kg	24-MAY-16	30-MAY-16	R3466663
Antimony (Sb)	1.50		0.10	mg/kg	24-MAY-16	30-MAY-16	R3466663
Arsenic (As)	5.74		0.10	mg/kg	24-MAY-16	30-MAY-16	R3466663
Barium (Ba)	447		0.50	mg/kg	24-MAY-16	30-MAY-16	R3466663
Beryllium (Be)	0.35		0.10	mg/kg	24-MAY-16	30-MAY-16	R3466663
Boron (B)	14.6		5.0	mg/kg	24-MAY-16	30-MAY-16	R3466663
Bismuth (Bi)	10.1		0.20	mg/kg	24-MAY-16	30-MAY-16	R3466663
Cadmium (Cd)	4.17		0.020	mg/kg	24-MAY-16	30-MAY-16	R3466663
Calcium (Ca)	64300		50	mg/kg	24-MAY-16	30-MAY-16	R3466663
Chromium (Cr)	59.5		0.50	mg/kg	24-MAY-16	30-MAY-16	R3466663
Cobalt (Co)	5.88		0.10	mg/kg	24-MAY-16	30-MAY-16	R3466663
Copper (Cu)	441		0.50	mg/kg	24-MAY-16	30-MAY-16	R3466663
Iron (Fe)	17000		50	mg/kg	24-MAY-16	30-MAY-16	R3466663
Lead (Pb)	129		0.50	mg/kg	24-MAY-16	30-MAY-16	R3466663
Lithium (Li)	11.1		2.0	mg/kg	24-MAY-16	30-MAY-16	R3466663
Magnesium (Mg)	34600		20	mg/kg	24-MAY-16	30-MAY-16	R3466663
Manganese (Mn)	242		1.0	mg/kg	24-MAY-16	30-MAY-16	R3466663
Molybdenum (Mo)	11.3		0.10	mg/kg	24-MAY-16	30-MAY-16	R3466663
Nickel (Ni)	31.6		0.50	mg/kg	24-MAY-16	30-MAY-16	R3466663
Phosphorus (P)	6070		50	mg/kg	24-MAY-16	30-MAY-16	R3466663
Potassium (K)	1920		100	mg/kg	24-MAY-16	30-MAY-16	R3466663
Selenium (Se)	3.02		0.20	mg/kg	24-MAY-16	30-MAY-16	R3466663
Silver (Ag)	33.7	DLM	0.20	mg/kg	24-MAY-16	30-MAY-16	R3466663
Sodium (Na)	235		50	mg/kg	24-MAY-16	30-MAY-16	R3466663
Strontium (Sr)	87.8		0.50	mg/kg	24-MAY-16	30-MAY-16	R3466663
Thallium (Tl)	0.205		0.050	mg/kg	24-MAY-16	30-MAY-16	R3466663
Tin (Sn)	69.4		2.0	mg/kg	24-MAY-16	30-MAY-16	R3466663
Titanium (Ti)	93.4		1.0	mg/kg	24-MAY-16	30-MAY-16	R3466663
Uranium (U)	3.43		0.050	mg/kg	24-MAY-16	30-MAY-16	R3466663
Vanadium (V)	28.4		0.20	mg/kg	24-MAY-16	30-MAY-16	R3466663
Zinc (Zn)	522	DLHC	5.0	mg/kg	24-MAY-16	30-MAY-16	R3466663
Zirconium (Zr)	1.3		1.0	mg/kg	24-MAY-16	30-MAY-16	R3466663

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1770066-2 THE PAS DRY BED							
Sampled By: NOEL BOISVOF on 16-MAY-16 @ 14:30							
Matrix: WW							
Total Organic Nitrogen - Soil							
Available Ammonium-N							
Available Ammonium-N	490	DLR	26	mg/kg	20-MAY-16	20-MAY-16	R3463139
Note: Done as Rec'd, back calc to dry							
Nitrogen, Total Organic - calculation							
Total Organic Nitrogen	1.38		0.020	%		26-MAY-16	
Total Kjeldahl Nitrogen							
Total Kjeldahl Nitrogen	1.43	DLHC	0.40	%	26-MAY-16	26-MAY-16	R3465663
Available N, P and K							
Available Nitrate-N							
Available Nitrate-N	<4.0	NSSM	4.0	mg/kg	27-MAY-16	27-MAY-16	R3467354
Plant Available Phosphorus and Potassium							
Available Phosphate-P	162	DLHC	40	mg/kg	30-MAY-16	30-MAY-16	R3467973
Available Potassium	246		20	mg/kg	30-MAY-16	30-MAY-16	R3467973

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects.
DLR	Detection Limit Raised due to required dilution, limited sample amount, and/or high moisture content (soil samples)
NSSM	Non-standard sample matrix. Modified methods were used for sample processing and analysis.
NSSM	Non-standard sample matrix. Modified methods were used for sample processing and analysis.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ETL-N-TOTORG-CALC-SK	Soil	Nitrogen, Total Organic - calculation	APHA 4500 Norg-Calculated as TKN - NH3-N
HG-200.2-CVAF-SK	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

MET-200.2-CCMS-SK	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

MOIST-SK	Soil	Moisture Content	ASTM D2216-80

The weighed portion of soil is placed in a 105□C oven overnight. The dried soil is allowed to cooled to room temperature, weighed and the % moisture is calculated.

Reference: ASTM D2216-80

N-TOT-LECO-SK	Soil	Total Nitrogen by combustion method	SSSA (1996) P. 973-974

The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.

N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (2008) 22.2.3

The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.

NH4-AVAIL-SK	Soil	Available Ammonium-N	CSSS(1993) 4.2/COMM SOIL SCI 19(6)

Ammonium (NH4-N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.

NO3-AVAIL-SK	Soil	Available Nitrate-N	Method = Alberta Ag (1988)

Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution.
Nitrate is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm.

Reference:
Recommended Methods of Soil Analysis for Canadian Prairie Agricultural Soils. Alberta Agriculture (1988) p. 19 and 28

PH,EC-1:2-SK	Soil	pH and EC (1:2 Soil:Water Extraction)	CSSC 3.13/CSSS 18.3.1

1 part dry soil and 2 parts de-ionized water (by volume) is mixed. The slurry is allowed to stand with occasional stirring for 30 - 60 minutes. After equilibration, pH of the slurry is measured using a pH meter. Conductivity of the filtered extract is measured by a conductivity meter.

PO4-AVAIL-OLSEN-SK	Soil	Available Phosphate-P by Olsen	CSSS (1993) 7.2,7.3.1

Plant available phosphorus is extracted from the sample with sodium bicarbonate. PO4-P in the filtered extract is determined colorimetrically at 880 nm.

PO4/K-AVAIL-SK	Soil	Plant Available Phosphorus and Potassium	Comm. Soil Sci. Plant Anal, 25 (5&6)

Plant available phosphorus and potassium are extracted from the soil usng Modified Kelowna solution. Phosphorous in the soil extract is determined colorimetrically at 880 nm, while potassiumis determined by flame emission at 770 nm.

