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P&R 8.231 JRCC

W-579.02

RURAL MUNICIPALITY OF WALLACE

Environment Act Proposal
for
Wastewater Treatment Lagoon Construction

Prepared by:

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August 2014

PROVINCE OF MANITOBA
14/08/13
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APEGM
Certificate of Authorization
J. R. Cousin Consultants Ltd.
No. 234 Date: 14/08/13

JRCC ENGINEERING CONSULTANTS

ACKNOWLEDGMENTS

To prepare this report various sources of information were investigated and researched. JR Cousin Consultants Ltd. (JRCC) wishes to thank the RM of Wallace and the Manitoba Water Services Board (MWSB) who contributed to the data and content of this study. In addition, we wish to commend the RM of Wallace and the Manitoba Water Services Board for their fortitude in addressing the need for a long-term solution to wastewater treatment in the RM of Wallace.

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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Environment Act Proposal Form

Manitoba
Conservation and Water Stewardship

Name of the development: RM of Wallace, Wastewater Treatment Lagoon			
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88): Class 2 Development			
Legal name of the applicant: RM of Wallace			
Mailing address of the applicant: 305 Nelson St. West, Box 2200			
Contact Person: Ms. Janice Thevenot, CAO			
City: Virden	Province: Manitoba	Postal Code: R0M 2C0	
Phone Number: (204) 748-1239	Fax: (204) 748-3450	email:	
Location of the development: RM of Wallace, Manitoba			
Contact Person: Ms. Janice Thevenot, CAO			
Street Address:			
Legal Description: NW 14-10-29 WPM			
City/Town:	Province: Manitoba	Postal Code: R0M 2C0	
Phone Number: (204) 748-1239	Fax: (204) 748-3450	email:	
Name of proponent contact person for purposes of the environmental assessment: Mr. Jason Cousin, P.Eng., JR Cousin Consultants Ltd.			
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Email address: jrcousin@jrcc.ca			
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Date: Aug 13/14	Signature of proponent, or corporate principal of corporate proponent: Printed name: Jason Cousin		

EXECUTIVE SUMMARY

General

The RM of Wallace and the Manitoba Water Services Board (MWSB) are proposing to construct a new wastewater treatment lagoon for the communities and residents in the RM of Wallace. An Environment Act Licence will be required from Manitoba Conservation for the construction and operation of the proposed lagoon. JR Cousin Consultants Ltd. (JRCC) was retained for the engineering services.

Description

A new facultative wastewater treatment lagoon is being proposed by the RM of Wallace to service residents throughout the RM, through both a potential piped collection system in Kola and truck hauling of septage in the remainder of the RM. Currently septic haulers have to travel to wastewater treatment lagoons in the surrounding RMs to dump septage from residents in the RM of Wallace. The new lagoon construction would include constructing earthen primary and secondary cells with a spillway, truck turnaround, perimeter fencing and ditching.

The proposed site of development is located approximately 2.5 km southeast of the community of Kola, on agricultural land, with Provincial Road 257 bordering the site to the north and agricultural land surrounding the site to the east, west and south.

Population Contributing Effluent

The projected year 20 service population utilized for sizing the proposed RM of Wallace lagoon would include residents within the communities of Kola, Hargrave, Kirkella, Elkhorn, Virden, the surrounding rural residents in the RM of Wallace, an allowance for construction camps in the RM, and the Kola School. The year 20 service area includes the community of Kola (200 people), the Kola School (17 equivalent people), the rural population utilizing the lagoon for truck hauled septage (1,544 people), the allowance for construction camps (100 people), and 40 septic tanks from Virden and Elkhorn. The communities of Elkhorn and Virden both have existing sewage treatment facilities for the piped collection systems in the communities. An annual growth rate of 0.5% was utilized for projecting the year 20 design populations, except for Kola, where a future population of 200 people was used at the request of the proponent.

Lagoon Loading

The total projected year 20 organic loading to the lagoon primary cell would be approximately 62.1 kg BOD_5/day, which includes average daily loading from piped sources and a peak daily load of septage from the surrounding rural residents (six tank pump outs per day or two truckloads of septage per day).

Based on a per capita hydraulic loading rate of 288 L/person/day for a piped collection system, the projected year 20 hydraulic load to the lagoon would be approximately 115 m^3/day. Therefore, the lagoon would require a total hydraulic capacity of 26,380 m^3 in design year 20, for the required 230 days of winter storage.

Topographical Survey and Geotechnical Investigation

The proposed development site was observed to be undulating agricultural land used for grain production with scattered mounds and low lying areas. A maximum elevation difference of approximately 1.7 m was recorded at the site. The land generally slopes towards the north and east.

The general soil profile consisted of surficial topsoil followed by a layer of medium plastic silty clay down to the bottom of the test holes. Bedrock was not encountered. The static water level was recorded at depths 2.1 m and 2.4 m below the surface.

Based on the laboratory analysis, the layer of medium plastic silty clay had an in-situ hydraulic conductivity value of 2.5×10^{-8} cm/sec. This permeability testing result was within Manitoba Conservation requirements for hydraulic conductivity in a lagoon clay liner.

Lagoon Liner

Based on the onsite geotechnical investigation and results of the laboratory analysis, it is recommended that the lagoon horizontal liner be constructed of in-situ soil material, while the vertical cut-off walls are constructed of reworked soil material from the site excavation. A key trench will be utilized to connect the vertical liner to the in-situ horizontal liner.

Nutrient Management Plan

Based on the 2011 *Manitoba Water Quality Standards, Objectives and Guidelines*, the Municipal wastewater effluent discharge requirement is a limit of 1.0 mg/L of phosphorus. The exception being small wastewater treatment facilities that serve less than 2,000 equivalent people, which have the option of implementing a nutrient reduction strategy instead of the 1.0 mg/L phosphorus limit.

Various options were considered for meeting the required phosphorus limit, however the most feasible option included utilizing a trickle discharge from the lagoon into the provincial road drainage ditch to the north of the site and to a first order provincial drain. It is expected that nutrient uptake along the discharge route will occur by plants and soils, reducing the concentration of phosphorus prior to discharge into the nearest permanent body of surface water (Oak Lake).

1.0 INTRODUCTION AND BACKGROUND

The development described herein is for construction of a new facultative wastewater treatment lagoon in the RM of Wallace, Manitoba.

1.1 Introduction

The RM of Wallace and Manitoba Water Services Board are proposing to construct a facultative wastewater treatment lagoon for the communities and rural residents in the RM of Wallace. An Environment Act Licence is required from Manitoba Conservation for the construction and operation of the proposed lagoon. JR Cousin Consultants Ltd. (JRCC) was retained for the engineering services.

1.2 Contact Information

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1.3 Background Information

The RM of Wallace is located near the border of Saskatchewan and contains the communities of Kola, Hargrave, and Kirkella, along with the Village of Elkhorn and the Town of Virden. The service population for the RM of Wallace proposed wastewater lagoon would include the residents in the communities of Kola, Hargrave, Kirkella and the surrounding rural residents in the RM. Currently these residents use septic tank systems with disposal fields and septage hauling to wastewater lagoon sites in the surrounding rural municipalities of Pipestone, Archie and Sifton, based on which sites can receive truck hauled septage. The Village of Elkhorn and the Town of Virden have independent wastewater treatment facilities servicing residents in those communities, however those facilities do not receive truck hauled septage.

1.4 Description of Previous Studies

The report entitled *RM of Wallace Feasibility Study for Lagoon Construction*, by JRCC in April 2014 was reviewed to obtain background information on the proposed site of development. Three lagoon siting options were considered and evaluated, including the proposed lagoon development site. Consideration was also given to a truck haul only lagoon for the RM. The study included an onsite topographic and geotechnical investigation for all three proposed lagoon sites.

1.5 Project Description

The RM of Wallace is in need of a wastewater treatment lagoon to service the population in the RM that includes several small communities (Kola, Hargrave, Kirkella) and the surrounding rural residents. The development is proposed to be a facultative lagoon with one primary cell and one secondary cell constructed with an in-situ horizontal soil liner and a reworked vertical cut-off wall. The lagoon is to be located at NW 14-10-29 WPM, southeast of the community of Kola, along PR 257. The lagoon discharge will be east along the PR ditch to a first order provincial drain.

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 proposed lagoon development site is located in NW 14-10-29 WPM, approximately 2.5 km southeast of Kola, Manitoba. The land is open agricultural grassland used for grain production, with small low lying pockets scattered throughout the field. The lands surrounding the proposed site are also agricultural lands, with Provincial Road 257 bordering the site to the north. The land is currently owned by Leslie Penner of Kola, MB under certificate of title number 1431846/2. The RM has had discussions with the land owner for the purchase of the land and the two parties have a pending agreement of purchase for the lagoon development area.

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:

The Crown Lands & Property Agency was contacted regarding the ownership of the mines and minerals at the proposed development location. According to the Crown Lands & Property Agency, the ownership of the mines & minerals and sand & gravel remains with the surface title. The Crown (Province of Manitoba) has no interests (see email correspondence from the Crown Lands & Property Agency in Appendix A).

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 proposed lagoon development site is agricultural land currently being used for crop production. The surrounding adjacent lands are also agricultural and being used as for crop production. Provincial Road 257 (PR 257) is bordering the site to the north. The nearest residence is a farmyard located approximately 600 m to the west and an oil well pump is located approximately 750 m to the east. The community of Kola is located approximately 2.9 km to the east of the proposed lagoon development, on the north side of PR 257 (see Plan L1 in Appendix D).

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 construction site is currently zoned as Agricultural (Ag80), based on the RM of Wallace zoning.

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

Lagoon design is proposed to begin upon receipt of an Environment Act Licence. Lagoon construction works are proposed to begin in the spring of 2015. Commissioning and operation of the lagoon is proposed to begin upon completion of lagoon construction and after approval for use is obtained from Manitoba Conservation. No date for decommissioning has been set for the lagoon, however the lagoon is being designed for a projected year 20 (2034) service population, and a lagoon assessment should be conducted when the lagoon approaches this year 20 design life.

2.5.2 Basis for Proposed Lagoon Expansion Site Selection

The location for the lagoon construction was chosen based on a feasibility study conducted by JRCC in 2014, which takes into account the proximity to the existing community of Kola (as discussed below), rural residents, drainage routes and property boundaries.

Manitoba Conservation's guidelines for the location of a wastewater treatment lagoon (*Design Objectives for Standard Sewage Lagoons, Province of Manitoba, Environmental Management*, July 1985) are outlined in the following table. A description of the proposed lagoon development site in relation to each of the guidelines is also provided in the table.

Table A: Location of Proposed Lagoon Site in Relation to Manitoba Conservation Guidelines

Manitoba Conservation Guideline	Proposed Relation to Site
Lagoons must be located a minimum of 460 m from any community centre.	The proposed lagoon site is located approximately 2.9 km from the community of Kola.
Lagoons must be located a minimum of 300 m from any residence. (The distance is to be measured from the centreline of the nearest dike).	The proposed lagoon site is located approximately 600 m from the nearest residence.

Manitoba Conservation Guideline	Proposed Relation to Site
Consideration should be given to sites in which prevailing winds are in the direction of uninhabited areas.	The prevailing winds typically blow from the north and west. The proposed lagoon expansion site is located southeast (downwind) of the community of Kola, and is located approximately 1.2 km to the nearest downwind residence.
Sites with an unobstructed wind sweep across the lagoon are preferred.	The land surrounding the proposed lagoon is open agricultural land, however the site has a treed windbreak along the north and west boundaries.
Areas that are habitually flooded shall be avoided.	Flooding is not expected in the proposed lagoon site, as there is no significant body of surface water in the vicinity. The top of dikes of the proposed lagoon cells would be constructed approximately 1.0 m to 1.5 m above the surrounding grade elevation. There have been no reports of flooding around the proposed lagoon site.
Areas of porous soils and fissured rock formations should be critically evaluated to avoid creation of health hazards or other undesirable conditions.	Area does not contain porous soils or fissured rock formations. A soil liner will be utilized in the lagoon cell construction according to Provincial guidelines, thus reducing the possibility of groundwater contamination.

The proposed lagoon construction area is located beyond all setback distances required by Manitoba Conservation, therefore there are no expected siting concerns for the location of the lagoon cells. The advantage of a lagoon having a wind sweep across the surface is the ability to generate wave action that creates turbulence and aeration within the cells, which aids in wastewater treatment. As the site is partially surrounded by a windbreak, the wind sweep across the lagoon will be limited. Plan L2 in Appendix D, shows the minimum setback distance requirements for the proposed lagoon to the local residents and the community of Kola.

2.5.3 Lagoon Drainage Route

The proposed lagoon would discharge effluent into the existing provincial road (PR 257) drainage ditch to the north of the site that flows west to east towards a first order provincial drain. This drain flows southeast and eventually turns into a third order provincial drain that flows into Oak Lake, approximately 43 km away (see Plan L2 in Appendix D).

2.5.3.1 Fish Species Information

The following fish species have been identified in Oak Lake according to the Fisheries Inventory Habitat and Classification System (FIHCS): northern pike, smallmouth bass, walleye, white sucker and yellow perch.

According to the FIHCS, Oak Lake is rated as a Class 3 water body that has moderate limitations for the production of fish. Email correspondence with Manitoba Conservation and Water Stewardship – Fisheries Branch (included in Appendix B), indicates that general use on Oak Lake is recreational angling with no special regulations.

2.5.3.2 Water Quality Information

Manitoba Conservation and Water Stewardship were contacted for water quality data in Oak Lake. From correspondence with the Water Science and Management Branch, historic water quality data was available for Oak Lake and average values are summarized in the table provided below. Samples were retrieved from various monitoring stations on Oak Lake, which is located approximately 43 km southeast of the lagoon site. The samples were recorded between May 1979 and August 2013. The water quality parameters were averaged over this time period for all samples obtained.

Table B: Average Water Quality in Oak Lake

Parameter	Average Concentration	Unit
Ammonia Dissolved	0.37	mg/L
Coliforms, Fecal	11.7	CFU/100 mL
E. Coli	18.1	CFU/100 mL
Conductivity (at 25˚C)	1781	uS/cm
pH	8.17	pH units
Nitrogen Dissolved NO_3 & NO_2	0.02	mg/L
Nitrogen Total Kjeldahl (TKN)	2.64	mg/L
Oxygen Dissolved	5.46	mg/L
Total Phosphorus (TP)	0.16	mg/L
Total Phosphorus Dissolved	0.14	mg/L
Total Dissolved Solids (TDS)	750*	mg/L
Total Suspended Solids (TSS)	30*	mg/L

* Only one sample was recorded.

2.5.4 Access Road

The proposed lagoon development site would require an access road (approach) off of PR 257, to the north. This access road would be gated, and provide all weather access from PR 257 to the lagoon truck turnaround. This lagoon access road would be constructed of a compacted granular base.

2.5.5 Population Contributing Effluent

Population data was obtained from Statistics Canada, a review of aerial mapping, and discussions with the RM of Wallace. The service population utilizing the proposed RM of Wallace lagoon would include residents within the communities of Kola, Hargrave, Kirkella, the

surrounding rural residents in the RM of Wallace and the Kola School. The majority of the population utilizing the proposed lagoon will be from truck haul sources throughout the RM, while the population from the community of Kola and the Kola School would be considered as a piped source to the lagoon. The communities of Elkhorn and Virden are also located within the RM of Wallace and, while those communities have independent wastewater treatment systems, there are several households on pressure sewer systems requiring tank cleaning that will contribute septage to the RM of Wallace lagoon.

2.5.5.1 Community of Kola

The community of Kola consists of residential dwellings and a public school. Based on a review of aerial mapping, the community has approximately 43 lots. Based on the average RM population per household (3.0 people/household), as reported by Statistics Canada, the current population in the community of Kola is approximately 129 people. From discussions with the RM of Wallace, a design year 20 population of 200 people will be used for the community of Kola.

2.5.5.2 Kola School

The Kola School includes students from Grade 1 to Grade 9 and services the community and surrounding RM of Wallace. Based on discussions with the Fort La Bosse School Division, the additional population to consider from the bussed-in students is 47 people. The population of bussed-in students would have an assumed occupancy of a third of the population, based on the amount of time spent at school, and would therefore represent an equivalent population of 16 people (47/3). The population of the school is estimated to have a growth rate matching the R.M. of 0.5%, therefore the year 20 equivalent population is estimated to be 17 people.

2.5.5.3 Rural Population

The majority of the wastewater loading to the lagoon will be from truck haul sources within the RM of Wallace. Statistics Canada reported the RM of Wallace population to be 1,526 people in 2011, which includes the populations of Kola, Hargrave and Kirkella. Excluded from that population were the communities of Virden and Elkhorn, both of which already have their own sewage treatment facilities. The rural service population to consider would be approximately 1,397 people, which excludes the population of Kola (129 people), as this population would be considered separately for a future piped collection system. Using the RM's recent growth of 0.5%, it is anticipated the year 20 population will be 1,544 people.

Based on information from the local Environmental Compliance officer, 37% of new sewage installations were holding tanks and 63% of new installations were septic tanks and fields. Based on discussions with the RM of Wallace, it was determined that 35% holding tanks and 65% septic tanks were to be used for population growth in the RM to determine the number of people on holding tanks and septic tanks in design year 20.

Based on the information provided by Manitoba Conservation on the holding tanks installed between 2010 and 2013, there are an estimated 57 people using holding tanks and 1,340 people using septic tanks. Based on the 0.5% growth rate and percentage of new holding and septic tanks, the projected year 20 population is 108 people on holding tanks and 1,435 people on septic tanks.

