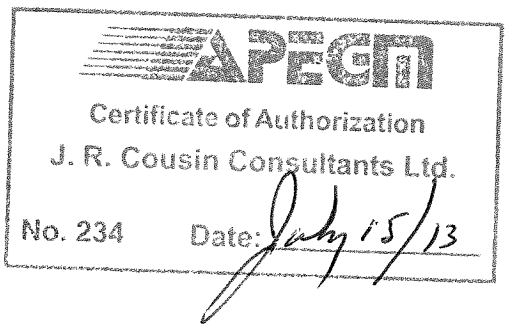
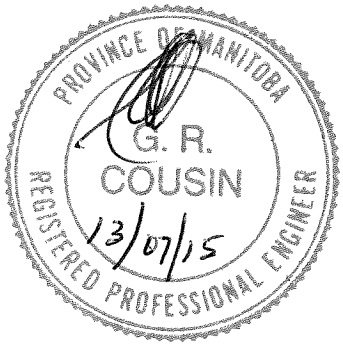
TOWN OF BEAUSEJOUR

Environment Act Proposal
for the
Wastewater Treatment Lagoon Expansion





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July 2013

ACKNOWLEDGMENTS

To prepare this report various sources of information were investigated and researched. J. R. Cousin Consultants Ltd. (JRCC) wishes to thank the Town of Beausejour who contributed to the data and content of this report.

REMARKS

J. R. 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

Name of the development:	TOWN OF BEAUSEJOUR - WASTEWATER TREATMENT LAGOON EXPANSION
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):	WASTEWATER TREATMENT LAGOON - CLASS 2 DEVELOPMENT
Legal name of the proponent of the development: TOWN OF BEAUSEJOUR	Mailing address: 639 PARK AVE, P.O. BOX 1028 BEAUSEJOUR, MB, R0E 0C0
Location (street address, city, town, municipality, legal description) of the development: SW 1/4 OF 12-13-07 EPM	
Name of proponent contact person for purposes of the environmental assessment: MR. JERRY COUSIN	
Phone: (204) 489-0474 Fax: (204) 489-0487	Mailing address: J. R. COUSIN CONSULTANTS LTD. 91A SCURFIELD BLVD WINNIPEG, MB, R3Y 1G4
Email address: JCOUSIN@JRCC.CA	
Webpage address: WWW.JRCC.CA	
Date: JULY 15, 2013	Signature of proponent, or corporate principal of corporate proponent: Printed name: JERRY COUSIN

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

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

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

Class 1 Developments $500
Class 2 Developments $5,000
Class 3 Developments:
Transportation and Transmission Lines.....$5,000
Water Developments $50,000
Energy and Mining.....$100,000

Submit the complete EAP to:

Director
Environmental Assessment and Licensing Branch
Manitoba Conservation
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:
Phone: (204) 945-7100
Fax: (204) 945-5229
Toll Free: 1-800-282-8069, ext. 7100
http://www.gov.mb.ca/conservation/eal

1.0 INTRODUCTION AND BACKGROUND

The development described herein is for an expansion of the wastewater treatment lagoon servicing the Town of Beausejour.

1.1 Introduction

The Town of Beausejour is proposing to expand the existing wastewater treatment lagoon servicing Beausejour. A lagoon expansion is required to accommodate the future proposed growth in the town. An Environment Act Licence is required from Manitoba Conservation for the construction and operation of the upgraded and expanded lagoon. J. R. Cousin Consultants Ltd. (JRCC) was retained for the related engineering services.

1.2 Contact Information

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R3Y 1G4
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Mr. Jack Douglas
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1.3 Background Information

Beausejour is located approximately 36 km northeast of Winnipeg at the intersection of PTH 12, PTH 44 and PR 302. The in-town residents and businesses, the out of town employees and the bussed-in students are currently the only contributors to the lagoon via a piped wastewater collection system.

The Town of Beausejour sewer collection system experiences high infiltration loading that results in hydraulic overloading of the lagoon. In the spring of 2010, the lagoon was operated with less than 0.3 m of freeboard and was in danger of overtopping the dikes. An emergency discharge was granted by Manitoba Conservation. A lagoon expansion is required to meet the design year 20 hydraulic loadings to the lagoon.

The lagoon is currently operated under Environmental Licence No. 1303 R, issued August 30, 1989 and Revised November 2, 2009. A minor alteration to the licence was authorized on

January 24, 2012 for the summer of 2012 on a trial basis. The minor alteration permitted discharge of the lagoon between May 15 and October 31 subject to meeting various conditions. One major condition being only one storage cell could be discharged at a time. The existing Lagoon Licence Clause 17 d) only permitted discharge between May 15 and June 15 and between September 15 and October 31, which was not sufficient for complete discharge of the lagoon cells.

It is requested that the typical hydraulic storage period for a facultative lagoon of June 15 - October 31 be permitted on the new licence with multiple storage cells permitted to be discharged at once.

1.4 Description of Previous Studies

A report entitled *Town of Beausejour Sewage Lagoon Site Expansion* by Reid Crowther & Partners Ltd. was completed in December of 1988 to assess the current and projected lagoon loadings for expansion of the Beausejour lagoon.

A report was completed by JRCC in July of 2011 entitled *Town of Beausejour Assessment of Sanitary Sewer Piping for Lift Station #4 and #6 Catchment Area*. The report assessed the heavy infiltration into the Beausejour sewer collection system and made recommendations to reduce infiltration to the sewer system.

A letter report was submitted by JRCC on March 25, 2011 and revised on April 4, 2011 entitled *Letter Report for Early Discharge of the Beausejour Sewage Lagoon*. The report outlined the projected loadings to the lagoon from March to May 15, 2011 and requested an early sewage lagoon discharge from Manitoba Conservation.