SOLIDS-TOT/TOTVOL-SK	Manure	Total Solids and Total Volatile Solids	APHA 2540G

A well-mixed sample is evaporated in a weighed dish and dried to constant weight in an oven at 103-105"C. The increase in weight over that of the empty dish represents the Total Solids. The crucible is then ignited at 550"–10"C for 1 hour. The remaining solids represent the Total Fixed Solids,

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

while the weight lost on ignition represents the Total Volatile Solids.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Appendix D

Title Page

Plan 1: Existing Lagoon Site Plan

Plan 2: Proposed Lagoon Upgrade with Setbacks and Discharge Route

Plan 3: Proposed Lagoon Upgrade Layout Plan

Plan 4: SAGR Cell Details

Plan 5: Wastewater Treatment Process Diagram

Plan 6: Treatment Building Overall Layout

Plan 7: Fence, Pipe Trench, Silt Fence and Swale Details

Plan 8: Carrot River Valley Agricultural Land

TOWN OF THE PAS

LAGOON UPGRADE EAP

PRELIMINARY
NOT FOR CONSTRUCTION

REDUCED PLANSET
DO NOT SCALE

PLAN INDEX

PLAN 1. EXISTING LAGOON SITE PLAN
PLAN 2. PROPOSED LAGOON UPGRADE WITH SETBACKS AND DISCHARGE ROUTE
PLAN 3. PROPOSED LAGOON UPGRADE LAYOUT PLAN
PLAN 4. SAGR CELL DETAILS
PLAN 5. WASTEWATER TREATMENT PROCESS DIAGRAM
PLAN 6. TREATMENT BUILDING OVERALL LAYOUT
PLAN 7. FENCE, SILT FENCE, PIPE TRENCH AND SWALE DETAILS
PLAN 8. CARROT RIVER VALLEY AGRICULTURAL LAND PLAN

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SCALE BAR
(IN METRES)
25 0 12.5 25 50 75 100 125
1:1250

No.	REVISIONS	DATE	INITIALS
	B.M. EL.		

LOCATIONS OF UNDERGROUND STRUCTURES/UTILITIES AS SHOWN ARE BASED ON AVAILABLE INFORMATION BUT NO GUARANTEE IS GIVEN OR IMPLIED THAT ALL EXISTING UNDERGROUND STRUCTURES/UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL UNDERGROUND STRUCTURES/UTILITIES MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY/OWNER, BY THE CONTRACTOR, BEFORE PROCEEDING WITH CONSTRUCTION.

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No. 234 **Date:** 17/11/10

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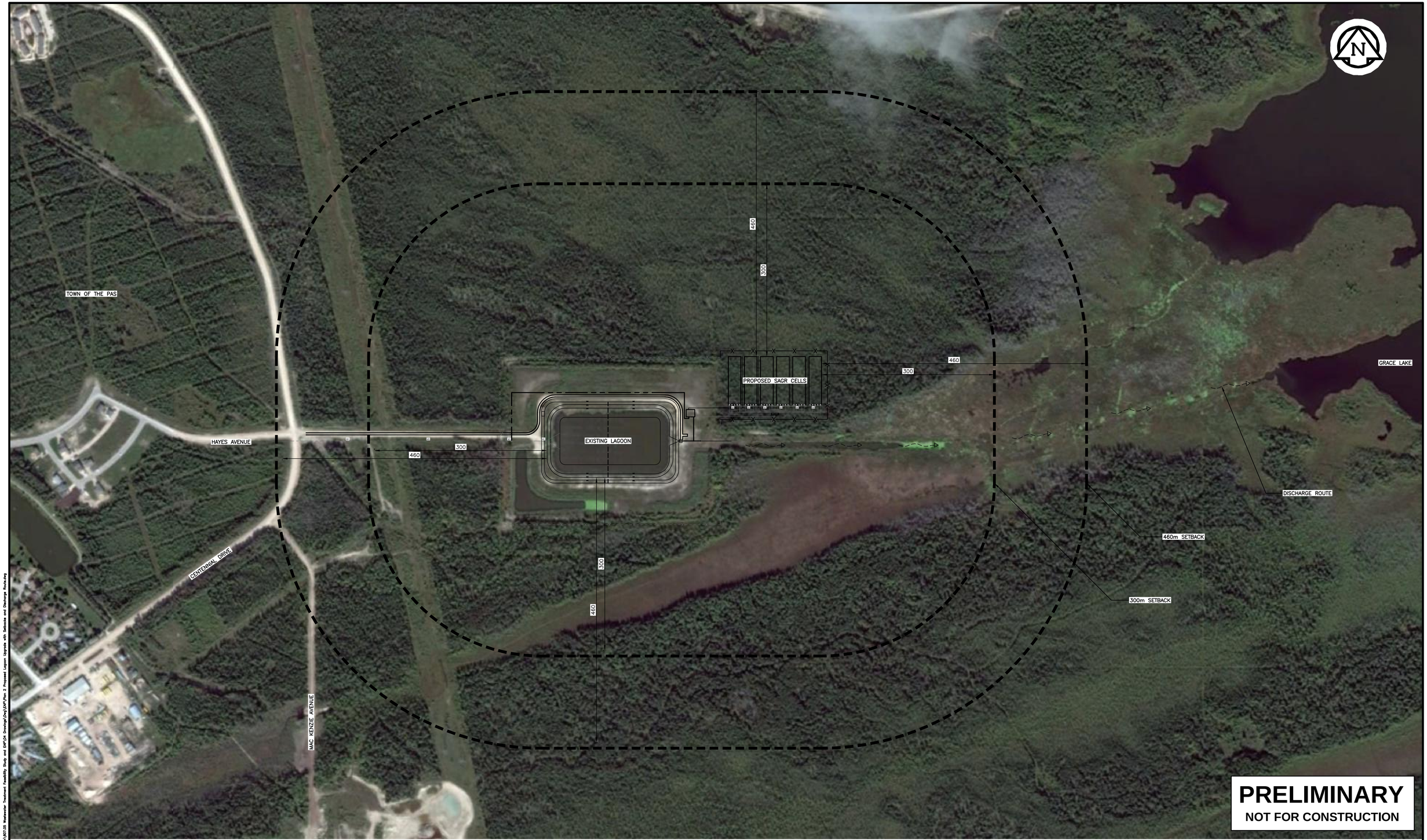
CODE:	T-607.05
DESIGNED BY:	DK
DRAWN BY:	DK
REVIEWED BY:	JRC

PROJECT: TOWN OF THE PAS
LAGOON UPGRADE EAP

TITLE: EXISTING LAGOON SITE PLAN

SCALE:	DATE:	PLAN:	SHEET:
1:1250	17/09/13	1	1 of 8

Mar 18, 2015 - 4:02pm P:\607\607.05 The Pas, Town\607.05 Wastewater Treatment Feasibility Study and EAP\04 Drawings\Dwg\EAP Plan 1 Existing Lagoon Site Plan.dwg



PRELIMINARY
NOT FOR CONSTRUCTION

SCALE BAR
(IN METRES)
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1:1000

No.	REVISIONS	DATE	INITIALS

B.M. EL.

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No. 234 **Date:** 17/11/10

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CODE:	T-607.05
DESIGNED BY:	DK
DRAWN BY:	DK
REVIEWED BY:	JRC

PROJECT: TOWN OF THE PAS LAGOON UPGRADE EAP

TITLE: PROPOSED LAGOON UPGRADE WITH SETBACKS AND DISCHARGE ROUTE

SCALE:	DATE:	PLAN:	SHEET:
1:1000	17/09/13	2	2 of 8

Mar 16, 2018 - 4:12pm K:\607\607.05 The Pas, Town\607.05 Wastewater Treatment Feasibility Study and EAP\04 Drawing\Dwg\WWF Rev 3 Proposed Lagoon Upgrade with Setbacks and Discharge Route.dwg

PRELIMINARY

NOT FOR CONSTRUCTION

SCALE BAR
(IN METRES)
20 0 10 20 40 60 80 100
1:1000

No.	REVISIONS	DATE	INITIALS

B.M. EL.