2.5.5.4 Construction Camp

The RM of Wallace requested an allowance for 100 people on holding tanks for the population in temporary construction camps. No growth rate has been applied to the construction camp population, therefore the design year 20 population is projected to remain at 100 people.

2.5.5.5 Virden and Elkhorn

Based on information provided by the RM of Wallace, the community of Elkhorn has 30 septic tanks and the town of Virden has 6 septic tanks that require annual pump outs, resulting in a total of 36 septic tanks in Virden and Elkhorn that will contribute to the RM of Wallace lagoon. Currently septic haulers have to haul this waste to lagoons in other RMs that accept truck hauled septage. Using the RM's recent growth rate of 0.5%, it is anticipated there will be 40 septic tanks in Elkhorn and Virden requiring disposal in design year 20.

2.5.5.6 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 of Appendix B.

Contributing Population	Current Population	Year 20 Population
Community of Kola	129	200
Kola School	16	17
Rural Population (Septic Tanks)	1,340	1,435
Rural Population (Holding Tanks)	57	108
Construction Camp Personnel (Holding Tanks)	100	100
Elkhorn and Virden (Septic Tanks)	36 tanks	40 tanks

2.5.6 Wastewater Production

The proposed wastewater treatment lagoon is to service the projected year 20 populations as stated above, which includes a future piped collection system in the community of Kola and for the Kola School.

2.5.6.1 Organic Loading

The organic loading calculation is based upon the organics in typical residential wastewater and septage. A typical value of 0.076 kg BOD_5/person/day was utilized to estimate the organic loading from the residents and school population within the community of Kola, through a piped collection system and from the rural population and construction camp population on holding tanks. Based on the projected year 20 population of 425, an organic load of 32.3 kg BOD_5/day will be generated.

Truck hauled septage from community and rural septic tanks also needs to be considered as additional organic loading to the lagoon, as it will typically impact the peak daily Biochemical Oxygen Demand (BOD) loading. Using the rural housing population of 3.0 people/household and assuming each septic tank is 4,500 L and is pumped out annually, each septic tank pump out generates 4.96 kg BOD_5. The tank loading is based on 200 L/person/year of septage at a typical concentration of 0.007 kg BOD_5/L, and non-septage effluent with a typical concentration of 0.000196 kg BOD_5/L. The BOD loading for each septic tank is calculated from the following:

$$(200 \times 3.0 \times 0.007) + (4{,}500-(200 \times 3.0)) \times 0.000196 = 4.96 \text{ kg } BOD_5$$

Septage is only permitted to be hauled to the lagoon over the time period of 135 days (June 1 to October 15), as typically specified by Manitoba Conservation in Environmental 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.

The organic loading from septic tanks would be based on the current rural population of 1,340 people, a housing density of 3.0 people/household and 96 hauling days. Based on these parameters, an average of 4.7 tanks would need to be pumped out daily in 2014. With the projected year 20 rural population of 1,435 people, an average of 5.0 tanks would need to be pumped out daily in the 96 hauling days. There are currently 36 septic tanks in Elkhorn and Virden. Based on 96 hauling days, an average of 0.4 tanks would need to be pumped out daily in 2014. In design year 20, 40 septic tanks would need to be pumped out, resulting in an average of 0.4 tanks per day. Therefore the total pump outs required per day is 5.1 in 2014 and 5.4 in design year 20. Since only full tanks will be pumped out, the organic load will be based on six tank pump outs daily, resulting in a truck haul organic loading rate of 29.8 kg BOD_5/day.

The RM of Wallace will be responsible for limiting truck haul dumping to the proposed lagoon from septic tanks to six tank loads per day in accordance with the proposed primary cell design. Based on the size of a typical septic hauling truck, this would be the equivalent of two full truck loads of septage per day.

Manitoba provincial guidelines state the peak organic loading to the primary cell of the lagoon is limited to 56 kg BOD_5/ha/day. The 56 kg BOD_5/ha/day is based on the size of the primary cell(s) at the minimum volume of 0.75 m from the cell floor. One of the concerns from Manitoba Conservation with truck hauling and septage dumping are the odours generated at the lagoon during disposal. This potential impact is considered in the organic loading rate limit of 56 kg BOD_5/ha/day.

The daily organic loading expected from both piped and truck haul sources is expected to be 62.1 kg BOD_5/day (peak day) in design year 20. Table 1, attached in Appendix A, shows the current and projected year 20 organic loadings to the lagoon.

2.5.6.2 Hydraulic Loading

The hydraulic loading to the wastewater treatment lagoon would be comprised of four waste streams: water usage, infiltration, truck haul from holding tanks, and truck hauled septage. The wastewater conveyed by the piped collection system includes both water usage and infiltration. The wastewater collected in holding tanks includes only water usage. The per capita wastewater production identified for the community and school populations is 288 L/person/day, based off of typical values for similar communities in southern Manitoba. The per capita wastewater production rate identified for the population on holding tanks is 250 L/person/day.

The projected hydraulic loading to the lagoon from the community and school populations would be approximately 115 m^3/day in design year 20, assuming the community and school are connected to a piped collection system. For lagoon hydraulic storage requirements, only the flow between November 1 and June 15 is of importance as it represents the lagoon storage period. The additional volume of wastewater from truck hauled septage is minimal and has not been included in the hydraulic loading to the lagoon, as the septage is generally not permitted to be hauled to the lagoon during the 230 day storage period, with the exception of a 15 day period between June 1 and June 15.

The total hydraulic loading rate to the lagoon from all sources would currently be 81 m^3/day, and in design year 20 would be 115 m^3/day. The storage capacity of the lagoon would need to be 26,380 m^3 over the required 230 day storage period, to meet the year 20 demand. The proposed lagoon cells would be sized for the projected year 20 hydraulic loading. Table 1, attached in Appendix A, shows the current and projected year 20 hydraulic loadings to the lagoon.

2.5.6.3 Wastewater Production Summary Table

The projected year 20 wastewater (organic and hydraulic) loadings for the service population, on both a piped collection system and from truck hauling, have been included in the following summary table below and in the attached Table 1 of Appendix B.

Year 20 Lagoon Loading	Maximum Daily Loading	Capacity Required
Organic	62.1 kg BOD_5/day	11,092 m^2 @ 0.75 m in primary cell
Hydraulic	115 m^3/day	26,380 m^3

2.5.7 Lagoon Sizing Requirements

The proposed lagoon would be designed with sufficient capacity to meet the 20 year organic and hydraulic loadings. The lagoon sizing reflects a future piped collection system within the community of Kola, however consideration was also given to designing the lagoon so that it meets the requirements of a truck haul only lagoon, as it will be operated as a truck haul only lagoon until the piped collection system is constructed. From a review of the 2014 lagoon feasibility study, the organic and hydraulic requirements of a truck haul only lagoon were less than for that of a lagoon designed for piped and truck hauled sources (as proposed). Therefore the lagoon sizing below reflects the design for the greater organic and hydraulic loading requirements of a lagoon with piped and truck haul sources.

The proposed lagoon would consist of one primary cell and one storage cell. Sizing of the cells was based on 4H:1V inner dike slopes, an operating depth of 1.5 m, a freeboard height of 1.0 m and a discharge invert of 0.3 m.

2.5.7.1 Primary Cell

Provincial guidelines stipulate that the organic loading rate of a lagoon must not exceed 56 kg BOD_5/ha/day in the primary cell. The effluent surface area at a 0.75 m depth in the primary cell is used to determine the treatment surface area.

Based on the estimated organic loading rate discussed above, the primary cell would require a minimum surface area of 11,092 m^2 at a depth of 0.75 m, in design year 20 for a total organic loading rate of 62.1 kg BOD_5/day.

2.5.7.2 Storage Cell

Provincial guidelines stipulate that the hydraulic storage capacity of a lagoon is determined from the volume of the top half of the primary cell and the secondary (storage) cell volume, between the discharge pipe invert and the maximum liquid level (1.5 m depth).

Based on the estimated year 20 hydraulic loading rate discussed above, the lagoon requires a total storage volume of 26,380 m^3 over the 230 day winter storage period, for a total daily hydraulic load of 115 m^3/day.

2.5.8 Topography and Geotechnical Review

An onsite geotechnical and topographical investigation was completed on November 13 and 15, 2013 to determine the suitability of the potential lagoon site for the proposed lagoon siting and construction.

2.5.8.1 Past Geotechnical Investigations

Groundwater Driller Well Logs

The nearest driller well log reports available from the Manitoba Water Stewardship database, were from the adjacent quarter section at SW 14-10-29 WPM were reviewed. Soils in that quarter section consisted of surficial clay down to approximately 18 m, followed by stones and boulders, hardpan and shale was recorded at 45 m - 48 m below the surface. Static water level was recorded at 24 m below the surface.

Canada-Manitoba Soil Survey

Reconnaissance Soils Survey data of the region indicate the soils in the potential lagoon areas are all classified in the Oxbow Association and described as Oxbow Loam to Clay Loam. These soils are clay loams from lacustrine deposits (deposits of glacial Lake Souris) developed on moderately calcareous boulder till, with shale parent material. Topography consists of low knolls and ridges separated by shallow depressions that are interspersed in an irregular pattern characteristic of ground moraine. The short slopes generally range from 2% to 5% and surface runoff is excessive on the knolls and poor in the depressions, so soil drainage can vary considerably. Detailed soil survey information was not available for the proposed lagoon site.

2.5.8.2 Onsite Geotechnical Investigation

The onsite geotechnical investigation for the proposed lagoon development site was conducted on November 15, 2013 by JRCC. A tracked drill rig was employed to conduct the test hole drilling under direct supervision by JRCC personnel. The proposed site was tested to determine whether the soils were suitable for use as a clay lagoon liner in an undisturbed state (in-situ) or after reworking, and whether soils could be used for potential borrow material. Test hole locations are shown on Plan L1, attached in Appendix D.

The subsurface soil profile within each test hole was logged, water conditions were noted and representative soil samples were collected as the soils varied along the profile. The samples were visually field-classified and confirmed through laboratory analysis. Shelby tubes of undisturbed in-situ soil were collected in various test holes and at depths appropriate for a lagoon liner. Bulk samples were also collected for utilization if testing of a reworked soil sample was deemed necessary. Following completion of drilling, an assessment of the short term groundwater conditions was

completed by measuring the level of static water in the test holes. All test holes were then backfilled with bentonite mixed with excavated material.

Soil Profile

There were four test holes (TH4 to TH7) drilled in the quarter section of the proposed development to determine the most ideal location for the proposed lagoon site. During the field assessment of the soils, it was determined that TH5, TH6 and TH7 (in northwest corner) would be located in the footprint of the potential lagoon location. All test holes were drilled to a maximum depth of 6.0 m. The subsurface soil profile consisted of surficial topsoil (0.2 m - 0.3 m thick, with the top 0.075 m containing organic soil with roots and the remaining topsoil consisting of clayey organic soil). In TH4 and TH5, the topsoil layer was followed by a layer of medium plastic silty clay, with lenses of wet silt and sand to the bottom of the test holes. In TH6 and TH7, the topsoil layer was followed by a layer of medium plastic silty clay down to the bottom of the test holes. Bedrock was not encountered. The static water level was recorded in TH4 and TH5 at depths 2.1 m and 2.4 m below the surface.

Details of the soil profile in each test hole can be found in the test hole logs, attached in Appendix C.

Laboratory Analysis

Representative bagged soil samples from the proposed lagoon site were submitted to Stantec Consulting Ltd. for testing and analysis. The following is a summary of the testing results, while details of soil analysis and testing results are attached in Appendix C.

One representative bagged sample was analyzed for the following:

- Atterberg Limits (plastic limit, liquid limit, and plasticity index, ASTM D4318)
- Soil Classification (ASTM D2487)
- Moisture Content (ASTM D2216)
- Particle Size Analysis (Hydrometer test, ASTM D422)
- Visual Classification.

In addition, one in-situ Shelby tube sample was tested for:

- Hydraulic Conductivity (ASTM D5084).

JRCC requested that the laboratory also provide a professional assessment, based on the analysis and the testing, as to whether the soil samples could achieve a permeability of 1×10^{-7} cm/sec or less in their in-situ and reworked states. A summary of the laboratory results are as follows:

The laboratory analysis of the bagged sample indicated that the soils considered in cell construction (depth of approximately 0.2 m to 3.0 m) consisted of CL – medium plastic silty, sandy clay. The Plasticity Index in the bagged samples ranged from 16 to 17, and the percentage of clay ranged from 23% to 27%.

An in-situ Shelby tube sample from this same soil layer (TH6 1.5 m – 2.1 m) was analyzed for permeability and had a hydraulic conductivity value of 2.5×10^{-8} cm/sec, which is within the Manitoba Conservation requirements for a clay liner. The sand layer in TH5 is likely not suitable for use as a clay liner either in-situ or reworked and re-compacted. If that layer is encountered in the perimeter dike area, a clay lined key trench will have to be constructed to tie into the lower clay layer. A permeability test of in-situ soils in the laboratory is expected to be an accurate representation of in-situ soils encountered during construction and is therefore used to estimate the hydraulic conductivity in a liner of in-situ soil material.

Discussion

Manitoba Conservation guidelines require a standard wastewater lagoon clay liner to be a minimum of 1.0 m in thickness and have a maximum hydraulic conductivity (i.e. the potential rate of fluid movement through the soil) of 1×10^{-7} cm/sec or less. This low rate is to protect the underlying groundwater from lagoon seepage.

Based on the results of the onsite investigation and laboratory analysis, the medium plastic clay soils observed at the site are likely to consistently achieve hydraulic conductivities of less than 1×10^{-7} cm/sec in an in-situ state. As indicated above, the suitable soil layer for construction of the horizontal and vertical lagoon cell liner was estimated from 0.2 m - 0.3 m (top of layer), to 6.0 m (bottom of layer) below the surface. As a layer of unsuitable soil (sand) was encountered at the proposed site in one of the test holes, it is possible that unsuitable soil material will be encountered during the lagoon construction works and if this occurs that unsuitable soil material will require removal and replacement with suitable compacted material. The in-situ soils forming the horizontal liner (lagoon floor) is to be constructed to a minimum thickness of 1.0 m. The reworked soils forming the vertical lagoon liner (cut-off wall) is recommended to have a minimum width of 2.0 m, with 1H:1V slopes from 1.0 m above the bottom of the liner to existing ground (see Plan L4 in Appendix D).

2.5.8.3 Topography

The proposed development site was observed to be undulating agricultural land used for grain production with scattered mounds and low lying areas. A maximum elevation difference of approximately 1.7 m was recorded at the site. The land generally slopes towards the north and east. From a survey of the existing provincial road drainage ditch to the north of the proposed site, the drainage flows consistently from the west to the east at a slope of approximately 0.6%. Based on these measurements and a review of topographical mapping for the area, it appears that the existing surface

drainage route from the potential lagoon site is towards the east along PR 257 towards a first order provincial drain that flows southeast and eventually turns into a third order provincial drain that flows into Oak Lake, approximately 43 km away.

2.5.9 Lagoon Regulatory Requirements

2.5.9.1 Province of Manitoba Design Objectives

The Province of Manitoba *Design Objectives for Standard Sewage Lagoons (1985)* were used as a guideline in the layout and design of the lagoon expansion.

Organic Loading

Although a facultative lagoon operates at various organic efficiencies throughout the year, an average organic treatment capacity of 56 kg BOD_5/ha/day at a depth of 0.75 m in the primary cell has been established by Manitoba Conservation for facultative lagoon design purposes.

Hydraulic Loading

According to current guidelines a facultative lagoon cannot be discharged between November 1 and June 15 (230 day winter storage period). Therefore, the lagoon must have the storage capacity for this time period based upon half the volume of the primary cell and the storage cell(s) volume from the invert of the discharge pipe to the maximum liquid level.

Lagoon Liner

Sewage lagoons are to be designed and constructed such that the interior surface of the proposed lagoon is underlain by soil with a thickness of at least 1.0 m and having a hydraulic conductivity of 1×10^{-7} cm/sec or less.

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 Wallace wastewater treatment lagoon, at a minimum, would be:

- 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 15°C
- a demonstrated nutrient reduction strategy.

2.5.9.2 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 regulations 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.

A 1.0 mg/L phosphorus limit applies for effluent upon discharge, with the exception being small wastewater treatment facilities that serve less than 2,000 equivalent people, which have the option of implementing a nutrient reduction strategy instead of the 1.0 mg/L phosphorus limit. Nitrogen reduction to 15 mg/L is required on a site-specific basis depending on the receiving environment for new and expanding wastewater treatment facilities serving more than 10,000 equivalent people. The RM of Wallace lagoon would not be required to adhere to a nitrogen limit of 15 mg/L, based on the service population. A limit of 1.25 mg/L of un-ionized ammonia applies to all lagoons, however the un-ionized portion of ammonia is pH and temperature dependent, and will increase with higher temperatures and pH. Typically this ammonia limit can be met by regular lagoon operations such as discharging effluent in the spring and fall and not during the warmest period of the summer. Algae blooms in a lagoon can trigger an increase in pH and un-ionized ammonia, however these algae blooms also typically occur during the warmest period of the summer, and so the most simple solution would be to wait until the water temperatures drop in the fall before discharging.

Nutrient reduction strategies include, but are not limited to, effluent irrigation, trickle discharge or constructed wetlands. The guidelines also set the discharge requirements for fecal coliform at 200 organisms/100 ml sample, Total Suspended Solids at 25 mg/L and the Biochemical Oxygen Demand at 25 mg/L (facilities with ammonia or total nitrogen limits have a Carbonaceous Biochemical Oxygen Demand limit of 25 mg/L).

The following options were considered to address nutrient management, with particular emphasis on phosphorus reduction for the RM of Wallace lagoon operation.