LOCATIONS OF UNDERGROUND STRUCTURES/UTILITIES AS SHOWN ARE BASED ON AVAILABLE INFORMATION BUT NO GUARANTEE IS GIVEN OR IMPLIED THAT ALL EXISTING UNDERGROUND STRUCTURES/UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL UNDERGROUND STRUCTURES/UTILITIES MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY/OWNER, BY THE CONTRACTOR, BEFORE PROCEEDING WITH CONSTRUCTION.

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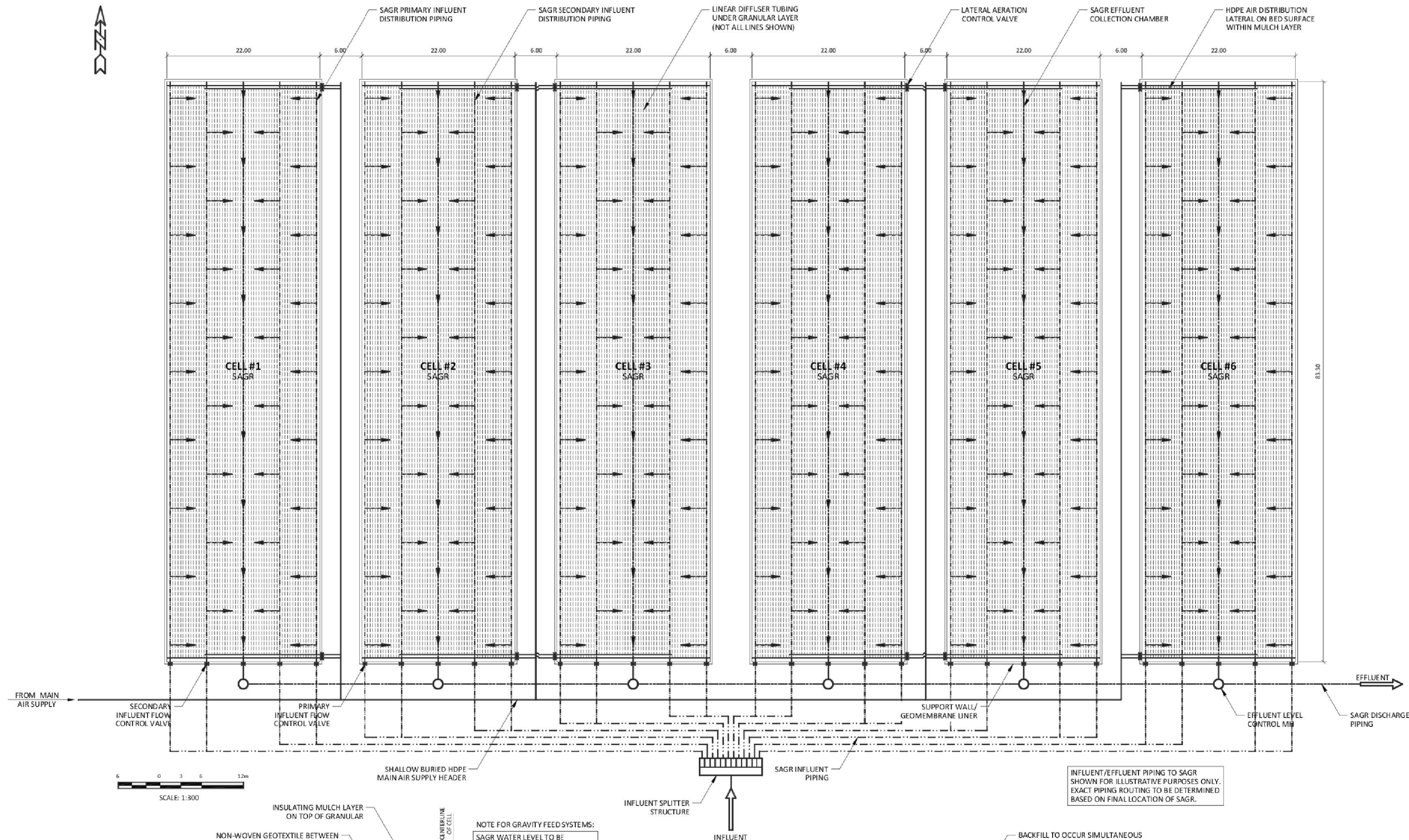
CODE: T-607.05
DESIGNED BY: DK
DRAWN BY: DK
REVIEWED BY: JRC

PROJECT: TOWN OF THE PAS LAGOON UPGRADE EAP

TITLE: PROPOSED LAGOON UPGRADE LAYOUT PLAN

SCALE: 1:1000 | DATE: 17/09/14 | PLAN: 3 | SHEET: 3 of 8



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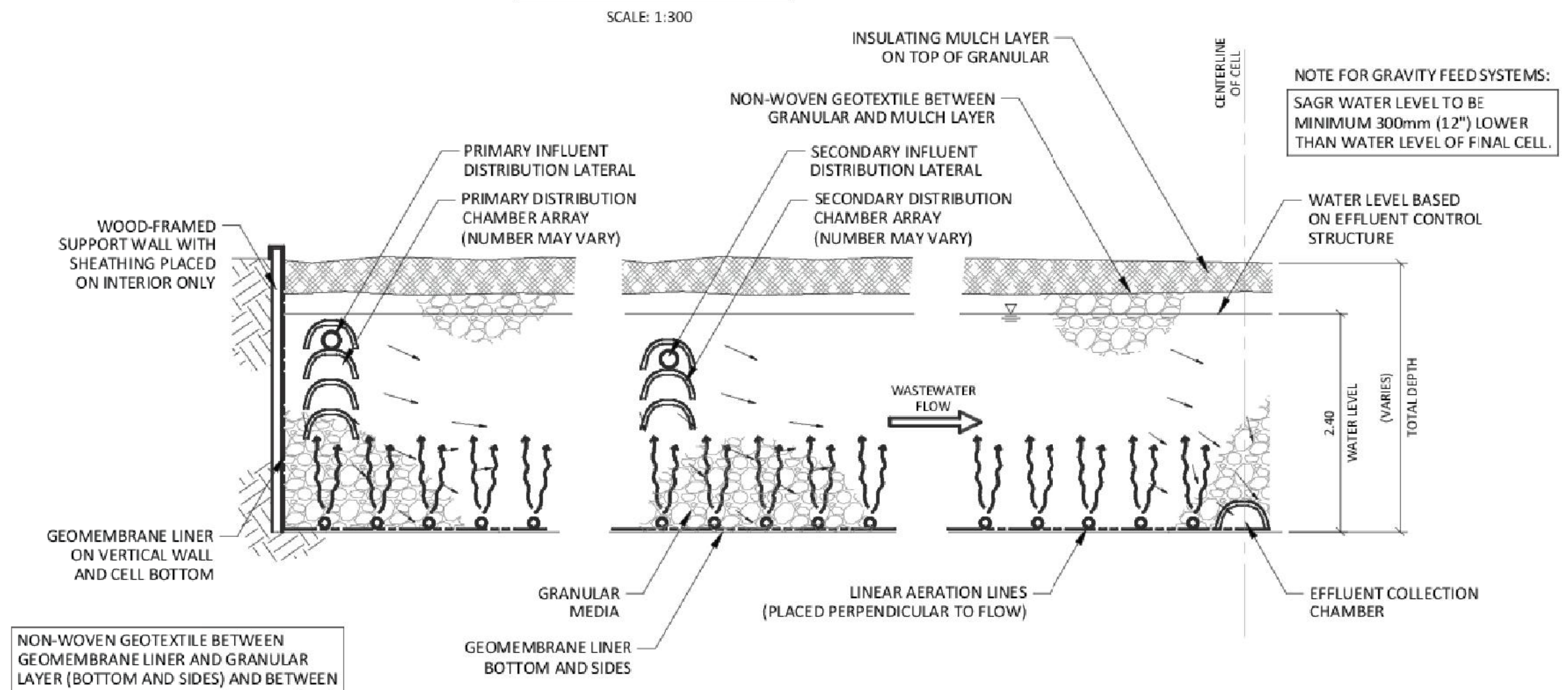
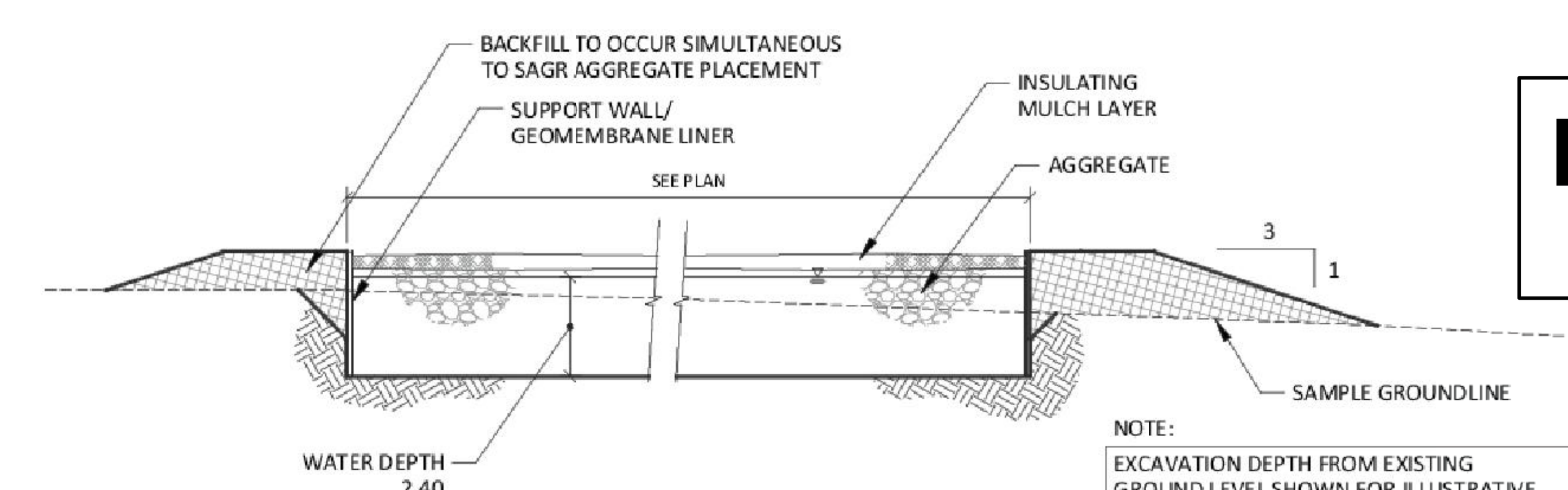


HORIZONTAL FLOW SAGR - SECTION
SCALE: N.T.S.



TYPICAL SAGR CONSTRUCTION
SCALE: N.T.S.

PRELIMINARY
NOT FOR CONSTRUCTION

NELSON ENVIRONMENTAL INC.
5 BURKS WAY
WINNIPEG, MANITOBA
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Ph: (204) 949-7500
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www.nelsonenvironmental.com

PROJECT:	THE PAS, MB PROPOSED WASTEWATER TREATMENT SYSTEM
TITLE:	PROPOSED OPTAER SAGR SYSTEM PROPOSED SAGR LAYOUT, TYPICAL SECTIONS
DRAWN BY:	AM
APPROVED BY:	MH
SCALE:	AS NOTED
DRAWING NO.:	NE02
SHT:	2 of 2
REV:	0
DATE:	2016/08/05
FILE #:	CD2771.02

No.	REVISIONS	DATE	INITIALS

B.M. EL.

LOCATIONS OF UNDERGROUND STRUCTURES/UTILITIES AS SHOWN ARE BASED ON AVAILABLE INFORMATION BUT NO GUARANTEE IS GIVEN OR IMPLIED THAT ALL EXISTING UNDERGROUND STRUCTURES/UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL UNDERGROUND STRUCTURES/UTILITIES MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY/OWNER, BY THE CONTRACTOR, BEFORE PROCEEDING WITH CONSTRUCTION.

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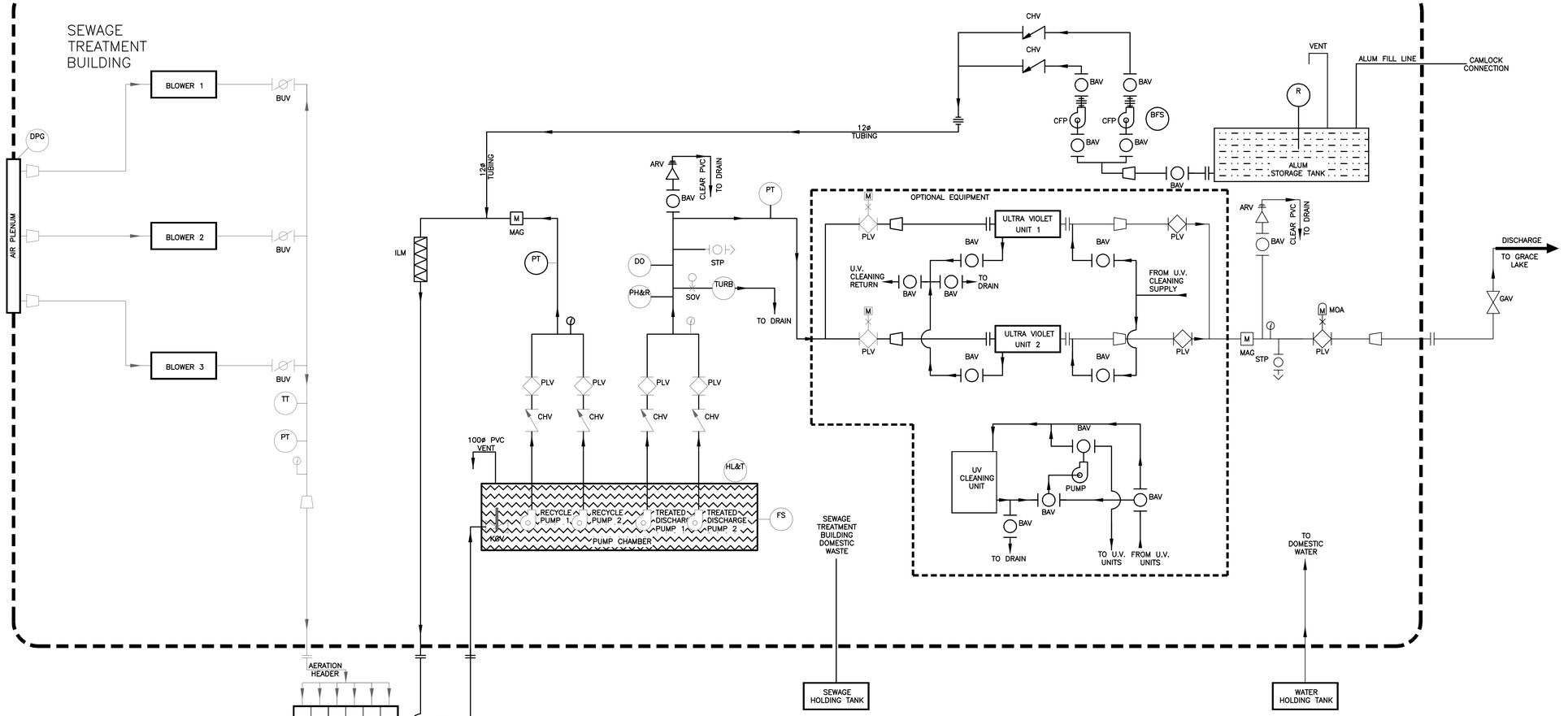
ENGINEERING CONSULTANTS
ENGINEERING EXCELLENCE SINCE 1981