Phosphorus Reduction by Filtration

Sewage treatment plant technology, such as chemical addition and filtration systems could be utilized to reduce the phosphorus concentration in the lagoon. The effluent could be pumped through a filtration system prior to discharge. A chemical flocculent such as alum would have to be added to the wastewater prior to filtration. Backwash containing the phosphorus would be sent back to the primary cell where it

would settle out into the sludge blanket at the bottom. The sludge will accumulate in the lagoon for approximately 20 - 25 years before requiring removal.

This level of treatment is costly as equipment and housing is required as well as annual operating costs and chemical costs. An electrical power source is also required, such as a hydro line to the lagoon. It was therefore not considered a feasible option for the RM of Wallace lagoon due to the higher capital cost and associated operating and maintenance costs.

Phosphorus Reduction by Surface Chemical Treatment

This option involves application of chemicals such as alum to wastewater in the storage cell to reduce the level of phosphorus in the treated effluent. The alum is broadcast onto the surface of the storage cell utilizing a gas driven pump and spray system from the top of the dike, or from a boat on the surface of the cell. The alum produces a chemical reaction with the phosphorus causing a pin floc. The pin floc of phosphorus and the turbidity settle to the bottom. The effluent can then be discharged from the storage cells with a reduced level of phosphorus. This option requires higher operation and maintenance costs and tends to be complicated for the lagoon operator to conduct successfully, therefore it was not considered a feasible option for the RM of Wallace lagoon.

Constructed or Natural Wetlands

Constructed wetlands or natural wetlands can be used to polish treated effluent from a lagoon, and have the potential to provide biological and nutrient reduction. However, constructing engineered wetlands can require large land areas and add significant construction costs to a project, making the option unfeasible. However, if natural wetlands exist in the vicinity of the lagoon discharge, they can potentially be utilized for enhanced biological and nutrient reduction in the discharge route. As a natural wetland area is not present near the lagoon discharge route, a constructed/engineered wetland would be required for this option. Due to the increased project cost, the use of constructed/engineered wetlands for the RM of Wallace lagoon was not considered feasible.

Trickle Discharge

A slower discharge of effluent is expected to increase opportunity for nutrients to be taken up by growing plants along the discharge route, which is a means of reducing phosphorus concentration in the treated effluent. The proposed drainage route is from the perimeter ditch to the PR 257 ditch, to a first order drain that eventually flows to Oak Lake. The total length of the discharge route is approximately 43 km (400 m in the PR ditch and the remainder in the provincial drain).

The maximum discharge volume from the lagoon would be approximately 17,668 m^3 (the total available volume in the storage cell). Typically the hydraulic storage

volume of the primary cell is not included in the discharge volume, as the intercell valve between the primary and storage cell is closed during lagoon discharge, to prevent untreated effluent in the primary cell from being discharged. If the entire volume of the storage cell was discharged over a 4 week period, the average discharge rate would be approximately 7.3 L/sec.

Based on the trickle discharge rate from the lagoon and the length of the proposed drainage route, it is expected that natural uptake of nutrients by the plants and soils will occur prior to the effluent reaching Oak Lake.

Public Awareness

In conjunction with the nutrient reduction methods described above, preventative measures can also be taken to reduce nutrients in the wastewater influent. As the majority of the influent to the RM of Wallace lagoon would be residential in nature, the RM is encouraged to inform residents and school personnel in the community of nutrient reducing strategies, such as using non-phosphate based soap and cleaning products for domestic use. This would reduce the amount of phosphorus being released into the lagoon and reduce the level of treatment required.

Proposed Option

As the population being serviced by the Wallace lagoon is less than 2,000 people, a nutrient reduction strategy is proposed, as opposed to a strict phosphorus limit of 1.0 mg/L prior to discharge. The proposed option to meet the nutrient reduction requirements in the Environment Act Licence would be to utilize a trickle discharge from the storage cells (as described above). In addition, the RM will be encouraged to notify and educate residents about the importance of nutrient source reduction in their homes and school.

2.5.10 Conceptual Lagoon Design and Construction Details

2.5.10.1 Conceptual Liner Design and Construction Details

The proposed lagoon would consist of a primary cell to the west and a storage cell to the east. The proposed lagoon layout is shown on Plan L3 in Appendix D. Conceptual design plans and details for the lagoon construction are provided in Appendix D (Plans L1 to L6).

The primary cell and storage cell liner would be constructed by extending the vertical cut-off wall surrounding the cells to 1.0 m below the top of the in-situ horizontal liner. Based on field observations, the primary cell floor will be constructed of in-situ horizontal liner, and as a safety precaution the soils below the inner slopes of the primary cell will be reworked to a depth of 1.0 m. In this way, if unsuitable soils are encountered during construction and excavation and the floor of the primary cell needed to be reworked, then the inner slopes would not have to be excavated after construction.

Based on information obtained during the site investigation, the elevations of the medium plastic silty clay soils being utilized for the in-situ horizontal liner will need to be field identified during construction, as the elevations may vary across the site. For portions of the east, north, and south dikes around the secondary cell, sand seams are potentially present, and therefore the vertical cut-off wall will extend to the lower clay layer (approximately 1.5 m below the cell floor elevation). Any unsuitable soil material (silt or sand) excavated will be stockpiled and not utilized in the construction of the lagoon liner.

The primary cell would have a flat bottom area of approximately 9,875 m^2 and the storage cell would have a flat bottom area of approximately 13,000 m^2. The lagoon cells would be constructed with a total height of 2.5 m from the cell floor to the top of dike. The two cells would share an intercell dike, which would have an intercell pipe extending through the dike, with a valve box at the top of dike to allow equalization of liquid in the cells. A discharge pipe would be installed through the north perimeter dike of the storage cell to allow for lagoon effluent discharge. A valve box would be located on the top of the dike to open and close the discharge pipe, when required. A section of forcemain will be extended into the primary cell and capped outside of the perimeter dike, allowing for a future forcemain or pressure sewer connection.

A 1.5 m high barbed wire fence would be constructed around the perimeter of the lagoon and a lockable gate would be installed at the entrance to the lagoon site to limit access. A concrete spillway with bollards would be installed along the interior slope of the primary cell to allow for truck hauled septage dumping into the lagoon. A compacted granular access road would be constructed from PR 257 to the lagoon truck turnaround. The truck turnaround area would also be a compacted granular material and would allow for septic hauling trucks to dump effluent into the primary cell. A perimeter ditch will be constructed along the outside toe of the lagoon dikes to direct surface water flow around the lagoon cells to the discharge route. Rip rap stone would be placed around the pipe ends to prevent erosion.

2.5.10.2 Construction Techniques

All topsoil would be removed to a minimum depth of 0.3 m from the lagoon cell construction area including the lagoon cell floor area. The vertical cell liner (cut-off wall) will be constructed of reworked and compacted clay soils from the site excavation to a width of 2.0 m. The liner is to be compacted to a minimum Standard Proctor Density of 98% in lifts of 150 mm. The dike and liner material should be compacted with a minimum of eight passes of a sheepsfoot roller on each 150 mm compacted lift. The cell bottom will be graded to a tolerance of ± 50 mm. The inner and outer dikes would be constructed with a mixture of excavated soil material (clay, silt, topsoil) at slopes of 4H:1V.

The lagoon construction specifications should indicate that the sheepsfoot roller shall have a minimum foot pressure of no less than 1,700 kPa (250 psi). The drum diameter of the sheepsfoot roller should not be less than 1,200 mm. Each roller should be equipped with cleaning fingers designed to prevent the accumulation of material between the tamping feet. The foot pressure would be calculated by taking the total mass of the roller and dividing it by the greater of: the area of the maximum number of tamping feet in one row parallel to the axis of the roller, or by 5 percent of the total foot area. The roller feet should be at least 200 mm long and should have a minimum area of at least 4,500 mm^2.

A limited range of moisture content should be permitted in the liner soils. The material shall not be so wet nor so dry that compaction equipment cannot compact the fill into a homogeneous mass. Material too wet shall be dried or wasted as directed by the engineer and material too dry shall be wetted as directed by the engineer. All constructed earthen lagoon components shall be graded to a tolerance of ± 50 mm.

The granular access road and truck turnaround material would consist of 150 mm C base and 150 mm A base, with a geotextile material over the compacted subgrade. The spillway located on the inner slope of the primary cell will be constructed of concrete.

2.5.11 Summarized Selected Design Criteria

The following selected criteria would be used for design purposes:

- A 20 year design period
- A total design population of 217 people being serviced from the future piped collection system in the community of Kola
- A total design population of 208 people on holding tanks from the rural population and construction camps
- A total design population of 1,435 people on septic tanks from the rural population and 40 additional septic tanks from Virden and Elkhorn
- A winter storage period of 230 days
- A total projected daily organic loading rate of 62.1 kg BOD_5/day, which includes six septic tank pump outs of septage
- A total projected hydraulic load of 26,380 m^3 during the 230 day storage period
- The primary cell to have a surface area of 11,135 m^2 at a height of 0.75 m from the cell floor
- The secondary cell to have a flat bottom area of 13,000 m^2
- A total usable hydraulic storage capacity of 26,519 m^3
- A height of 2.5 m from the cell floor to the top of dike in the primary and storage cells

- A maximum operating depth of 1.5 m in the primary and storage cells
- A discharge pipe invert of 0.3 m above the cell floor elevation in the storage cell
- A discharge pipe installed through the north perimeter dike of the storage cell
- A 2.0 m wide vertical cut-off wall of reworked medium plastic silty clay that ties into the horizontal liner
- A horizontal liner of in-situ medium plastic silty clay at the cell floor elevation of the primary cell
- A horizontal liner of reworked medium plastic silty clay under the inner slopes of the primary cell
- A horizontal liner of in-situ medium plastic silty clay at approximately 1.5 m below the cell floor elevation in the secondary cell
- A 4H:1V slope will be used for the inner and outer dike slopes
- A compacted granular access road and truck turnaround
- A concrete spillway installed in the primary cell
- An intercell pipe with valve box installed in the intercell dike
- A forcemain installed into the primary cell and capped outside of the perimeter dike
- A 1.5 m high barbed wire fence installed around the perimeter of the lagoon cells
- A lockable gate installed at the entrance to the site on the access road
- Rip rap stone installed around the end of the pipes to control erosion
- A perimeter ditch constructed around the toe of the lagoon cells and to the PR 257 ditch
- Discharge from the lagoon to follow existing drainage route along PR 257 drainage ditch and provincial drain towards Oak Lake
- Warning signs will be placed on each side of the lagoon fencing
- A Lagoon entrace sign and valve markers will be installed.

2.5.12 Decommissioning

The proposed lagoon cells will have a design life of 20 years, after which time a lagoon assessment should be conducted to determine the state of the lagoon and whether expansion or decommissioning are required.

Decommissioning would typically require a decommissioning plan submitted to Manitoba Conservation, discussing the removal of liquid and sludge, backfilling of lagoon cells (possible), site grading and seeding, and discussion on future use of the lands.

2.5.13 Lagoon Maintenance and Operation

The lagoon site will have a designated and trained operator from the RM of Wallace public works department.

Maintenance of the lagoon will include:

- Maintaining the fencing, gate and lock
- Ensuring the gate is locked at all times and only the local septic haulers and community public works department have access to the site
- Restricting truck hauling to the lagoon primary cell to 2 truck loads per day, as specified in Section 2.5.6.1 above
- Monitoring liquid level of lagoon
- Closing the intercell valve prior to sampling effluent in storage cell
- Sampling lagoon effluent prior to and during discharge period, in accordance with the lagoon effluent monitoring plan
- Opening and closing the intercell and discharge piping valves
- Maintaining records of discharge events and water quality testing
- Maintaining the intercell and discharge piping and valves in working condition
- Maintaining rip rap stone at location of lagoon discharge to prevent erosion of soils
- Maintaining grass cover on dikes to a height of no more than 0.3 m
- Maintaining a program to prevent and remove burrowing animals
- Maintaining surface of access road and truck turnaround area
- Clearing of snow from the lagoon access and truck turnaround.

Typical operation of the storage cell in a facultative lagoon will allow for two discharges per year at the peak design loading. During operation, the intercell valve would be opened after the fall discharge of the lagoon and allowed to fill up from winter and spring loadings. Prior to June 15, the intercell valve would be closed and the storage cell effluent would be tested for the discharge criteria. If the test results are acceptable, the storage cell volume from the discharge pipe invert elevation to the maximum operating level would be discharged starting on June 15. Once the storage cell is fully discharged, the discharge valve would be closed and the intercell valve would be opened to allow the lagoon cells to equalize. The intercell valve would remain open and all of the lagoon cells would be allowed to fill up from the summer hydraulic loadings. The intercell valve would again be closed and the storage cell effluent would be tested for the discharge criteria. If test results are acceptable, the storage cell could be discharged while the primary cell would accept hydraulic loadings to the lagoon during the discharge period. This final discharge would need to be completed prior to the end of the discharge period (before October 31). This discharge procedure would be repeated each year.

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. During the summer, the lagoon would be aerobic near the surface, facultative at the centre and anaerobic near the bottom. Minimal to no treatment would occur in the winter due to the ice cover on the surface and water temperatures near 0°C. The treatment process would predominantly be anaerobic during winter and would also include solids settling. Therefore, the lagoon may generate some odours for a short time each spring during the thawing or turn-over period when water temperature inversion causes turbulence in the lagoon cells and gases produced from the anaerobic treatment process are brought to the surface. Prevailing winds in the area can carry odours if the area is exposed and wind breaks are not utilized around the lagoon cells. These odours have the potential to be a nuisance to nearby residents.

There is also a potential for greenhouse gas emissions during construction works from heavy equipment and transport vehicles. Impacts from dust generation are not expected to be significant as the construction area will meet the minimal setback distances from residences, and a treed windbreak exists on the north and west sides of the site.

3.1.2 Water

Pollutants that may be released into surface water and groundwater during the operation of the lagoon would include coliforms, organic wastes, suspended solids, and other materials that are typically disposed of into the sewer 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 water or groundwater during the lagoon construction activities, include petroleum hydrocarbons (PHCs) from heavy equipment and sediments from soil erosion.

Surface Water

Surface water may be impacted if the wastewater is not sufficiently treated and subsequently discharged from the lagoon. Effluent discharged from the lagoon would eventually reach Oak Lake, however the discharge route is 43 km, therefore impacts to the lake would likely be insignificant. There is also potential to impact surface water via sedimentation from soil erosion in the discharge route during construction.

The discharge from the lagoon should not cause or contribute to flooding in or along the drainage route, therefore the lagoon would not be discharged during flooding conditions. There is no potential to impact the navigation of surface waters as a result of the lagoon construction, as the existing drainage route is not in the immediate vicinity of a navigable body of water.

Groundwater

There is a potential for groundwater to be impacted if wastewater leaks/seeps through the lagoon liner or forcemain pipe and into the groundwater below. There is also a potential for groundwater impacts from equipment leaks and/or fuel spills during construction.

3.1.3 Land

The landscape would be altered by construction of the lagoon dikes and perimeter ditching. Fencing would also be installed around the perimeter of the lagoon. Disturbed areas can be impacted through soil erosion if not covered or re-vegetated.

Pollutants that may be released to the land are predominantly petroleum hydrocarbons (PHCs), which could be released during construction activities. Equipment leaks, and/or re-fuelling incidences could result in impacts to the soils/land as a result of construction activities.

3.2 Wildlife

The proposed lagoon site is located in the "Aspen Parkland" Ecoregion of Canada. Characteristic wildlife includes white-tailed deer, coyote, snowshoe hare, cottontail, red fox, northern pocket gopher, and ground squirrel. Bird species include waterfowl, sharp-tailed grouse and black-billed magpie.

The typical concern on any construction project is that wildlife species would be displaced through the construction works. However from observations made during the site investigation it is unlikely that the construction works will have any significant impact on wildlife or wildlife habitat in the area, as the development site is an actively farmed and cleared section of land. The land is also bordered to the north by PR 257, which has a significant and regular volume of traffic, therefore human activity in the area is evident.

In addition, the Manitoba Conservation Data Centre and Wildlife and Ecosystem Protection Branch were contacted regarding occurrences of rare or endangered wildlife and bird species in their database at the proposed lagoon site. The response indicated there were no occurrences of rare species identified in the area of the proposed development, based on information in the provincial database (see Email correspondence attached in Appendix B).

3.3 Fisheries

Fish species identified in Oak Lake according to correspondence with Manitoba Conservation and Water Stewardship Fisheries Branch were described in Section 2.5.3.1.

The typical concerns with impacts to fish and fish habitat are from sediments released during construction and the lagoon effluent discharges 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 unfavorable environment for fish or fish eggs. However, impacts to fish along the discharge route are unlikely as the lagoon effluent would not be discharged directly into a body of surface water with known fish species. In addition, lagoon discharge would only occur after the spring fish spawning period has occurred and only when the treated effluent meets the water quality requirements of the Environment Act Licence for lagoon discharges.

3.4 Forestry

The area of the lagoon expansion is a cleared parcel of land, therefore there are no potential impacts to forestry in the area, as tree removal will be minimal and the area is not commercially forested.

3.5 Vegetation

Characteristic vegetation in the "Aspen Parkland" Ecoregion is classified as being a transitional grassland ecoclimate, with a significant degree of farmland. The native landscape is characterized by trembling aspen, oak groves and mixed tall shrubs and intermittent fescue grasslands.

The typical concern on any construction project is the removal of vegetative species through the construction works, however as the area is actively farmed there will be a minimal loss of native vegetation. Manitoba Conservation Wildlife and Ecosystem Protection Branch was contacted regarding occurrences of rare or endangered vegetative species in their database at the proposed lagoon site. The response indicated that there were no occurrences of rare species identified at the proposed development site (see Email correspondence attached in Appendix B).

3.6 Noise Impacts

There is a potential for noise impacts in the immediate area of lagoon construction due to the heavy equipment utilized during construction. Other than maintenance vehicles (for lagoon maintenance or mowing grass) or wastewater hauling trucks, the operation of the lagoon itself, will not have a potential for noise impacts.

3.7 Health and Safety

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. The potential for public trespassing during lagoon operation will be minimal.

3.8 Heritage Resources

The RM of Wallace was not aware of any historic, traditional or heritage resources located at the proposed lagoon development site. The Manitoba Historic Resources Branch was contacted regarding the proposed site. The Historic Resources Branch indicated that the potential to impact significant heritage resources

is low and that they have no concerns with the project (see correspondence with Manitoba Historic Resources Branch, June 3, 2014 in Appendix B).

While impacts to historic or heritage resources are not expected at the site, there is always potential for an unexpected discovery when excavating an area that has not recently been excavated.

3.9 Socio-Economic Implications

The lagoon expansion is not expected to have adverse socio-economic impacts. In fact, construction related economic activity is likely to have a positive economic impact on the community of Kola, due to the relative distance from the development site. In addition, the community would have increased wastewater capacity upon completion of the project, which will encourage continued growth in the community.

Traffic along PR 257 will increase from heavy construction equipment and transportation vehicles traveling to the construction site, and there is potential for delays.

3.10 Aesthetics

The lagoon construction is will have an impact on the general aesthetics of the area, as the lagoon construction would include construction of dikes above grade. The works would occur adjacent to PR 257, however a tree line would be maintained between PR 257 and the proposed lagoon site that would limit the impacts to aesthetics.

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 in the community of Kola, the primary cell has been sized for the projected year 20 organic loadings, from the service population. This takes into consideration the maximum allowable organic loading rate of 56 kg BOD_5/ha/day into the lagoon primary cell, which is the design value indicated by Manitoba Conservation to reduce impacts from odours generated during peak organic loading to the lagoon. The RM of Wallace will be required to limit the amount of truck hauled dumping to two truckloads per day from the RM, as discussed in Section 2.5.6.1 above. Therefore, nuisance odours as a result of organic over-loading are not expected.

Although the lagoon would likely generate some odours for a short time each spring, during the thawing or turn-over period, prevailing (i.e. northwesterly) winds should not cause significant impacts to the community of Kola from drifting odours, as the community is located northwest of the proposed lagoon site. Furthermore, the proposed lagoon would be located beyond the minimum setback requirements of 300 metres from the nearest resident and 460 metres from the nearest centre of a community, as required by Manitoba Conservation.

Emissions from construction equipment and transport vehicles will be controlled through regular maintenance by the 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, and becomes a nuisance to nearby residents. Due to the setback distance from residences and the surrounding treed windbreak, it is unlikely that dust will have any impact on the community or nearby residents.

4.2 Mitigation of Impacts to Water

4.2.1 Surface Water

Impacts to surface waters from the discharge of lagoon effluent are not expected, as the lagoon effluent would not be discharged until the requirements of Tier I *Manitoba Water Quality Standards, Objectives and Guidelines*, and the Federal Wastewater Systems Regulations are met, as described in Section 2.5.9.1 above.

Impacts to nearby surface waters due to discharge of the lagoon are not expected, as treatment will occur in the lagoon cells and measures such as a trickle discharge would be utilized to further reduce nutrient loading to downstream surface waters.

Erosion from any excess material stockpiles would be prevented by the use of silt fencing at drainage locations and by either covering any bare soil stockpiles temporarily or seeding with grass if stockpile is to remain after construction is complete. Clean rock material from an appropriate land-based source would be utilized as rip rap to reduce occurrence of erosion at the

lagoon discharge outlet. Silt fencing would be installed in the perimeter ditching and in the PR 257 drainage ditch during construction, and should remain in place until grass growth is established in disturbed areas. Perimeter ditch slopes would be seeded with grass to control erosion and sediment entry into the discharge route. Disturbance of the soils adjacent to the perimeter ditches 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 construction specifications 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 waterbody or drainage route
- Waste hazardous materials from construction activities and equipment must be properly collected and disposed of in compliance with provincial regulations
- In the event of spills or leaks of fuels and hazardous materials, the contractor or operator should notify the project engineer and provincial authorities (Manitoba Conservation at (204) 944-4888).

Hazardous material handling and storage are to follow all provincial and federal regulations including WHMIS and spill containment requirements.

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 or drainage route.

If flooding occurs along the drainage route, the community must not discharge the lagoon. The discharge should not cause or contribute to flooding in or along the drainage route. Overland flooding around the lagoon would be unlikely as there are no significant bodies of water in the direct vicinity of the lagoon.

4.2.2 Groundwater

Seepage of effluent from the lagoon is unlikely to affect groundwater as the lagoon cell construction would utilize an in-situ and reworked clay liner, having a minimum thickness of

1.0 m and a hydraulic conductivity of 1 x 10^{-7} cm/sec or less, as required by Manitoba Conservation.

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.

4.3 Mitigation of Impacts to Land

As the lagoon would utilize a clay liner, seepage to the surrounding land is expected to be negligible. To minimize the potential for the release of Petroleum Hydrocarbon (PHC) pollutants into the soil, the mitigation measures described in Section 4.2.1 above, outlining fuel-handling procedures, should be followed.

To minimize the potential for slope erosion, the outside slopes of the newly constructed dikes would be constructed at 4H:1V. In addition, the dike tops, outside slopes and permanent soil stockpiles would be seeded with grass. The location of the discharge pipe outlet would be covered with rip rap stone to minimize potential soil erosion into the ditch during discharge events.

4.4 Mitigation of Impacts to Vegetation

The removal of vegetation will be limited to the construction area by clearly marking the site boundaries prior to construction. Vegetation outside of this construction area will not be damaged and the treed windbreak to the north and west will remain intact.

4.5 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.

4.6 Mitigation of Impacts to Health and Safety

To minimize impacts to health and safety of workers and the public, the construction specifications should state that the contractor 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. Personal protective equipment will be worn in accordance with the contractor's safety program. The lagoon will be surrounded with a barbed wire fence and a lockable gate to prevent public access during lagoon operation, and warning signs will be placed around the perimeter of the lagoon fencing.

4.7 Mitigation of Impacts to Heritage Resources

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

4.8 Socio-Economic Implications

If traffic from the construction activities limits access to PR 257, the contractor will place warning signs on the road and provide flagmen to direct traffic around the areas of construction or delay. Any impacts to traffic or access will only be temporary and will only take place during daylight hours, during the construction schedule. There is an existing access road onto PR 257 that can be used for parking heavy equipment, which would reduce impacts to traffic on PR 257 from parked equipment along the road.

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 proposed wastewater treatment lagoon, due to the mitigation measures described above. Positive residual effects to the RM of Wallace are expected from the wastewater treatment lagoon, which will allow for expansion of the service area in the future. No other construction projects in the area are expected to create cumulative effects on the service area.

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.)

The lagoon clay liner will be inspected and tested in the presence of Manitoba Conservation upon completion of cell construction. The liner will be tested for hydraulic conductivity to ensure that the Environment Act Licence requirements are met. 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 environmental licence. The operator is to ensure liquid levels in the lagoon cells are maintained within the required limits; conduct sampling of lagoon effluent prior to and during discharge; and is to ensure water quality guidelines as described in the Environment Act Licence are met. The operator is also to maintain records of discharge events and water quality monitoring. If there are any concerns with the operation of the lagoon, the owner is to contact the local environment officer to discuss options. The construction contractor is to ensure that grass growth occurs on slopes and disturbed areas, 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.

Partial funding for this project is being sought through the Manitoba Water Services Board. The lagoon construction project will require licensing under the *Water Rights Act* for the installation of a new effluent discharge outlet. Approval will also be required from Manitoba Infrastructure and Transportation for the lagoon access road approach from PR 257. During the construction works, Manitoba Hydro and MTS will need to be contacted to notify of the proposed works and to locate any buried utility lines. No additional approvals, licences or permits are required for the lagoon construction and operation. The RM of Wallace will also be responsible for registering the lagoon 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 RM of Wallace through a designated public forum, has not been conducted to date for the residents in the RM and would likely occur during future phases of the project, once funding has been established. Public comments received by Manitoba Conservation through the public registry during the Environmental Act Proposal review period will be addressed prior to lagoon construction.

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 design and construction can begin in a timely manner.

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.

APPENDICES

Appendix A

Certificate of Title

Crown Lands & Property Agency - Lands Branch, May 22, 2014 Email Correspondence

Appendix B

Table 1: RM of Wallace – Piped Collection and Truck Haul Lagoon - Population, Hydraulic, and Organic Loading Projections to Design Year 20

Manitoba Conservation and Water Stewardship - Fisheries Branch, May 28, 2014 Email Correspondence

Manitoba Conservation and Water Stewardship - Wildlife and Ecosystem Protection Branch, May 6, 2014 Email Correspondence

Manitoba Tourism, Heritage, Sport and Consumer Protection - Historic Resources Branch, June 3, 2014 Email Correspondence

Appendix C

Test Hole Logs

Stantec Consulting Ltd. Soils Analysis Report, December 12, 2013

Stantec Consulting Ltd. Soils Analysis Report, January 24, 2014

Driller's Well Logs

Appendix D

Title Page

Plan L1: Proposed Lagoon with Test Hole Location and Setback Plan

Plan L2: Proposed Lagoon Drainage Route

Plan L3: Proposed Lagoon Layout Plan

Plan L4: Dike Details

Plan L5: Truck Turnaround, Access Road, Fence, Gate, Lock and Sign Details

Plan L6: Silt Fence, Valve, Valve Marker, Rip Rap and Ditch Details

Appendix A

Certificate of Title

Crown Lands & Property Agency - Lands Branch, May 22, 2014 Email Correspondence

Certificate of Title

DATE: 2014/05/12
TIME: 15:52

MANITOBA

STATUS OF TITLE

TITLE NO: 1431846/2

PAGE: 1

STATUS OF TITLE..... ACCEPTED
ORIGINATING OFFICE... BRANDON
REGISTERING OFFICE... BRANDON
REGISTRATION DATE.... 1996/03/04
COMPLETION DATE..... 1996/03/08

PRODUCED FOR.. X
ADDRESS.....

CLIENT FILE... NA
PRODUCED BY... B.BOUX

LEGAL DESCRIPTION:

LESLIE PENNER
OF KOLA IN MANITOBA

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

NW 1/4 14-10-29 WPM
EXC FIRSTLY: ROAD PLAN 1253 BLTO
SECONDLY: ALL MINES AND MINERALS AS RESERVED IN THE GRANT FROM
THE CROWN

ACTIVE TITLE CHARGE(S):

142066/2 ACCEPTED MISCELLANEOUS REG'D: 1970/11/24
FROM/BY: MANITOBA TELEPHONE SYSTEM
TO:
CONSIDERATION: NOTES: EASEMENT AGRT PART

R131966/2 ACCEPTED CAVEAT REG'D: 1978/10/11
FROM/BY: MANITOBA TELEPHONE SYSTEM
TO:
CONSIDERATION: NOTES: PT SOUTH OF PL 1253

ADDRESS(ES) FOR SERVICE:

EFFECT	NAME AND ADDRESS	POSTAL CODE
ACTIVE	LESLIE PENNER GEN DEL KOLA MB	ROM 1B0

ORIGINATING INSTRUMENT(S):

REGISTRATION NUMBER	TYPE	REG. DATE	CONSIDERATION	SWORN VALUE
1002910/2	EREQC	1996/03/04	$0.00	$0.00

PRESENTED BY: BLTO CONVERSION
FROM: BRANDON LAND TITLES OFFICE CONVERSION
TO:

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA
STORAGE SYSTEM ON 2014/05/12 OF TITLE NUMBER 1431846/2

********** STATUS OF TITLE 1431846/2 CONTINUED ON NEXT PAGE **********

MANITOBA

STATUS OF TITLE

STATUS OF TITLE.....	ACCEPTED	PRODUCED FOR..	X
ORIGINATING OFFICE...	BRANDON	ADDRESS.....	
REGISTERING OFFICE...	BRANDON		
REGISTRATION DATE....	1996/03/04		
COMPLETION DATE.....	1996/03/08		
		CLIENT FILE...	NA
		PRODUCED BY...	B.BOUX

FROM TITLE NUMBER(S):

209603/2 ALL

LAND INDEX:

LOT	QUARTER SECTION	SECTION	TOWNSHIP	RANGE
	NW	14	10	29W

NOTE: EX PL 1253 AND EX M & M

ACCEPTED THIS 4TH DAY OF MARCH, 1996
BY W.KNIGHT FOR THE DISTRICT REGISTRAR OF
THE LAND TITLES DISTRICT OF BRANDON.

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA
STORAGE SYSTEM ON 2014/05/12 OF TITLE NUMBER 1431846/2.

********** END OF STATUS OF TITLE 1431846/2 **********

Crown Lands & Property Agency - Lands Branch, May 22, 2014 Email Correspondence

Oswald Wohlgemut

From: Little, Karen (CLPA) [Karen.Little@gov.mb.ca]
Sent: Thursday, May 22, 2014 11:07 AM
To: 'Oswald Wohlgemut'
Subject: RE: RM of Wallace Lagoon - Mineral Rights

Good morning Oswald, according to our records this date, the mines & minerals and sand & gravel in NW 14-10-29 WPM were originally granted in 1887. The Crown has no interests.

Based on Certificate of Title 1431846/2 – ownership of the mines & minerals and sand & gravel continues to be with this surface title.

Sincerely,
Karen Little
Supervisor of Crown Lands Registry

Crown Lands and Property Agency
308 - 25 Tupper Street North
Portage la Prairie MB R1N 3K1
P 204-239-3805 F 204-239-3560
Toll Free 1-866-210-9589
karen.little@gov.mb.ca

CLPA

An Agency of the Manitoba Government

From: Oswald Wohlgemut [mailto:owohlgemut@jrcc.ca]
Sent: May-20-14 4:16 PM
To: Little, Karen (CLPA)
Subject: RM of Wallace Lagoon - Mineral Rights

Hello Karen,

JR Cousin Consultants Ltd. is submitting an Environmental Act Proposal on behalf of the RM of Wallace, regarding the construction of a new wastewater treatment lagoon near the community of Kola, MB in NW 14-10-29 WPM. We have attached a copy of the certificate of title for the parcel of land proposed in the construction works. Could you confirm the ownership of the mineral rights?

Let me know if you have any questions.

Thank you,

Appendix B

Table 1: RM of Wallace – Piped Collection and Truck Haul Lagoon - Population, Hydraulic, and Organic Loading Projections to Design Year 20

Manitoba Conservation and Water Stewardship - Fisheries Branch, May 28, 2014 Email Correspondence

Manitoba Conservation and Water Stewardship - Wildlife and Ecosystem Protection Branch, May 6, 2014 Email Correspondence

Manitoba Tourism, Heritage, Sport and Consumer Protection - Historic Resources Branch, June 3, 2014 Email Correspondence

Table 1: RM of Wallace – Piped Collection and Truck Haul Lagoon - Population, Hydraulic, and Organic Loading Projections to Design Year 20