CODE:	T-607.05
DESIGNED BY:	
DRAWN BY:	
REVIEWED BY:	
PROJECT:	TOWN OF THE PAS LAGOON UPGRADE EAP
TITLE:	SAGR CELL DETAILS
SCALE:	NTS
DATE:	17/09/14
PLAN:	4
SHEET:	4 of 8



LEGEND

- PUMP
- MAG METER
- GAV — GATE VALVE (GENERAL)
- PLV — PLUG VALVE
- KGV — KNIFE GATE VALVE
- BAV — BALL VALVE
- BUV — BUTTERFLY VALVE
- STP — SAMPLE TAP
- FLOW DIRECTION
- FLANGE CONNECTION
- UNION
- CHV — CHECK VALVE
- ARV — AIR RELEASE
- PRESSURE GAUGE
- SOV — SOLENOID VALVE
- MOD — MOTORIZED VALVE (DIGITAL – OPEN/CLOSED)
- MOA — MOTORIZED VALVE (ANALOG – CONTROL)
- REDUCER
- DEV.ID — DEVICE IDENTIFIER
- ILM — INLINE MIXER

- TT — TEMPERATURE TRANSMITTER
- PT — PRESSURE TRANSDUCER
- DO — DISSOLVED OXYGEN UNIT
- PH&R — COMBINED PH & ORP SENSOR
- HL&T — HYDROSTATIC LEVEL SENSOR WITH TEMPERATURE
- BFS — BUILDING FLOOD SWITCH
- R — ROTOR
- US — ULTRASONIC TRANSDUCER
- FS — FLOAT SWITCH
- TURB — TURBIDITY METER
- M — MOTOR
- DPG — DIFFERENTIAL PRESSURE GAUGE
- PH — PH SENSOR
- HL — HYDROSTATIC LEVEL SENSOR

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No.	REVISIONS	DATE	INITIALS
			B.M. EL.

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APEGM
Certificate of Authorization
J.R. Cousin Consultants Ltd.
No. 234 **Date:** 17/11/10

ENGINEER'S SEAL
PROVINCE OF MANITOBA — J.R. COUSIN — Member 22391 — REGISTERED PROFESSIONAL ENGINEER — 17/11/10

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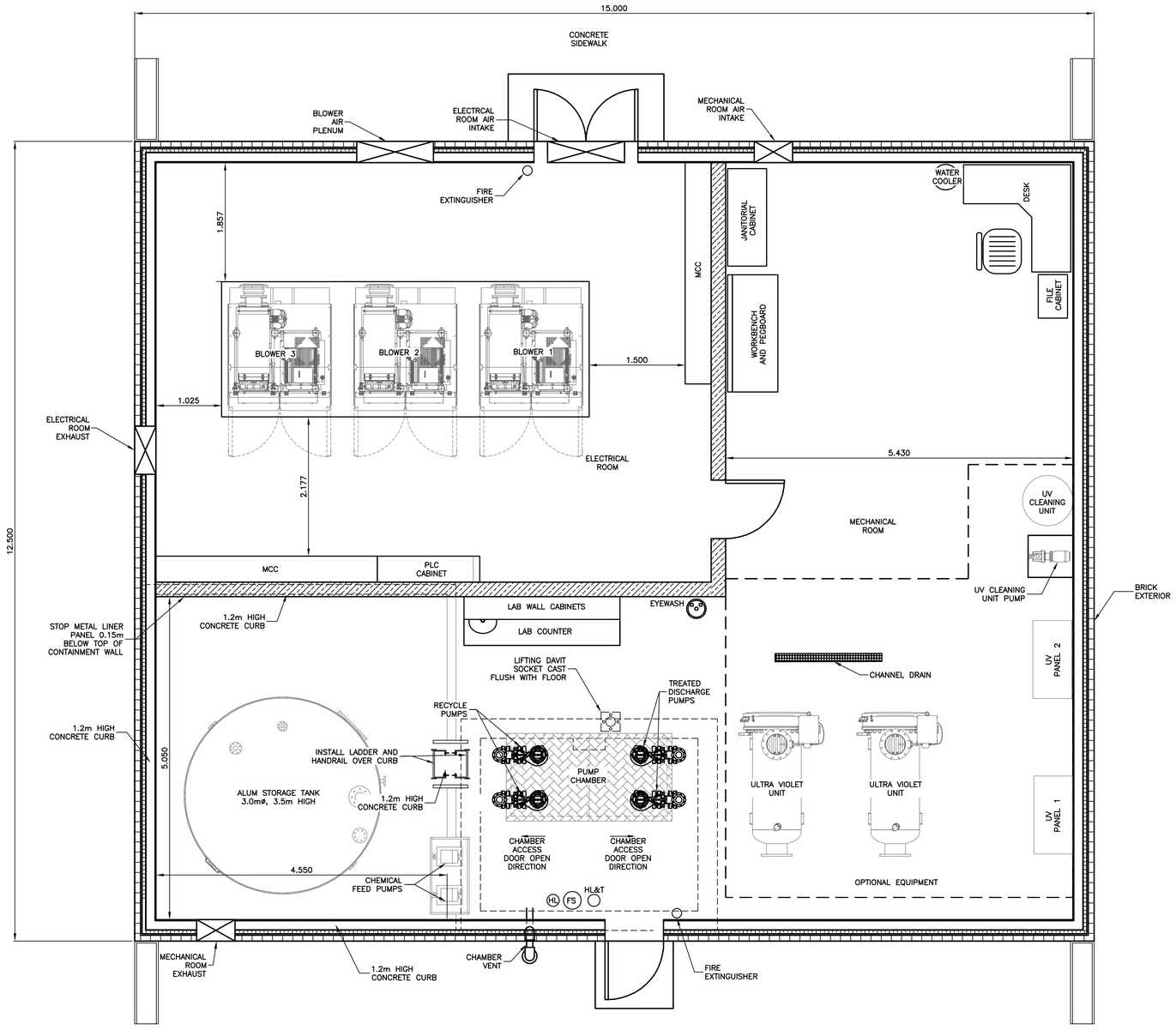
ENGINEERING EXCELLENCE SINCE 1981

CODE:	P–607.05
DESIGNED BY:	DK
DRAWN BY:	DK
REVIEWED BY:	JRC
PROJECT:	TOWN OF THE PAS LAGOON UPGRADE EAP
TITLE:	WASTEWATER TREATMENT PROCESS DIAGRAM
SCALE:	NTS
DATE:	17/09/14
PLAN:	5
SHEET:	5 of 8



PRELIMINARY
NOT FOR CONSTRUCTION

SCALE BAR
(IN METRES)

0.8 0 0.4 0.8 1.6 2.4 3.2 4

1:40

No.	REVISIONS	DATE	INITIALS

B.M. EL.