TABLE 1

RM OF WALLACE - PIPED COLLECTION AND TRUCK HAUL LAGOON

POPULATION, HYDRAULIC, AND ORGANIC LOADING PROJECTIONS TO DESIGN YEAR 20

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14	Column 15	Column 16	Column 17	Column 18	Column 19	Column 20
TIMELINE		**POPULATION**										**ORGANIC LOADING**				**HYDRAULIC LOADING**			
CALENDAR YEAR	DESIGN YEAR	COMMUNITY OF KOLA POPULATION	KOLA SCHOOL BUSSED IN STUDENTS		TOTAL RURAL POPULATION	RURAL POPULATION ON HOLDING TANKS	CONSTRUCTION CAMP PERSONNEL ON HOLDING TANKS	RURAL POPULATION ON SEPTIC TANKS	RURAL SEPTIC TANK PUMP OUTS PER DAY	ELKHORN AND VIRDEN SEPTIC TANK PUMP OUTS PER DAY	TOTAL SEPTIC TANK PUMP OUTS PER DAY	DAILY PER CAPITA BOD	DAILY SEPTIC TANK PUMP OUT	DAILY BOD PRODUCTION	PRIMARY CELL Area Req'd at 0.75m	WASTEWATER PRODUCTION (COMMUNITY AND SCHOOL)	WASTEWATER PRODUCTION (HOLDING TANK)	TOTAL DAILY WASTEWATER VOLUME	WASTEWATER VOLUME
			0.5% annual growth						Residents/Home				Septic Tank		(@56kg BOD/ha/day)	(Includes Infiltration)			**For 230 Days**
		2.22% annual growth	Actual	Equivalent (1/3)	0.5% annual growth	35% of annual growth		65% of annual growth	3.0	0.5% annual growth		(kg)	4.96 (kg)	(kg)	(sq. m.)	L/person/day	L/person/day	(cu. m.)	(cu. m.)
2013	0	129	47	16	1,397	57	100	1,340	4.65	0.38	6	0.076	29.8	52.7	9,408	288	250	81	18,610
2014	1	132	47	16	1,404	59	100	1,345	4.67	0.38	6	0.076	29.8	53.1	9,481	288	250	82	18,946
2015	2	135	47	16	1,411	62	100	1,349	4.68	0.38	6	0.076	29.8	53.5	9,556	288	250	84	19,286
2016	3	138	48	16	1,418	64	100	1,354	4.70	0.38	6	0.076	29.8	53.9	9,631	288	250	85	19,632
2017	4	141	48	16	1,425	67	100	1,358	4.72	0.38	6	0.076	29.8	54.4	9,707	288	250	87	19,982
2018	5	144	48	16	1,432	69	100	1,363	4.73	0.38	6	0.076	29.8	54.8	9,784	288	250	88	20,338
2019	6	147	48	16	1,439	72	100	1,368	4.75	0.39	6	0.076	29.8	55.2	9,863	288	250	90	20,699
2020	7	150	49	16	1,447	74	100	1,372	4.76	0.39	6	0.076	29.8	55.7	9,943	288	250	92	21,066
2021	8	154	49	16	1,454	77	100	1,377	4.78	0.39	6	0.076	29.8	56.1	10,023	288	250	93	21,438
2022	9	157	49	16	1,461	79	100	1,382	4.80	0.39	6	0.076	29.8	56.6	10,105	288	250	95	21,816
2023	10	161	49	16	1,468	82	100	1,386	4.81	0.39	6	0.076	29.8	57.1	10,188	288	250	97	22,199
2024	11	164	50	17	1,476	85	100	1,391	4.83	0.40	6	0.076	29.8	57.5	10,273	288	250	98	22,589
2025	12	168	50	17	1,483	87	100	1,396	4.85	0.40	6	0.076	29.8	58.0	10,358	288	250	100	22,984
2026	13	172	50	17	1,491	90	100	1,401	4.86	0.40	6	0.076	29.8	58.5	10,445	288	250	102	23,386
2027	14	175	50	17	1,498	92	100	1,406	4.88	0.40	6	0.076	29.8	59.0	10,534	288	250	103	23,794
2028	15	179	51	17	1,506	95	100	1,411	4.90	0.40	6	0.076	29.8	59.5	10,623	288	250	105	24,208
2029	16	183	51	17	1,513	98	100	1,415	4.91	0.41	6	0.076	29.8	60.0	10,714	288	250	107	24,629
2030	17	187	51	17	1,521	100	100	1,420	4.93	0.41	6	0.076	29.8	60.5	10,806	288	250	109	25,056
2031	18	192	51	17	1,528	103	100	1,425	4.95	0.41	6	0.076	29.8	61.0	10,900	288	250	111	25,490
2032	19	196	52	17	1,536	106	100	1,430	4.97	0.41	6	0.076	29.8	61.6	10,995	288	250	113	25,932
2033	20	200	52	17	1,544	108	100	1,435	4.98	0.41	6	0.076	29.8	62.1	11,092	288	250	115	26,380

Manitoba Conservation and Water Stewardship - Fisheries Branch, May 28, 2014
Email Correspondence

Oswald Wohlgemut

From: Janusz, Laureen R (CWS) [Laureen.Janusz@gov.mb.ca]
Sent: Wednesday, May 28, 2014 3:00 PM
To: Oswald Wohlgemut
Subject: RM of Wallace - Oak Lake Fish Species Info
Attachments: OAK_Lake_FIHCS_20140528 (2).pdf

Hi Oswald,

I am so sorry for the delay. Attached is the information from the FIHCS. General Use: recreational angling with no special regulations for this lake. I do not have any known spawning or unique habitat features identified. I have cc'd the regional fisheries biologist in case he has additional information that he can provide.

Laureen Janusz
Fisheries Science and Fish Culture Section
Fisheries Branch,
Manitoba Conservation and Water Stewardship
Box 20, 200 Saulteaux Crescent
Winnipeg, MB R3J 3W3

Phone: 204.945.7789
Cell: 204.793.1154
Fax: 204.948-2308
Email: Laureen.Janusz@gov.mb.ca

From: Oswald Wohlgemut [mailto:owohlgemut@jrcc.ca]
Sent: May-28-14 9:09 AM
To: Janusz, Laureen R (CWS)
Subject: RE: RM of Wallace - Oak Lake Fish Species Info

Laureen,

When can we expect a response to this enquiry for fish species data?

Let us know if you need any additional information.

Thank you,

Oswald Wohlgemut, M.Sc.
Environmental Scientist

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

Manitoba Conservation and Water Stewardship - Wildlife and Ecosystem Protection Branch, May 6, 2014 Email Correspondence

Oswald Wohlgemut

From: Friesen, Chris (CWS) [Chris.Friesen@gov.mb.ca]
Sent: Tuesday, May 06, 2014 3:50 PM
To: 'Oswald Wohlgemut'
Subject: RE: RM of Wallace lagoon - Species at Risk

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 Branch, Manitoba Conservation and Water Stewardship.

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
Biodiversity Information Manager
Manitoba Conservation Data Centre
204-945-7747
chris.friesen@gov.mb.ca
http://www.gov.mb.ca/conservation/cdc/

From: Oswald Wohlgemut [mailto:owohlgemut@jrcc.ca]
Sent: May-02-14 1:45 PM
To: Friesen, Chris (CWS)
Subject: RM of Wallace lagoon - Species at Risk

Hello Chris,

J.R. Cousin Consultants is conducting an Environment Act Proposal on behalf of the RM of Wallace for the construction of a new wastewater treatment lagoon. The construction works will occur on NW 14-10-29 WPM (see attached plan). The site is existing agricultural land, so no clearing will be required for the construction works. The site is surrounded by agricultural land and bordered to the north by PR 257. Works will include lagoon cell construction, access approach construction, fence installation and ditch construction.

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

Please let us know if you have any questions.

Thank you,

Oswald Wohlgemut, M.Sc.
Environmental Scientist

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

Manitoba Tourism, Heritage, Sport and Consumer Protection - Historic Resources Branch,
June 3, 2014 Email Correspondence

Oswald Wohlgemut

From: Sitchon, Myra (TCHSCP) [Myra.Sitchon@gov.mb.ca]
Sent: Tuesday, June 03, 2014 9:19 AM
To: 'Oswald Wohlgemut'
Subject: RE: RM of Wallace Lagoon - Heritage Resources

Good morning Oswald,
In response to your email regarding the above-noted project, I have examined Branch records for areas of potential concern. The potential to impact significant heritage resources is low, and, therefore, the Historic Resources Branch has no concerns with the project.

If at any time however, significant heritage resources are recorded in association with these lands during development, the Historic Resources Branch may require that an acceptable heritage resource management strategy be implemented by the developer to mitigate the effects of development on the heritage resources.

If you have any questions or comments, please contact me at 945-6539.

Thanks,
Myra

Myra L. Sitchon, *Ph.D.*
Impact Assessment Archaeologist,
Archaeological Assessment Services Unit,
Historic Resources Branch
Main Floor- 213 Notre Dame Avenue, Winnipeg, MB R3B 1N3
myra.sitchon@gov.mb.ca

Phone: (204) 945-6539
Toll Free: 1-800-282-8069+extension(6539)
Fax: (204) 948-2384
Website: http://www.manitoba.ca/heritage

Manitoba
Tourism, Culture, Heritage, Sport and Consumer Protection

From: Oswald Wohlgemut [mailto:owohlgemut@jrcc.ca]
Sent: June-02-14 2:51 PM
To: Sitchon, Myra (TCHSCP)
Subject: RM of Wallace Lagoon - Heritage Resources

Hello Myra,

J.R. Cousin Consultants is conducting an Environment Act Proposal on behalf of the RM of Wallace for the construction of a new wastewater treatment lagoon. The construction works will occur on NW 14-10-29 WPM (see attached plan). The site is existing agricultural land, so no clearing will be required for the construction works. The site is surrounded by agricultural land and bordered to the north by PR 257. Works will include lagoon cell construction, access approach construction, fence installation and ditch construction.

Please provide any comments or concerns you may have with the proposed project, in regards to historic or heritage resources, as we would like to include that information in the Environment Act Proposal.

Please let us know if you have any questions.

Appendix C

Test Hole Logs

Stantec Consulting Ltd. Soils Analysis Report, December 12, 2013

Stantec Consulting Ltd. Soils Analysis Report, January 24, 2014

Driller's Well Logs

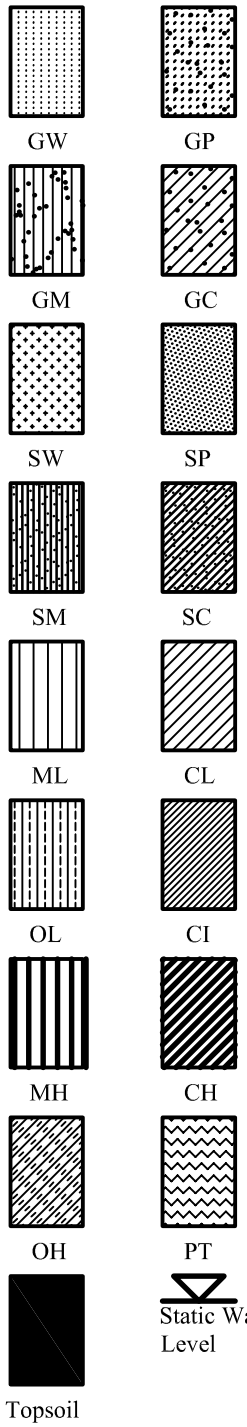
Test Hole Logs

J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : NW 14-10-29 W, Site B
CODE : W-579.02
DATE : November 15, 2013
COORDINATES : N 5523576, E 333298
ELEVATION : 522.694m
PROJECT : RM of Wallace Wastewater Lagoon Study
METHOD OF SAMPLING : Drill Rig
TEST HOLE # 4

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	TOPSOIL - Black, clayey, moist
2'	
1m / 4'	CLAY - Brown, medium plastic, silty, sandy, stones, moist, stiff
6'	
2m / 8'	SILT - Brown, low plastic, sandy, trace clay, wet, soft
3m / 10'	CLAY - Brown, medium plastic, silty, sandy, stones, moist, stiff
12'	
4m / 14'	SILT - Brown, low plastic, sandy, trace clay, wet, soft
	CLAY - Brown, medium plastic, silty, sandy, stones, moist, stiff
16'	
5m / 18'	CLAY - Grey, high plastic, silty, sandy, stones, moist, stiff
6m / 20'	- Static water at 2.1m below surface - Test hole open to 3.5m below surface



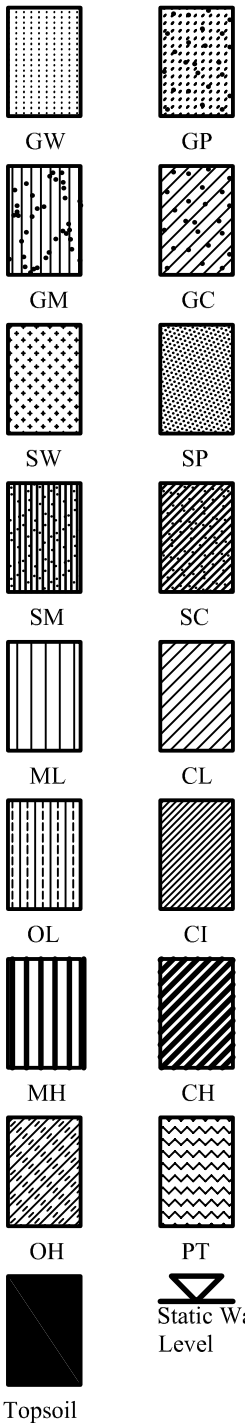
The soil logs are based upon objective data available to us at the time of forming our opinions. The soil logs indicate site specific soil characteristics and must not be generalized over larger areas do to the limited number of test holes as compared to that of a unlimited number of test holes. Every effort is made to evaluate the information by methods generally recognized. The soil represent our opinions. J.R. Cousin Consultants Ltd. cannot be responsible for actual site conditions proved to be materially at variance from our analysis or from the data generalization over untested areas.

J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : NW 14-10-29 W, Site B
CODE : W-579.02
DATE : November 15, 2013
COORDINATES : N 5523531, E 332976
ELEVATION : 526.297m
PROJECT : RM of Wallace Wastewater Lagoon Study
METHOD OF SAMPLING : Drill Rig
TEST HOLE # 5

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	TOPSOIL - Black, clayey, moist
		SAND - Brown, medium grain, moist
	2'	
1m		CLAY - Tan, medium plastic, silty, trace sand, stones, moist, stiff
	4'	
	6'	
2m		
		SAND - Tan, fine grain, silty, trace stone, wet, very soft
	8'	
3m	10'	
	12'	CLAY - Brown, medium plastic, silty, sandy, stones, moist, stiff
4m		
	14'	
	16'	
5m		CLAY - Grey, high plastic, silty, sandy, stones, moist, stiff
	18'	
6m	20'	- Static water at 2.4m below surface - Test hole open to 2.5m below surface



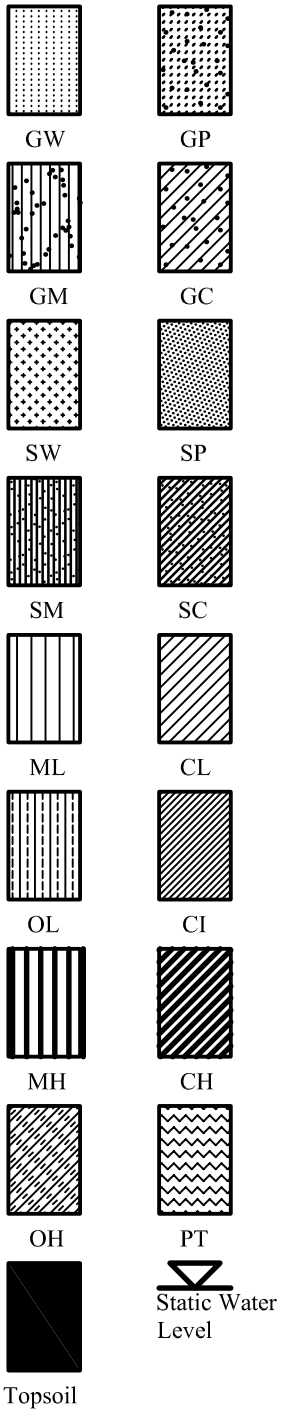
The soil logs are based upon objective data available to us at the time of forming our opinions. The soil logs indicate site specific soil characteristics and must not be generalized over larger areas do to the limited number of test holes as compared to that of a unlimited number of test holes. Every effort is made to evaluate the information by methods generally recognized. The soil represent our opinions. J.R. Cousin Consultants Ltd. cannot be responsible for actual site conditions proved to be materially at variance from our analysis or from the data generalization over untested areas.

J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : NW 14-10-29 W, Site B
CODE : W-579.02
DATE : November 15, 2013
COORDINATES : N 5523526, E 332774
ELEVATION : 526.961m
PROJECT : RM of Wallace Wastewater Lagoon Study
METHOD OF SAMPLING : Drill Rig
TEST HOLE # 6

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	TOPSOIL - Black, clayey, moist
	2'	
1m		
	4'	
	6'	
2m		
	8'	
		CLAY - Brown, medium plastic, silty, sandy, stones, moist, stiff to hard
3m	10'	
	12'	
4m		
	14'	
	16'	
5m		
	18'	
6m	20'	- Test hole open to 6.0m below surface



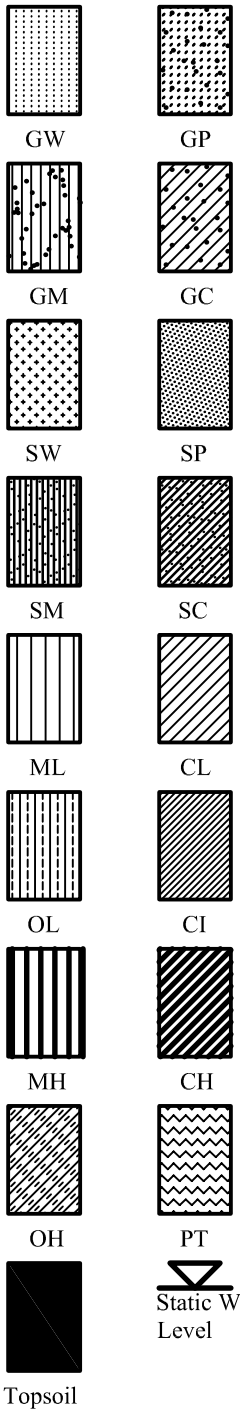
The soil logs are based upon objective data available to us at the time of forming our opinions. The soil logs indicate site specific soil characteristics and must not be generalized over larger areas do to the limited number of test holes as compared to that of a unlimited number of test holes. Every effort is made to evaluate the information by methods generally recognized. The soil represent our opinions. J.R. Cousin Consultants Ltd. cannot be responsible for actual site conditions proved to be materially at variance from our analysis or from the data generalization over untested areas.

J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : NW 14-10-29 W, Site B
CODE : W-579.02
DATE : November 15, 2013
COORDINATES : N 5523615, E 332731
ELEVATION : 527.209m
PROJECT : RM of Wallace Wastewater Lagoon Study
METHOD OF SAMPLING : Drill Rig
TEST HOLE # 7

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	TOPSOIL - Black, clayey, moist
2'	
1m / 4'	
6'	
2m / 8'	
3m / 10'	CLAY - Brown, medium plastic, silty, sandy, stones, moist, stiff to hard
12'	
4m / 14'	
16'	
5m / 18'	
6m / 20'	- Test hole open to 6.0m below surface



The soil logs are based upon objective data available to us at the time of forming our opinions. The soil logs indicate site specific soil characteristics and must not be generalized over larger areas do to the limited number of test holes as compared to that of a unlimited number of test holes. Every effort is made to evaluate the information by methods generally recognized. The soil represent our opinions. J.R. Cousin Consultants Ltd. cannot be responsible for actual site conditions proved to be materially at variance from our analysis or from the data generalization over untested areas.