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Certificate of Authorization
J.R. Cousin Consultants Ltd.
No. 234 **Date:** 17/11/10

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PROFESSIONAL ENGINEER
J.R. COUSIN
MEMBER
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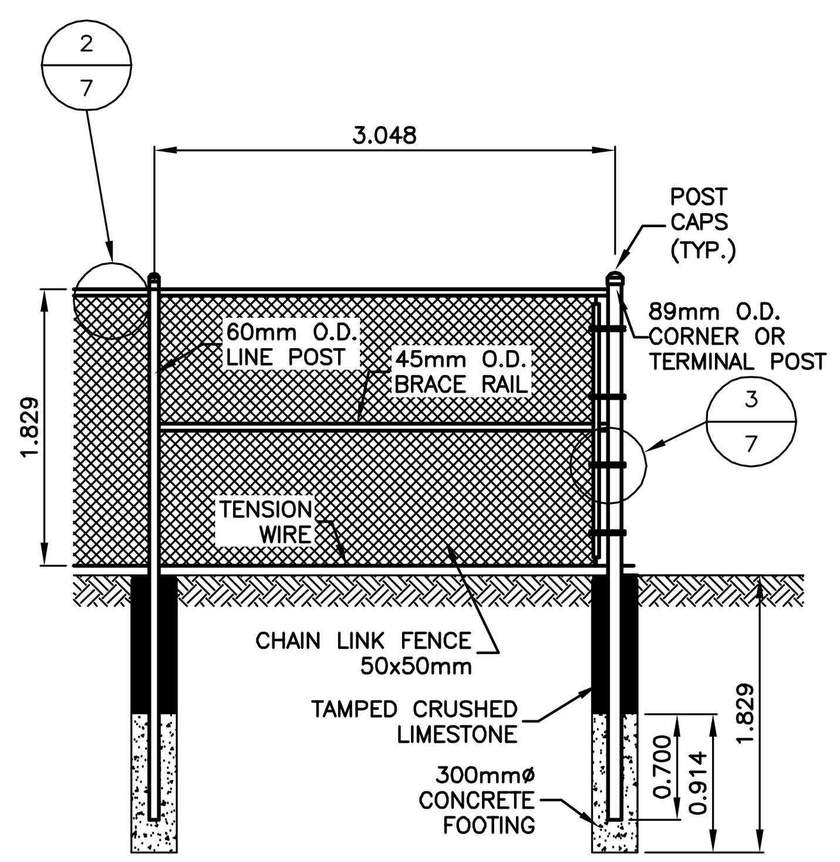
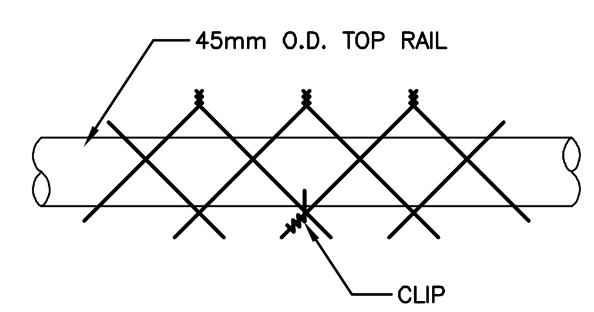
CODE:	T-607.05
DESIGNED BY:	DK
DRAWN BY:	DK
REVIEWED BY:	JRC
PROJECT:	TOWN OF THE PAS LAGOON UPGRADE EAP
TITLE:	TREATMENT BUILDING OVERALL LAYOUT
SCALE:	1:40
DATE:	17/09/14
PLAN:	6
SHEET:	6 of 8



1 CORNER POST
3 7
SCALE = 1:50



2 TOP RAIL
7
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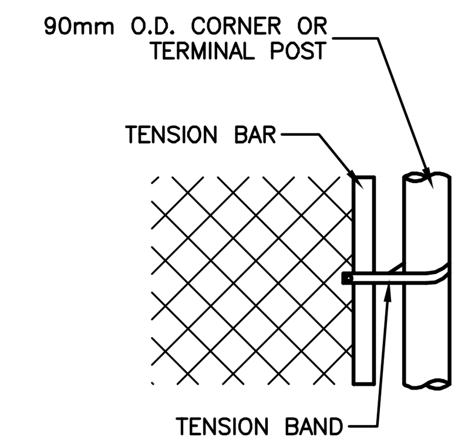
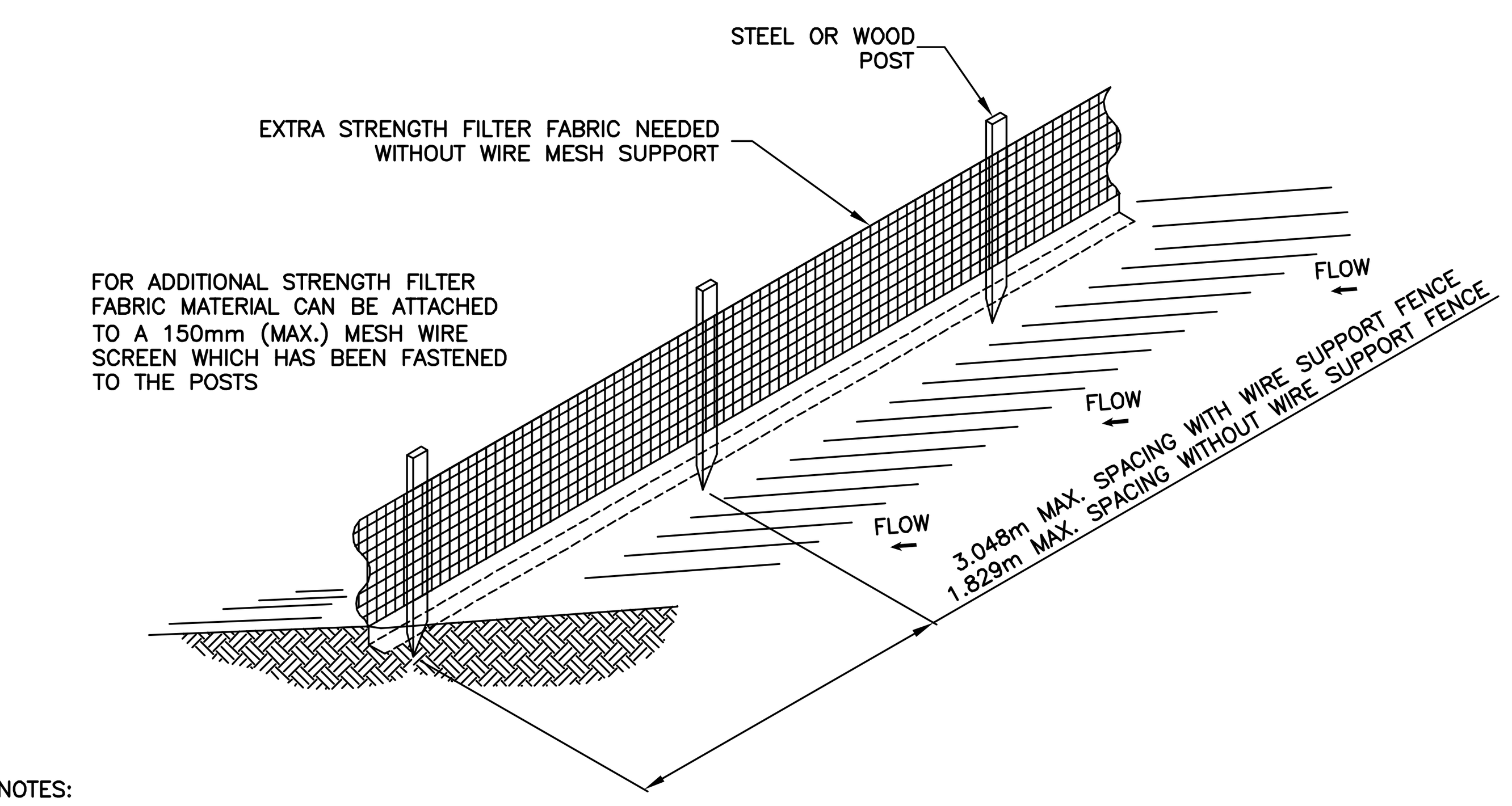