Stantec Consulting Ltd. Soils Analysis Report, December 12, 2013

Stantec Consulting Ltd.
199 Henlow Bay
Winnipeg MB R3Y 1G4
Tel: (204) 488-6999
Fax: (204) 488-6947

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

December 12, 2013

J.R. Cousin Consultants Ltd.
91 A Scurfield Blvd.
Winnipeg, MB
R3Y 1G4

Attention: Oswald Wohlgemut

Oswald,

Re: RM of Wallace Lagoon Construction

Soils sample were submitted to our laboratory on November 29, 2013. The following tests were conducted on the soil samples:

- Water Content (ASMT D2216)
- Particle-Size Analysis (ASTM D422)
- Atterberg Limits (ASTM D4318)
- Soil Classification (ASTM D2487)

The test results are summarized in the attached table and particle size analysis reports.

An assessment of the soil samples was conducted to determine whether the soil represented by the bagged samples could be used in-situ as a lagoon liner and would obtain a hydraulic conductivity of less than 1.0 x 10-7 cm/sec without being reworked, and when re-moulded and re-compacted.

Based upon previous testing conducted in our laboratory, homogeneous soil samples with a plasticity index greater than 25 and a clay content greater than 50% will typically have a hydraulic conductivity of 1.0 x 10-7 cm/sec or less. All samples submitted do not fall within this range and are not considered suitable for use as a lagoon liner. Our comments regarding the potential use of the materials as a liner are based upon the soil being homogeneous with no preferential flow paths. It should be noted that estimating the hydraulic conductivity of a soil based upon classification test results (plasticity index and particle size analysis) alone might be misleading if the soil contains layers of sand, silt, or organic material.

We appreciate the opportunity to assist you in this project. Please call if you have any questions regarding this report.

Trevor Schellenberg, B. Sc.
Geotechnical E.I.T.

Testhole	Depth (m)	Visual Classification	Water Content (%)	Particle Size Analysis						Atterberg Limits			Soil Classification ASTM D2487	Potential use as a lagoon liner when re-moulded and re-compacted	Potential use as a lagoon liner without being reworked
				Gravel (%)	Sand (%)			Silt (%)	Clay (%) <0.005 mm	Liquid Limit	Plastic Limit	Plasticity Index			
				75 to 4.75 mm	Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm	<0.075 to 0.005 mm							
TH1	0.3 - 4.5	brown, firm, moist, medium plasticity, sandy, trace fine gravel	17.2	2.8	3.5	11.5	24.3	30.7	27.2	37	14	23	CL (Sandy lean clay)	No	No
TH4	0.2 - 2.1	brown, firm, moist, medium plasticity, sandy, trace fine gravel	16.2	5.1	4.5	14.0	23.7	30.0	22.7	30	14	16	CL (Sandy lean clay)	No	No
TH6	0.3 - 6.0	brown, firm, moist, medium plasticity, sandy, trace fine gravel	14.1	2.9	3.6	10.5	22.6	33.4	27.0	32	15	17	CL (Sandy lean clay)	No	No

Notes
1. A high speed stirring device was used for 1 minute to disperse the test samples for particle size analysis.
2. Atterberg limits conducted in accordance with ASTM D4318 Method B (one-point liquid limit).
3. The soil samples were air-dried during sample preparation for Atterberg limits and particle size analysis.

PARTICLE SIZE ANALYSIS
ASTM D422

JR Cousin Consultants Ltd.
91 A Scurfield Blvd.
Winnipeg, MB
R3Y 1G4

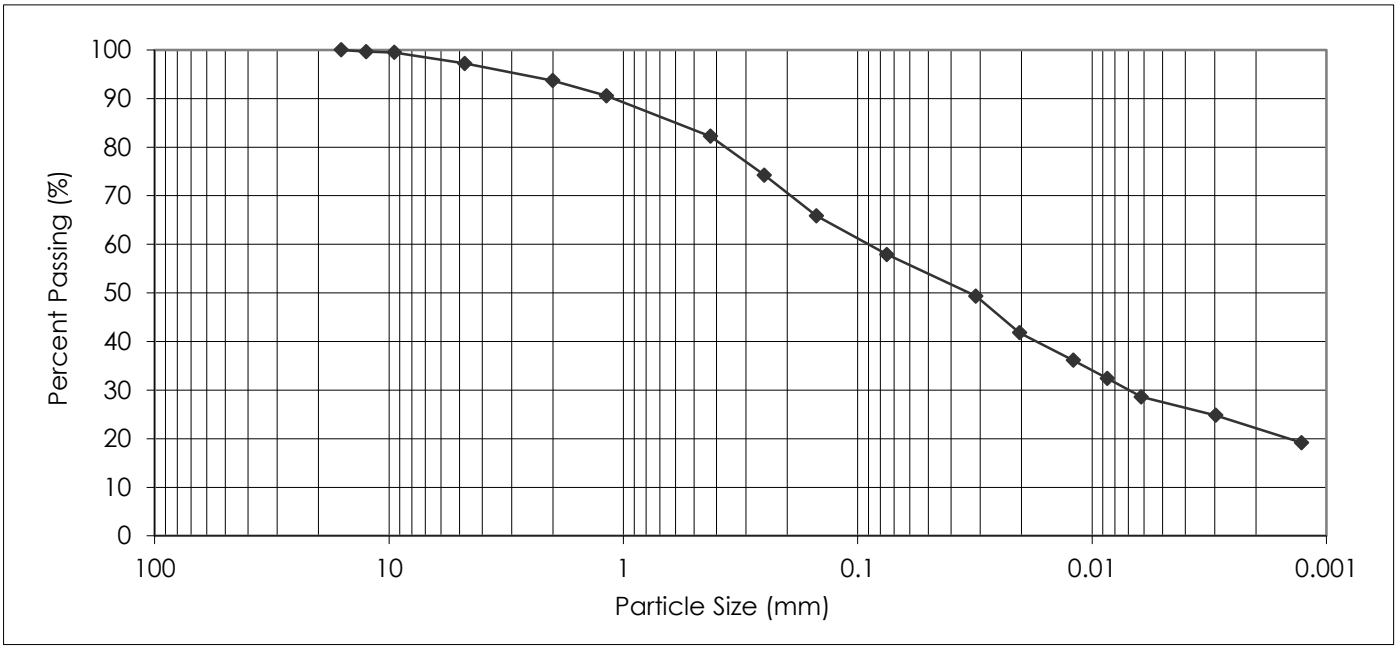
PROJECT: RM of Wallace Lagoon Construction

Attention: Oswald Wohlgemut

PROJECT NO.: 123301314

SAMPLED BY: Client
SAMPLE ID: TH1 at 0.3 - 4.5 m

DATE RECEIVED: November 30, 2013
TESTED BY: Nestor Abarca



PARTICLE SIZE	PERCENT PASSING
37.50 mm	100.0
25.00 mm	100.0
19.00 mm	100.0
16.00 mm	100.0
12.50 mm	99.6
9.50 mm	99.5
4.75 mm	97.2
2.00 mm	93.7

PARTICLE SIZE	PERCENT PASSING
1.18 mm	90.6
0.425 mm	82.2
0.250 mm	74.2
0.150 mm	65.9
0.075 mm	57.9
0.005 mm	27.2
0.002 mm	21.6
0.001 mm	NT*

Gravel, % 75 to 4.75 mm	Sand, %			Silt, % <0.075 to 0.005 mm	Clay, % <0.005 mm	Colloids, % < 0.001 mm
	Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm			
2.8	3.5	11.5	24.3	30.7	27.2	NT*

NT* Sample not tested for colloids

December 11, 2013

REVIEWED BY: Trevor Schellenberg, B.Sc., EIT

PARTICLE SIZE ANALYSIS
ASTM D422

JR Cousin Consultants Ltd.
91 A Scurfield Blvd.
Winnipeg, MB
R3Y 1G4

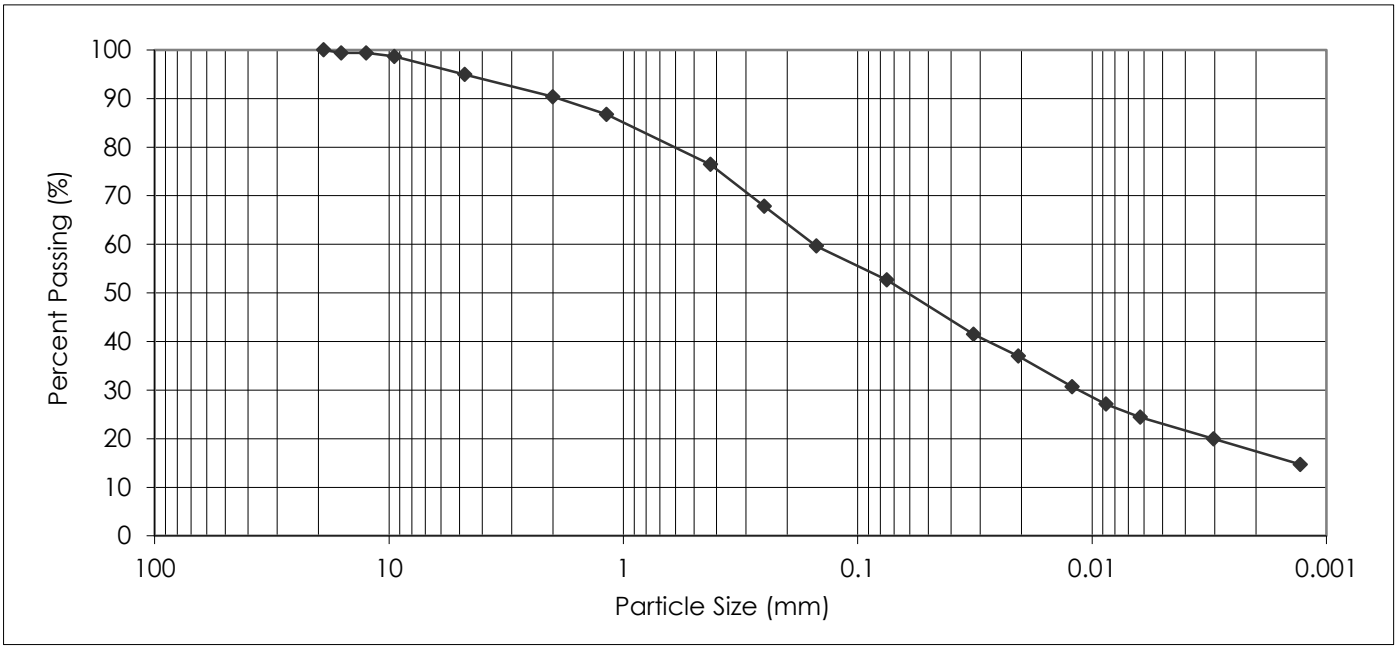
PROJECT: RM of Wallace Lagoon Construction

Attention: Oswald Wohlgemut

PROJECT NO.: 123301314

SAMPLED BY: Client
SAMPLE ID: TH4 at 0.2 - 2.1 m

DATE RECEIVED: November 30, 2013
TESTED BY: Nestor Abarca



PARTICLE SIZE	PERCENT PASSING
37.50 mm	100.0
25.00 mm	100.0
19.00 mm	100.0
16.00 mm	99.4
12.50 mm	99.4
9.50 mm	98.7
4.75 mm	94.9
2.00 mm	90.4

PARTICLE SIZE	PERCENT PASSING
1.18 mm	86.8
0.425 mm	76.4
0.250 mm	67.8
0.150 mm	59.6
0.075 mm	52.7
0.005 mm	22.7
0.002 mm	16.8
0.001 mm	NT*

Gravel, % 75 to 4.75 mm	Sand, %			Silt, % <0.075 to 0.005 mm	Clay, % <0.005 mm	Colloids, % < 0.001 mm
	Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm			
5.1	4.5	14.0	23.7	30.0	22.7	NT*

NT* Sample not tested for colloids

December 11, 2013

REVIEWED BY: Trevor Schellenberg, B.Sc., EIT

PARTICLE SIZE ANALYSIS
ASTM D422

JR Cousin Consultants Ltd.
91 A Scurfield Blvd.
Winnipeg, MB
R3Y 1G4

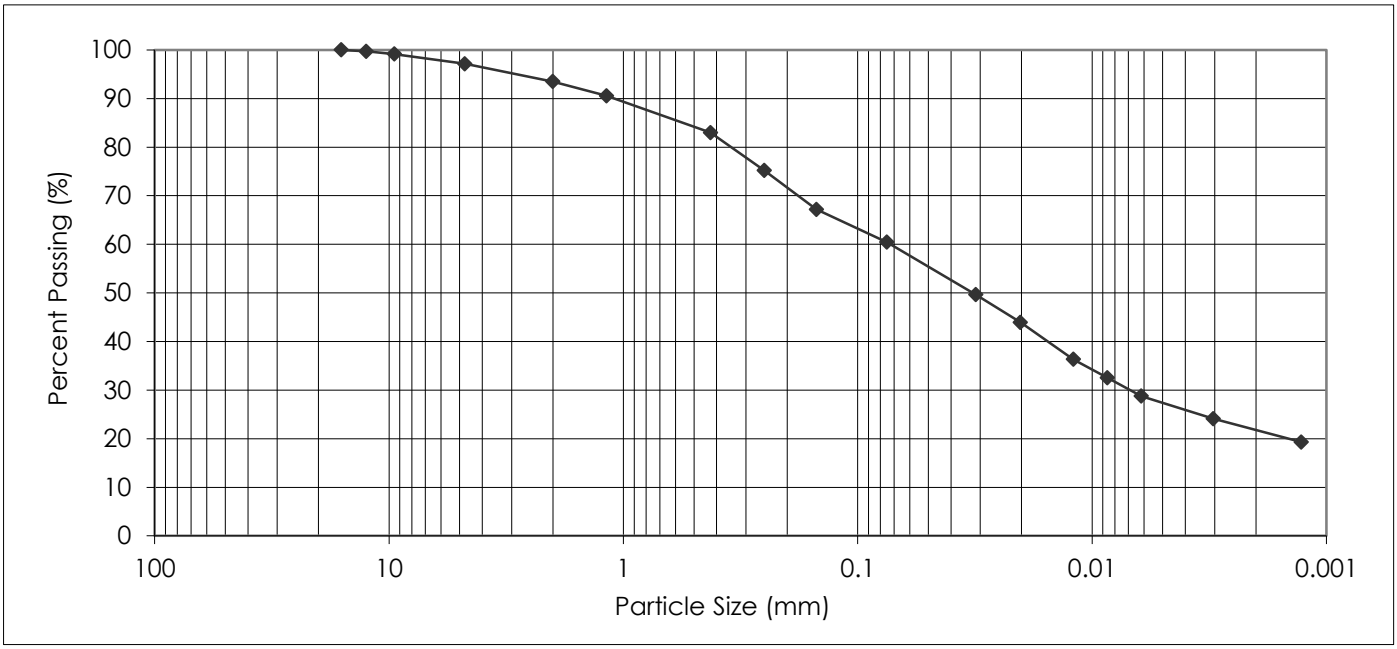
PROJECT: RM of Wallace Lagoon Construction

Attention: Oswald Wohlgemut

PROJECT NO.: 123301314

SAMPLED BY: Client
SAMPLE ID: TH6 at 0.3 - 6.0 m

DATE RECEIVED: November 30, 2013
TESTED BY: Nestor Abarca



PARTICLE SIZE	PERCENT PASSING
37.50 mm	100.0
25.00 mm	100.0
19.00 mm	100.0
16.00 mm	100.0
12.50 mm	99.7
9.50 mm	99.2
4.75 mm	97.1
2.00 mm	93.5

PARTICLE SIZE	PERCENT PASSING
1.18 mm	90.6
0.425 mm	83.0
0.250 mm	75.2
0.150 mm	67.2
0.075 mm	60.4
0.005 mm	27.0
0.002 mm	21.3
0.001 mm	NT*

Gravel, % 75 to 4.75 mm	Sand, %			Silt, % <0.075 to 0.005 mm	Clay, % <0.005 mm	Colloids, % < 0.001 mm
	Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm			
2.9	3.6	10.5	22.6	33.4	27.0	NT*

NT* Sample not tested for colloids

December 11, 2013

REVIEWED BY: Trevor Schellenberg, B.Sc., EIT

Stantec Consulting Ltd. Soils Analysis Report, January 24, 2014

Stantec Consulting Ltd.
199 Henlow Bay
Winnipeg MB R3Y 1G4
Tel: (204) 488-6999
Fax: (204) 488-6947

January 24, 2013

J.R. Cousin Consultants Ltd.
91 A Scurfield Blvd.
Winnipeg, MB
R3Y 1G4

Attention: Oswald Wohlgemut

Oswald,

Re: RM of Wallace Lagoon Construction

Two Shelby tube samples were submitted to our laboratory on December 23, 2013. Hydraulic conductivity testing (ASTM D5084) was conducted on both samples received, with test results summarized in the attached table.

An assessment of the soil samples was conducted to determine whether the soil represented by the Shelby tube samples could be used in-situ as a lagoon liner and would obtain a hydraulic conductivity of less than 1.0 x 10-7 cm/sec without being reworked, and when re-moulded and re-compacted.

Based on the hydraulic conductivity test results from the two samples submitted, these samples would be consider suitable as a lagoon liner with or without being re-worked. Both samples achieved a hydraulic condutivity value of less than $1x10^{-7}$ cm/sec.

We appreciate the opportunity to assist you in this project. Please call if you have any questions regarding this report.

German Gl.