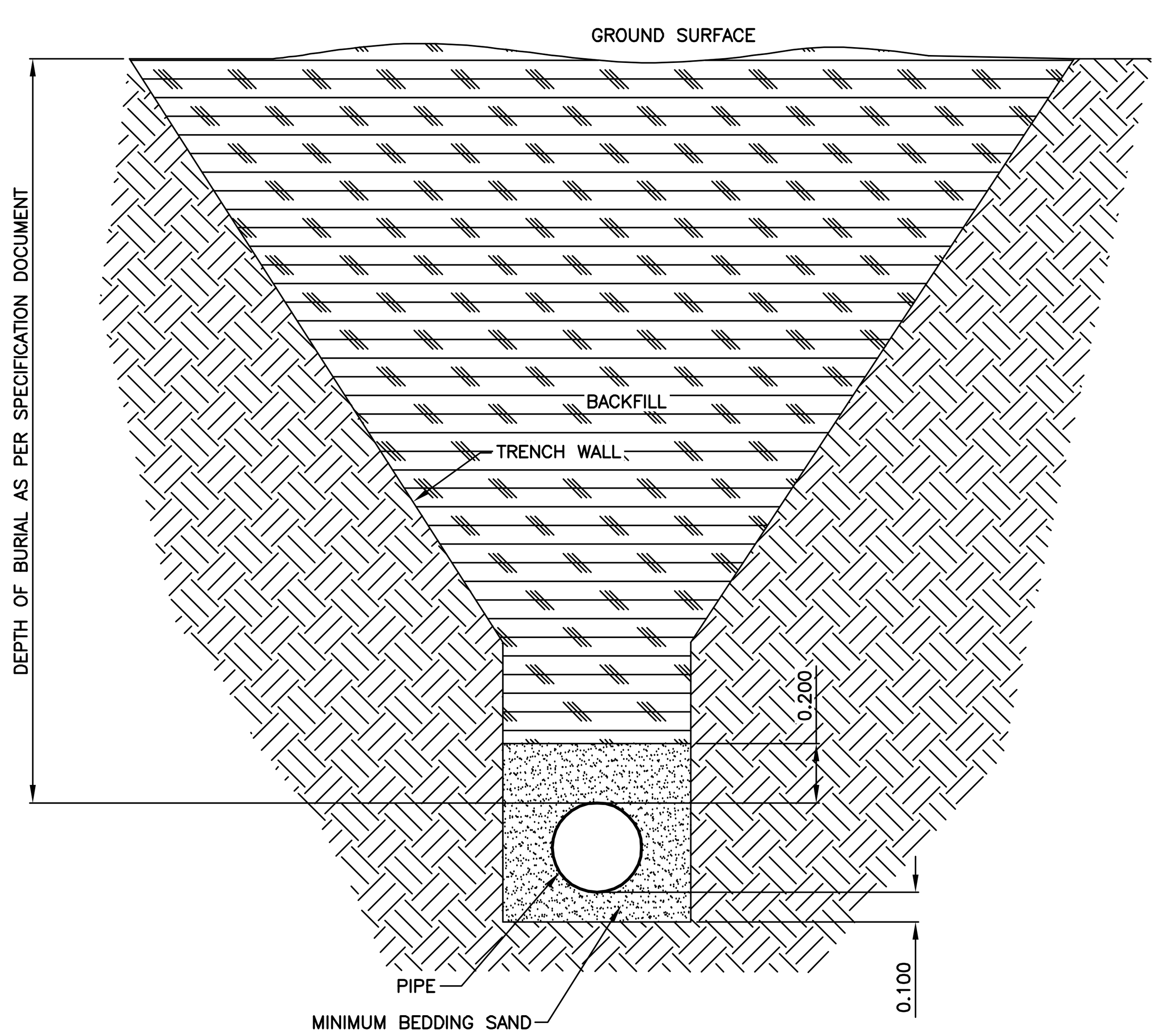
3 TENSION BAR
7
SCALE = 1:15



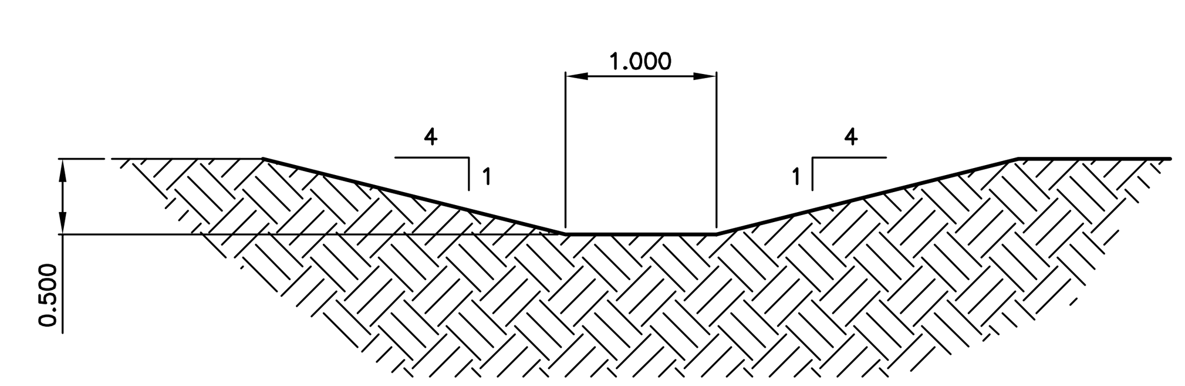
NOTES:

1. THE HEIGHT OF A SILT FENCE SHALL NOT EXCEED 914mm.
2. THE FILTER FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID THE USE OF JOINTS.
3. POSTS SHALL BE SPACED A MAXIMUM OF 3.048m APART AT THE BARRIER LOCATION AND DRIVEN SECURELY INTO THE GROUND A MINIMUM OF 300mm. WHEN EXTRA STRENGTH FABRIC IS USED WITHOUT THE WIRE SUPPORT FENCE, POST SPACING SHALL NOT EXCEED 1.829m.
4. A TRENCH SHALL BE EXCAVATED APPROXIMATELY 100mm WIDE AND 100mm DEEP ALONG THE LINE OF POSTS AND UPSLOPE FROM THE BARRIER.
5. WHEN STANDARD STRENGTH FILTER FABRIC IS USED, A WIRE MESH SUPPORT FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY DUTY WIRE STAPLES AT LEAST 25mm LONG, TIE WIRES, OR HOG RINGS. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 50mm AND SHALL NOT EXTEND MORE THAN 914mm ABOVE THE ORIGINAL GROUND SURFACE.
6. THE STANDARD STRENGTH FILTER FABRIC SHALL BE STAPLED OR WIRED TO THE FENCE, AND 200mm OF THE FABRIC SHALL BE EXTENDED INTO THE TRENCH. THE FABRIC SHALL NOT EXTEND MORE THAN 914mm ABOVE THE ORIGINAL GROUND SURFACE.
7. THE TRENCH SHALL BE BACKFILLED AND THE SOIL COMPACTED OVER THE FILTER FABRIC.
8. SILT FENCING TO BE POLYPROPYLENE SYNTHETIC FIBRE WITH ULTRAVIOLET STABILIZERS. AMOCO 1198 OR APPROVED EQUAL.
9. WOOD POSTS TO BE 38mm X 89mm (2" X 4"), POINTED AT ONE END AND FABRICATED.
10. INSTALL ALL SUPPORTING POSTS ON THE DOWN SLOPE SIDE OF THE FENCING
11. MAINTAIN SILT FENCE THROUGHOUT CONSTRUCTION AND UNTIL REVEGETATION OCCURS.