German Leal, B.Sc., P.Eng.
Project Manager, Geotechnical Engineering

Table 1 - Hydraulic Conductivity Test Data

Testhole	Depth (m)	Hydraulic Conductivity, "k20"	Potential use as a lagoon liner without being reworked	Potential use as a lagoon liner when re-moulded and re-compacted
TH1	1.5 - 2.1	$1.5x10^{-8}$ cm/sec	Yes	Yes
TH6	1.5 - 2.1	$2.5x10^{-8}$ cm/sec	Yes	Yes

HYDRAULIC CONDUCTIVITY
ASTM D5084

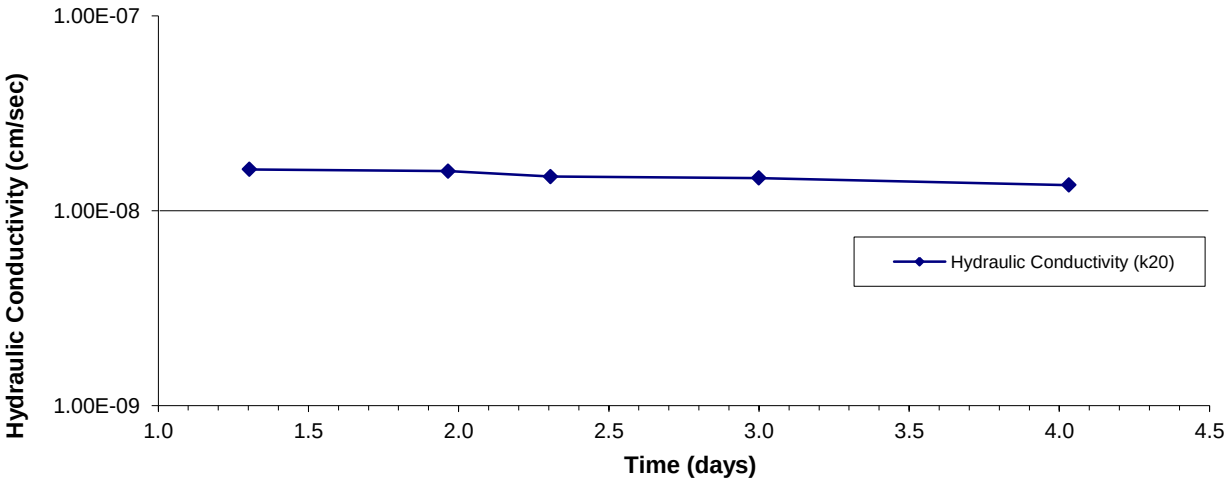
J.R. Cousin Consultants Ltd.
91 A Scurfeild Blvd.
Winnipeg, MB
R3Y 1G4

PROJECT: RM of Wallace Lagoon Construction

Attention: Oswald Wohlgemut PROJECT NO.: 123301315

SAMPLE I.D.:	**TH1 at 1.5 m to 2.1 m**
SOIL DESCRIPTION:	Clay till - brown, firm, moist, medium plasticity trace coarse gravel, trace fine to coarse sand
DATE TESTED:	03-Jan-14
CONFINING PRESSURE (kPa):	137.9
EFFECTIVE SATURATION STRESS (kPa):	34.5
ASSUMED SPECIFIC GRAVITY:	2.75
HYDRAULIC GRADIENT:	19.1
TYPE OF PERMEANT LIQUID:	De-aired Water
HYDRAULIC CONDUCTIVITY, "k" (cm/s):	1.5E-08
HYDRAULIC CONDUCTIVITY, "k_{20}" (cm/s):	**1.5E-08**

	Height (mm)	Diameter (mm)	Wet Mass (g)	Dry Density (g/cm^3)	Water Content (%)	Saturation (%)
Initial Reading	78.1	72.4	701.0	1.872	16.4	96.3
Final Reading	77.7	72.6	713.7	1.922	15.3	97.5



January 24, 2014

REVIEWED BY: German E. Leal, B.Sc., EIT

HYDRAULIC CONDUCTIVITY
ASTM D5084

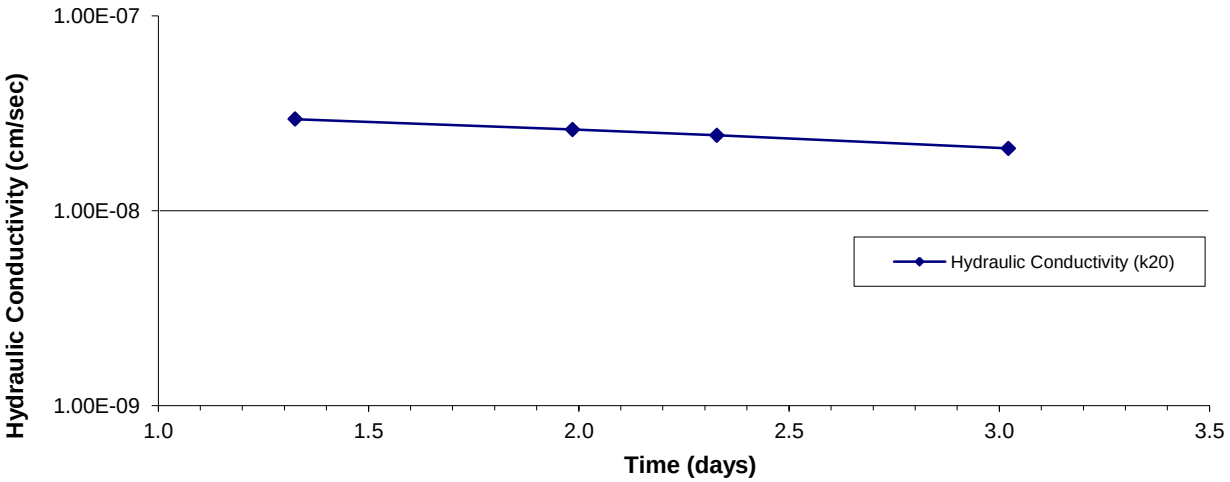
J.R. Cousin Consultants Ltd.
91 A Scurfeild Blvd.
Winnipeg, MB
R3Y 1G4

PROJECT: RM of Wallace Lagoon Construction

Attention: Oswald Wohlgemut PROJECT NO.: 123301315

SAMPLE I.D.:	**TH6 at 1.5 m to 2.1 m**
SOIL DESCRIPTION:	Silty clay till - tan, soft, moist, medium plasticity, trace fine to coarse gravel, trace fine to coarse sand
DATE TESTED:	03-Jan-14
CONFINING PRESSURE (kPa):	137.9
EFFECTIVE SATURATION STRESS (kPa):	34.5
ASSUMED SPECIFIC GRAVITY:	2.71
HYDRAULIC GRADIENT:	19.3
TYPE OF PERMEANT LIQUID:	De-aired Water
HYDRAULIC CONDUCTIVITY, "k" (cm/s):	2.6E-08
HYDRAULIC CONDUCTIVITY, "k_{20}" (cm/s):	**2.5E-08**

	Height (mm)	Diameter (mm)	Wet Mass (g)	Dry Density (g/cm^3)	Water Content (%)	Saturation (%)
Initial Reading	77.6	72.5	692.4	1.855	16.5	97.1
Final Reading	76.9	72.8	694.2	1.845	17.4	100.6



January 24, 2014

REVIEWED BY: German E. Leal, B.Sc., EIT

Driller's Well Logs

LOCATION: 14-10-29W

Well_PID: 815
Owner: E RUSSEL
Driller: MANITOBA GOVERNMENT
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 333479.679
UTMY: 5522871.58
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1911 Aug 26

WELL LOG

From (ft.)	To (ft.)	Log
0	25.0	CLAY
25.0	79.9	CLAY AND STONES
79.9	99.9	STONES AND BOULDERS
99.9	134.9	BLUE CLAY AND STONES
134.9	149.9	HARDPAN
149.9	169.9	STICKY SHALE
169.9	331.8	SHALE, SALTY WATER

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	228.8	casing	4.50				

Top of Casing: ft. below ground

PUMPING TEST

Date:
Pumping Rate: Imp. gallons/minute
Water level before pumping: 79.9 ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: ??? hours, ?? minutes
Water temperature: ?? degrees F

REMARKS

GROUND LEVEL ELEV EST 1730 FT

LOCATION: SW14-10-29W

Well_PID: 814

Owner: E RUSSELL
Driller: MANITOBA GOVERNMENT
Well Name:
Well Use: TEST WELL
Water Use:
UTMX: 333064.461
UTMY: 5522470.01
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1911 Aug 25

WELL LOG

From (ft.)	To (ft.)	Log
0	20.0	YELLOW CLAY
20.0	60.0	BLUE CLAY
60.0	79.9	BLUE CLAY AND BOULDERS
79.9	109.9	STONES AND BOULDERS
109.9	144.9	BLUE CLAY AND STONES
144.9	159.9	HARDPAN
159.9	331.8	SHALE, SALTY WATER AT 330 FEET

No construction data for this well.

Top of Casing: ft. below ground

PUMPING TEST

Date:
Pumping Rate: Imp. gallons/minute
Water level before pumping: 79.9 ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: ??? hours, ?? minutes
Water temperature: ?? degrees F

REMARKS

GROUND LEVEL ELEV EST 1730 FT

Appendix D

Title Page

Plan L1: Proposed Lagoon with Test Hole Location and Setback Plan

Plan L2: Proposed Lagoon Drainage Route

Plan L3: Proposed Lagoon Layout Plan

Plan L4: Dike Details

Plan L5: Truck Turnaround, Access Road, Fence, Gate, Lock and Sign Details

Plan L6: Silt Fence, Valve, Valve Marker, Rip Rap and Ditch Details

R.M. OF WALLACE

WASTEWATER LAGOON

ENVIRONMENT ACT PROPOSAL

PRELIMINARY
NOT FOR CONSTRUCTION

REDUCED DRAWING SET
DO NOT SCALE

PLAN INDEX

LAGOON

JR Cousin Consultants Ltd.

91A Scurfield Blvd. Winnipeg MB R3Y 1G4

p. (204) 489-0474

f. (204) 489-0487

www.jrcc.ca

ENGINEERING EXCELLENCE SINCE 1981

PRELIMINARY
NOT FOR CONSTRUCTION

SCALE BAR
(IN METRES)
100 0 50 100 200 300 400 500
1:5000

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.

APEGM
Certificate of Authorization
J.R. Cousin Consultants Ltd.
No. 234 **Date:** 2014/08/13

ENGINEER'S SEAL
PROVINCE OF MANITOBA
14/08/13
R.J.R.L.
COUSIN
Member
22391
REGISTERED PROFESSIONAL ENGINEER

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f. (204) 489-0487
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ENGINEERING CONSULTANTS
ENGINEERING EXCELLENCE SINCE 1981

CODE:	W-579.02
DESIGNED BY:	OW
DRAWN BY:	OT
REVIEWED BY:	JC

PROJECT: R.M. OF WALLACE
WASTEWATER LAGOON EAP

TITLE: PROPOSED LAGOON WITH TEST HOLE LOCATION AND SETBACK PLAN

SCALE:	DATE:	PLAN:	SHEET:
1:5000	14/05/13	L1	1 of 6

Aug 13, 2014 - 2:11pm K:\500\579.02 Wallace RM\579.02 Wastewater Lagoon Study\04 Drawing\dwg\MXD\Rev L1 - Proposed Lagoon with Test Hole Location and Setback Plan.dwg

N

LEGEND:

DRAINAGE DIRECTION

PRELIMINARY
NOT FOR CONSTRUCTION

SCALE BAR
(IN METRES)
150 0 75 150 300 450 600 750
1:7500

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.

APEGM
Certificate of Authorization
J.R. Cousin Consultants Ltd.
No. 234 **Date:** 2014/08/13

ENGINEER'S SEAL
PROVINCE OF MANITOBA
14/04/11
J.R.L. COUSIN
Member
22391
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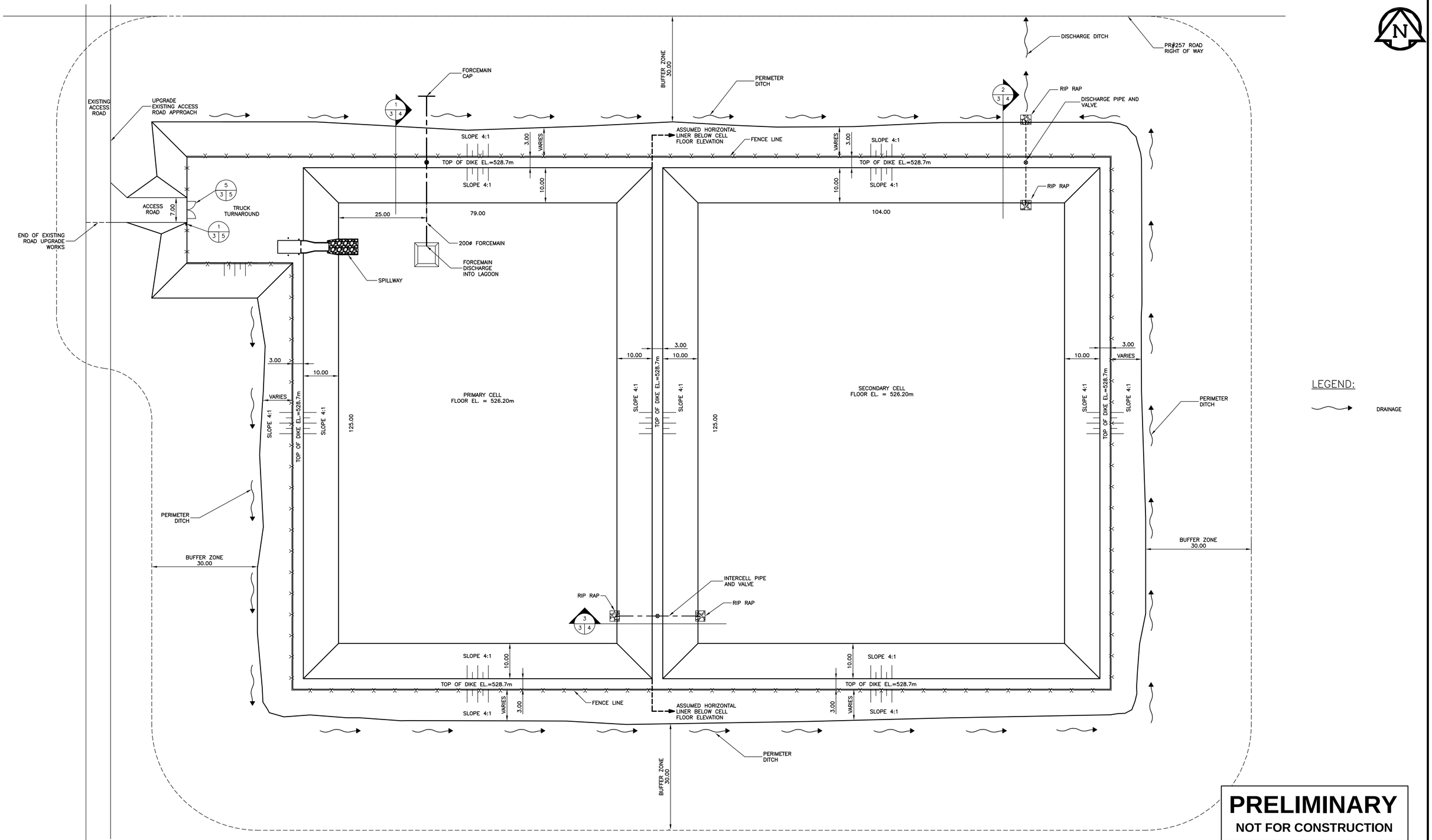
CODE:	W-579.02
DESIGNED BY:	OW
DRAWN BY:	OT
REVIEWED BY:	JC
PROJECT:	R.M. OF WALLACE WASTEWATER LAGOON EAP
TITLE:	PROPOSED LAGOON DRAINAGE ROUTE
SCALE:	1:7500
DATE:	14/05/13
PLAN:	L2
SHEET:	2 of 6

Aug 13, 2014 - 2:12pm P:\500\579 Wallace RM\579.02 Wastewater Lagoon Study\04 Drawing\Dwg\LAP\Rev L2 - Proposed Lagoon Drainage Route.dwg



LEGEND:

DRAINAGE

PRELIMINARY
NOT FOR CONSTRUCTION

SCALE BAR
(IN METRES)
10 0 5 10 20 30 40 50
1:500

No.	REVISIONS	DATE	INITIALS

B.M. EL.

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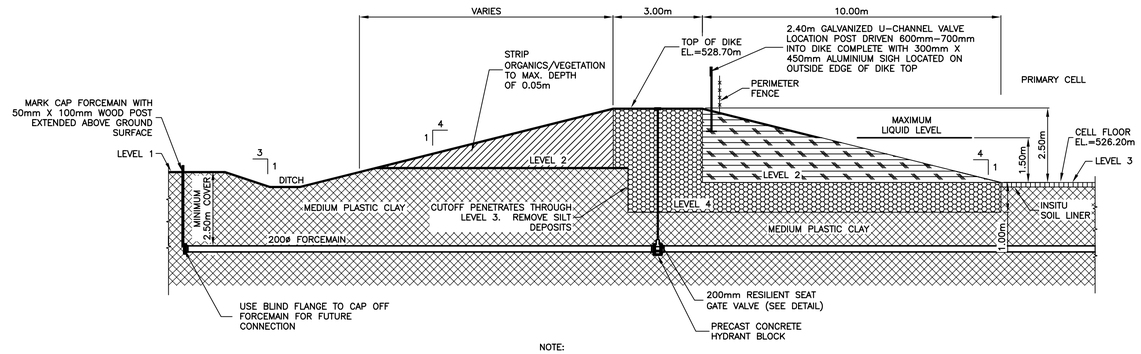
CODE:	W-579.02
DESIGNED BY:	OW
DRAWN BY:	OT
REVIEWED BY:	JC
PROJECT:	R.M. OF WALLACE WASTEWATER LAGOON
TITLE:	PROPOSED LAGOON LAYOUT PLAN
SCALE:	1:500
DATE:	14/05/13
PLAN:	L3
SHEET:	3 of 6

LEGEND:

- EXCAVATED AND COMPACTED CLAY TYPE SOIL
- SCARIFIED 150mm AND COMPACTED CLAY TYPE SOIL
- EXCAVATED AND COMPACTED SOIL MATERIAL
- EXCAVATED AND COMPACTED MIXTURE OF ORGANIC AND INORGANIC SOILS
- HIGH PLASTICITY CLAY TYPE SOIL
- CONCRETE
- RIP RAP
- TOPSOIL
- SAND TYPE SOIL
- MEDIUM PLASTICITY CLAY TYPE SOIL

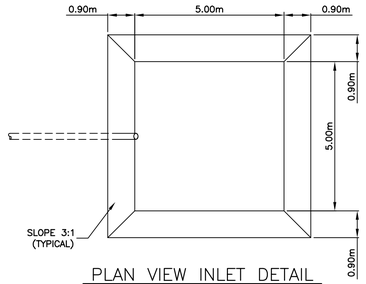
LEVEL 1 – PRE-CONSTRUCTION EXISTING PRAIRIE ELEVATION
LEVEL 2 – ELEVATION FOLLOWING STRIPPED ORGANICS/VEGETATION
LEVEL 3 – FINISHED CELL BOTTOM ELEVATION
LEVEL 2 AND 3 – TO BE COMPACTED WITH SHEEPSFOOT PACKER
LEVEL 4 – CUTOFF PENETRATED CLAY



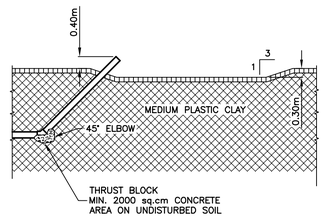
NOTE:

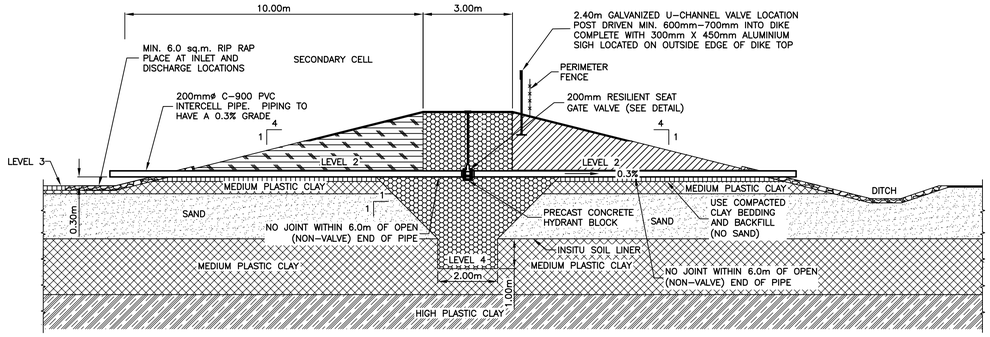
– SECTION MATERIAL IS BASED ON JRCC–TH7 (13/11/15).

1/3|4 PRIMARY CELL PERIMETER DIKE AT FORCEMAIN
SCALE = 1:100



PLAN VIEW INLET DETAIL
SCALE = 1:100

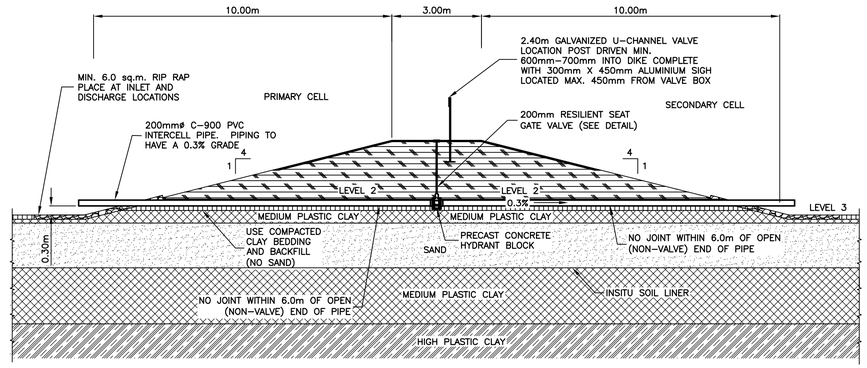




NOTE:

– SECTION MATERIAL IS BASED ON JRCC–TH5 (13/11/15).

2/3|4 SECONDARY CELL PERIMETER DIKE AT DISCHARGE PIPE
SCALE = 1:100



NOTE:

– SECTION MATERIAL IS BASED ON JRCC–TH5 (13/11/15).

3/3|4 INTERCELL DIKE AT INTERCELL PIPE (PRIMARY CELL TO SECONDARY CELL)
SCALE = 1:100

PRELIMINARY
NOT FOR CONSTRUCTION

No.	REVISIONS	DATE	INITIALS
	B.M. EL.		
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APEGM Certificate of Authorization
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No. 234 **Date:** 2014/08/13

ENGINEER'S SEAL
PROVINCE OF MANITOBA 14/05/14 J.R.L. COUSIN Member 22391 REGISTERED PROFESSIONAL ENGINEER

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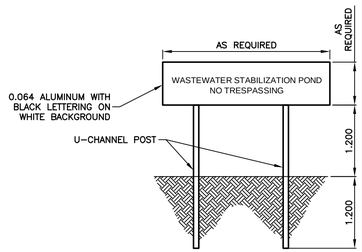
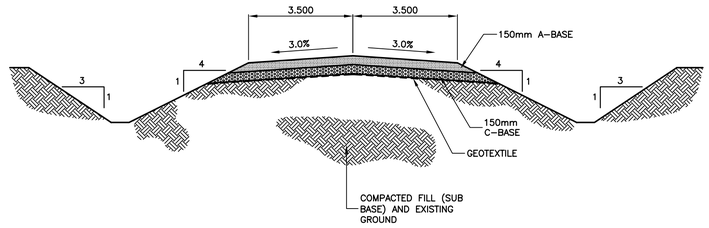
ENGINEERING CONSULTANTS
ENGINEERING EXCELLENCE SINCE 1981

CODE:	W-579.02
DESIGNED BY:	OW
DRAWN BY:	OT
REVIEWED BY:	JC
PROJECT:	R.M. OF WALLACE WASTEWATER LAGOON EAP
TITLE:	DIKE DETAILS
SCALE:	1:100
DATE:	14/05/14
PLAN:	L4
SHEET:	4 of 6



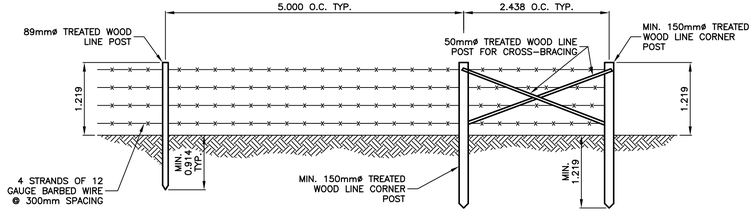
1/3 1/5 SIGN DETAIL
SCALE = 1:50



NOTE:

TOP SOIL AND ORGANICS TO BE REMOVED FOR ROAD BED PREPARATION

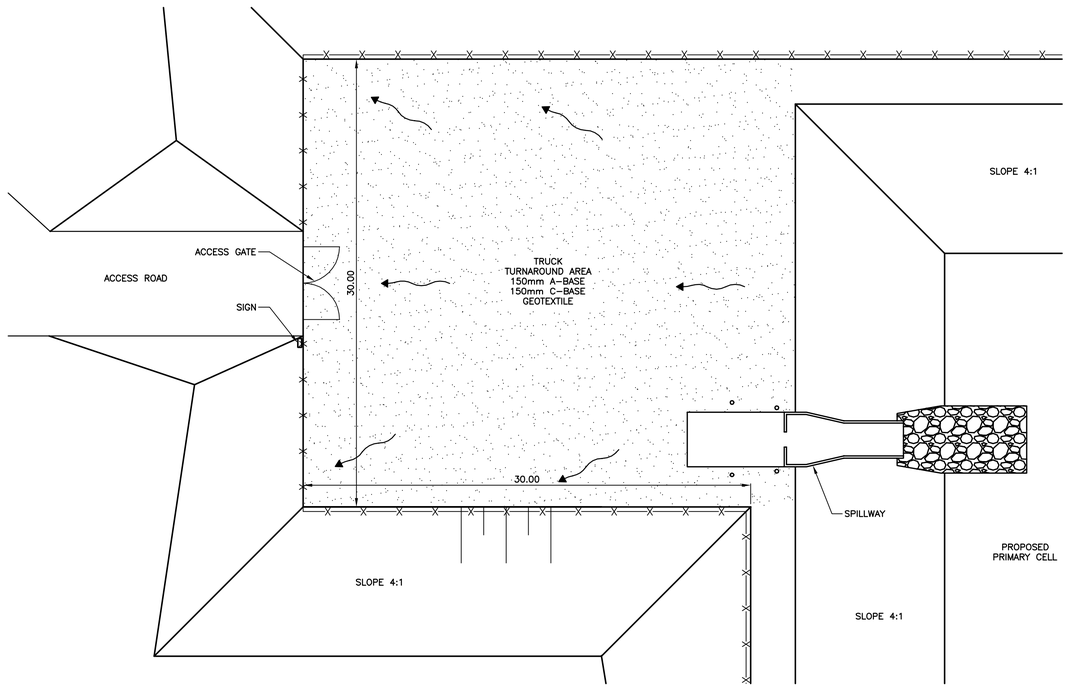
2/5 UPGRADED ACCESS ROAD CROSS-SECTION
Horizontal Scale = 1:100
Vertical Scale = 1:50



NOTE:

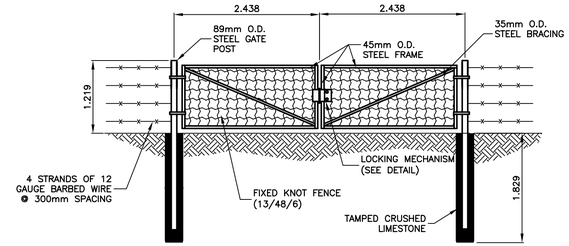
- PROVIDE CROSS BRACING AT CORNERS POSTS IN BOTH DIRECTIONS.
- SHOWN DIAMETER REFERS TO SMALLEST END OF POST.

3/5 FENCE DETAIL
SCALE = 1:50

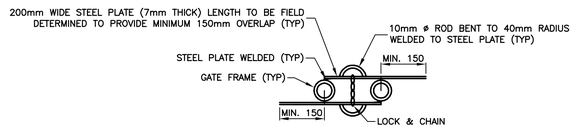


SCALE BAR
(IN METRES)
4 0 2 4 8 12 16 20
1:200

4/5 TRUCK TURNAROUND DETAIL
SCALE = 1:200



5/5 GATE DETAIL
SCALE = 1:50



6/5 LOCK DETAIL
SCALE = 1:10

PRELIMINARY
NOT FOR CONSTRUCTION

No.	REVISIONS	DATE	INITIALS
			B.M. EL.

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ENGINEER'S SEAL
PROVINCE OF MANITOBA
14/08/13
J.J.R.L. COUSIN
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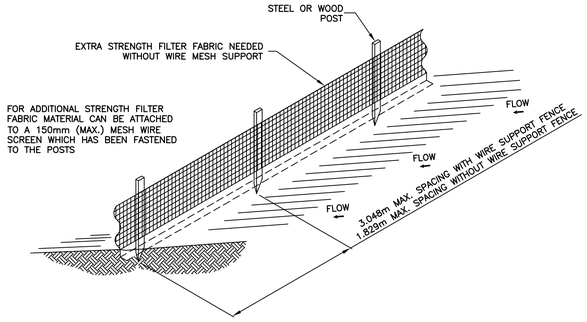
ENGINEERING CONSULTANTS
ENGINEERING EXCELLENCE SINCE 1981

CODE:	W-579.02
DESIGNED BY:	OW
DRAWN BY:	OT
REVIEWED BY:	JC
PROJECT:	R.M. OF WALLACE WASTEWATER LAGOON EAP
TITLE:	TRUCK TURNAROUND, ACCESS ROAD, FENCE, GATE, LOCK AND SIGN DETAILS
SCALE:	AS NOTED
DATE:	14/05/14
PLAN:	L5
SHEET:	5 of 6

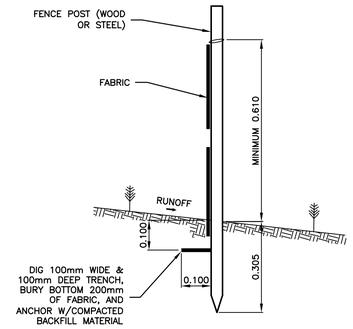
Aug 13, 2014 - 2:14pm K:\500\579\05 Wallace RM\579.02 Wastewater Lagoon Study\04 Drawing\dwg\MMP.Plan L5, L6 - Miscellaneous Details.dwg



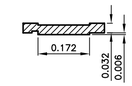
NOTES:

1. THE HEIGHT OF A SILT FENCE SHALL NOT EXCEED 914mm.
2. HE 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.

1/6 SILT FENCE DETAIL
SCALE = 1:40



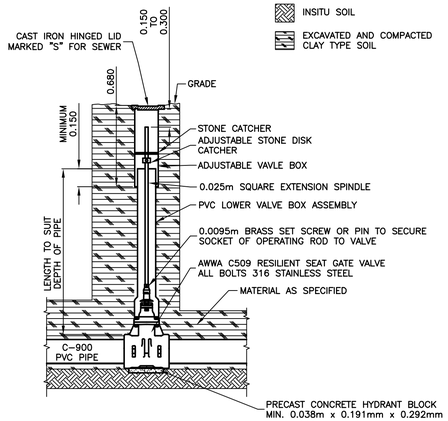
2/6 SILT FENCE SECTION
SCALE = 1:10



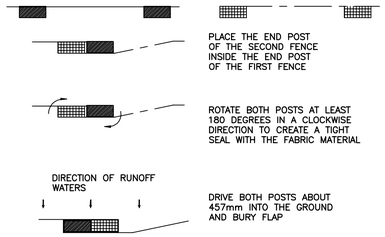
COVER DETAIL
SCALE = 1:10

LEGEND:

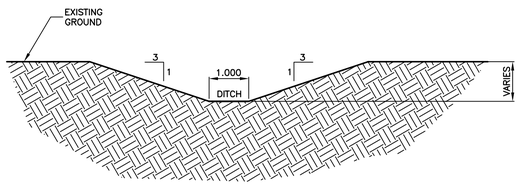
- INSITU SOIL
- EXCAVATED AND COMPACTED CLAY TYPE SOIL



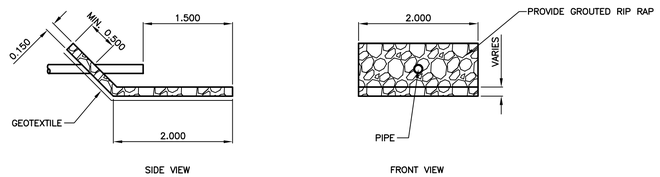
4/6 LAGOON DIKE VALVE DETAIL
SCALE = 1:25



3/6 ATTACHING TWO SILT FENCES
SCALE = 1:10



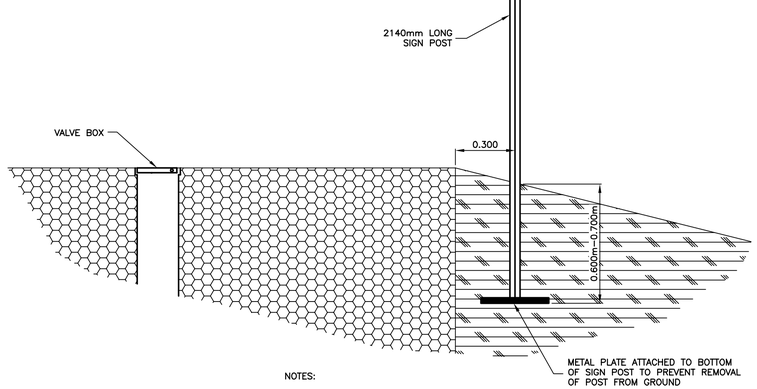
5/6 TYPICAL DISCHARGE DITCH DETAIL
SCALE = 1:75



NOTE:

–RIP RAP MATERIAL SHALL BE WELL GRADED 125mm TO 200mm HARD, DENSE, ROUNDED & DURABLE FIELD STONE.

6/6 RIP RAP DETAIL
SCALE = 1:50



NOTES:

- MINIMUM SIGN SIZE: 300mm X 450mm
- MINIMUM POST LENGTH: 2140mm
- CROSSING MARKERS TO BE SET IN 200mmø X 1.0m CONCRETE AS PER SPECIFICATIONS

7/6 VALVE MARKER DETAIL
SCALE = 1:15

PRELIMINARY
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No.	REVISIONS	DATE	INITIALS
	B.M. EL.		

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14/05/14
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DESIGNED BY:	OW
DRAWN BY:	OT
REVIEWED BY:	JC
PROJECT:	R.M. OF WALLACE WASTEWATER LAGOON EAP
TITLE:	SILT FENCE, VALVE, VALVE MARKER, RIP RAP AND DITCH DETAILS
SCALE:	AS NOTED
DATE:	14/05/14
PLAN:	L6
SHEET:	6 of 6