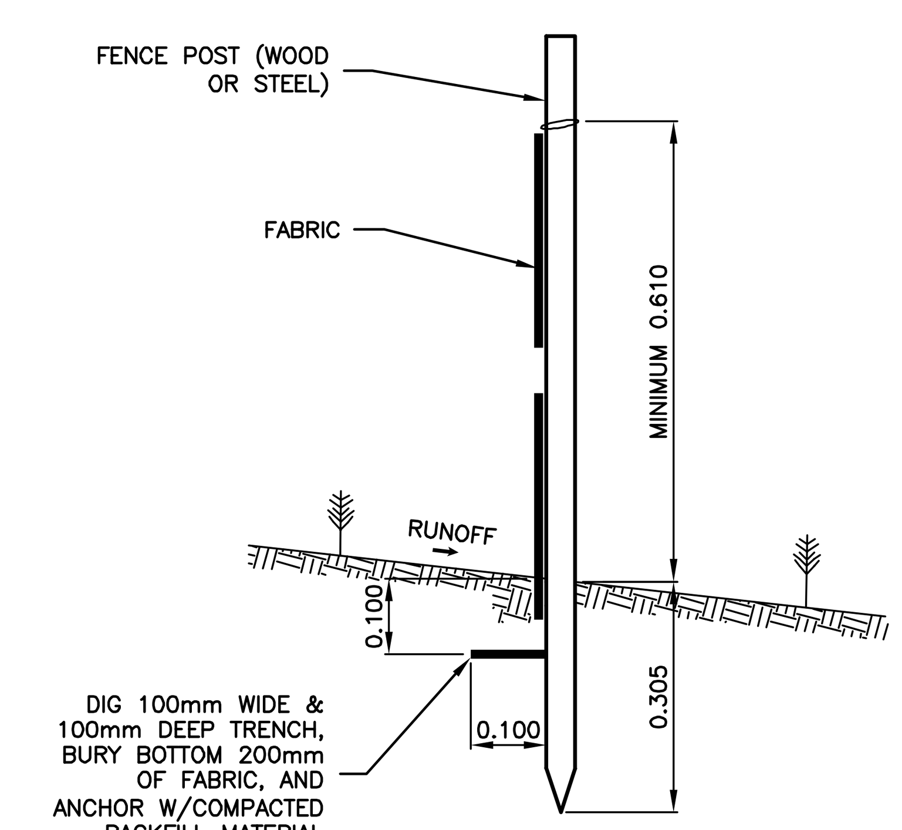
6 SILT FENCE DETAIL
7
SCALE = 1:40



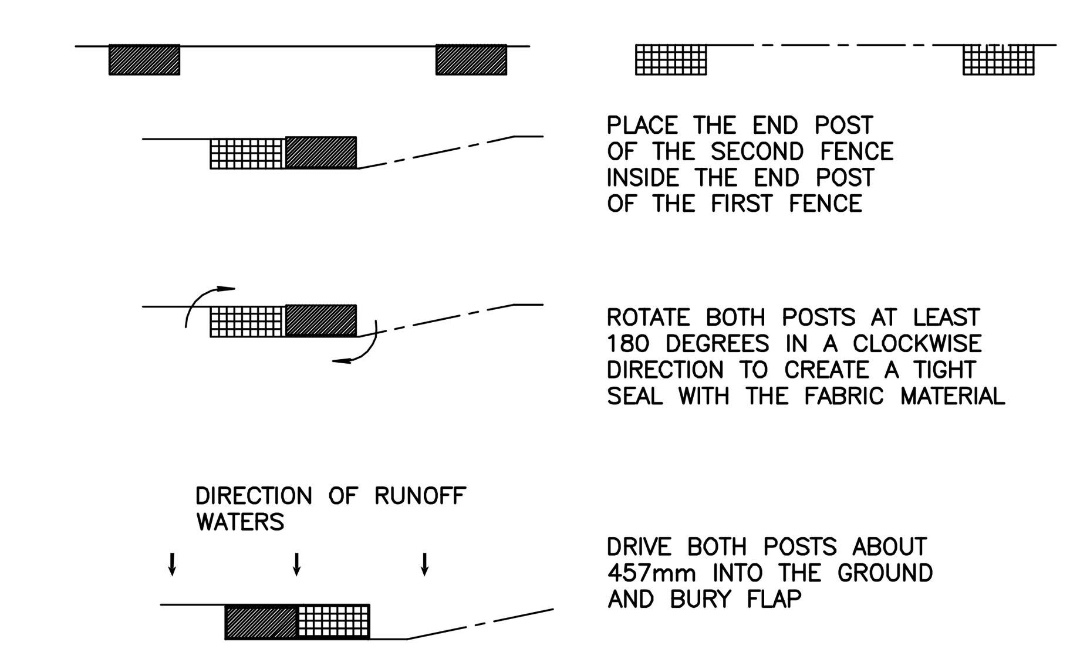
4 SINGLE TRENCH PIPING DETAIL
7
SCALE = 1:20



5 SWALE DETAIL
7
SCALE = 1:50



7 SILT FENCE SECTION
7
SCALE = 1:10



8 ATTACHING TWO SILT FENCES
7
SCALE = 1:10

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No.	REVISIONS	DATE	INITIALS

B.M. EL.

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Certificate of Authorization
J.R. Cousin Consultants Ltd.
No. 234 Date: 17/11/10

ENGINEER'S SEAL
J.R.L. COUSIN Member 22391 17/11/10

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ENGINEERING EXCELLENCE SINCE 1981

CODE: T–607.05
DESIGNED BY: DK
DRAWN BY: RH
REVIEWED BY: JRC

PROJECT: TOWN OF THE PAS LAGOON UPGRADE EAP

TITLE: FENCE, SILT FENCE, PIPE TRENCH, AND SWALE DETAILS

SCALE: AS NOTED | DATE: 17/09/14 | PLAN: 7 | SHEET: 7 of 8

PRELIMINARY
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SCALE BAR
(IN METRES)
1500 0 750 1500 3000 4500 6000 7500
1:75000

No.	REVISIONS	DATE	INITIALS
	B.M. EL.		

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J.R. Cousin Consultants Ltd.
No. 234 **Date:** 18/03/15

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CODE:	T-607.05
DESIGNED BY:	DK
DRAWN BY:	RH
REVIEWED BY:	JRC

PROJECT: TOWN OF THE PAS
LAGOON UPGRADE EAP

TITLE: CARROT RIVER VALLEY
AGRICULTURAL LAND PLAN

SCALE:	DATE:	PLAN:	SHEET:
1:75000	18/02/27	8	8 of 8