A report was submitted by JRCC in August of 2012 entitled *Town of Beausejour Wastewater Treatment Lagoon Expansion Feasibility Study*. The report outlined the conceptual design of the wastewater treatment lagoon expansion and discussed various options including aerated lagoon expansion options. Cost estimates for various options were included with the study.

2.0 DESCRIPTION OF THE DEVELOPMENT

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

2.1 Land Title/Location

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

The existing lagoon primary cells (#1 - 4) and the existing storage cell (#5) are located on the N ½ of 1-13-07 EPM. The existing storage cell #6 is location in the SE¼ of 12-13-07 EPM. The proposed lagoon expansion site is located in the SW ¼ of 12-13-07 EPM. The Town currently owns the existing lagoon sites as well as approximately 68 acres of land surrounding the existing storage cell #6. The Town recently acquired the land for the proposed lagoon expansion cells.

The certificate of title for the lagoon expansion site will be sent separately once available.

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 proposed development location. According to the Crown Lands & Property Agency, the mines and minerals and sand and gravel at the proposed lagoon site were originally granted to individuals in 1879 and the crown has no interests. Refer to the Crown Lands & Property Agency's February 22, 2012 correspondence, 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 lagoon site is currently being used for agricultural purposes. The site is bordered to the west and north by agricultural land, to the east by the existing lagoon storage cell #6 and agricultural land and to the south by PTH 12/44 (see Plan L1 in Appendix E).

Soil would be excavated in the area of the proposed lagoon expansion for construction of the lagoon dikes and drainage ditches. A lagoon access road to the new cells would be constructed from the existing service road north of PTH 12/44.

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 expansion site is zoned for public utilities, based on zoning designations in the RM of Brokenhead. The zoning regulation allows for collection of sewage, garbage or other waste.

2.4.1 Land Classification

According to the Agriculture and Agri-Food Canada Manitoba Agri-Map the proposed lagoon expansion site has a "fine" surface texture, a slope of "0 - 2%", "imperfect" soil drainage, "no significant limitations" of the soil capability for agriculture and "very low" risk of water erosion. According to the Canada Land Inventory Soil Capability for Agriculture map for the Selkirk region, the proposed lagoon expansion site is designated as Class 2W. Class 2 soils have moderate limitations that restrict the range of crops or require moderate conservation practices. Subclass W indicates soils with excess water other than from flooding which limits use for agriculture. The excess water may be due to poor drainage, a high water table, seepage or runoff from surrounding areas.

According to the Nutrient Management Regulation 62/2008, soils designated as Class 2 are part of water quality management zone N1. Because the site is located in water quality management zone N1, there are no restrictions for construction of a wastewater treatment lagoon.

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 environmental licence. Lagoon construction works are proposed to begin in the summer of 2014, dependent upon approval of funding. Commissioning and operation of the lagoon is proposed to begin upon completion of construction and after approval for use is obtained from Manitoba Conservation. No date for decommissioning has been set for the lagoon.

2.5.2 Basis for Proposed Lagoon Expansion Site Selection

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 site in relation to each of the guidelines is also provided in the table.

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

Manitoba Conservation Guideline	Proposed Relation to Site
1. Lagoons must be located a minimum of 460 m from any community centre, this distance is shown on Plan L1, attached in Appendix E.	The proposed new lagoon is located over 460 m from the nearest community centre (i.e. the nearest resident to the new lagoon cells).
2. 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 new lagoon is located over 460 m from the nearest resident.
3. Consideration should be given to sites in which prevailing winds are in the direction of uninhabited areas.	The prevailing winds are from the northwest. The lagoon is located north of the town. The new lagoon cells are located further from the town than the existing primary cells and existing storage cell #5.
4. Sites with an unobstructed wind sweep across the lagoon are preferred.	The lagoon site is in an open area (agricultural field).
5. Areas that are habitually flooded shall be avoided.	The proposed lagoon dikes would be constructed at the same elevation or higher than the existing lagoon. There have been no reports of flooding of the existing lagoon.
6. Sewage lagoons are to be designed and constructed such that the interior surface of the proposed lagoon is underlain by at least one metre of soil having a hydraulic conductivity of 1×10^{-7} cm/sec or less. In areas sensitive to groundwater contamination, a flexible synthetic liner may be recommended.	The in-situ soils are capable of achieving a consistent permeability of 1×10^{-7} cm/sec, if pockets of unsuitable materials are encountered, they will be replaced with re-worked and re-compacted high plastic clay.

Manitoba Infrastructure and Transportation was contacted regarding setbacks to the existing PTH 12/44. The department indicated the following:

- The 'controlled area' along PTH 12 in this location is established as 76.2m (250 feet) from the right-of-way limits. A permit is required from the Highway Traffic Board (HTB) for any construction within the control lines and for the change in use for the land.
- Any berm constructed as part of the lagoon expansion should be a minimum of 22.86 m (75 feet) from the PTH 12 right-of-way. This distance is measured from the right-of-way to the outside toe of the berm.
- If any pipes are proposed to cross Departmental roads (including PTH 12), JRCC should contact MIT's Regional Operations (Steinbach) to enter into an agreement.

The e-mail correspondence dated April 12, 2012 is attached in Appendix A.

The lagoon expansion cells will be located a minimum of 76.2 m from the edge of the right-of-way of PTH 12/44 and therefore a permit though MIT would not be required.

The lagoon expansion area is located beyond all setback distances required by Manitoba Conservation, therefore there are no expected concerns for the location of the expansion cells. Plan L1 in Appendix E, shows the minimum setback distance requirements for the expanded lagoon to the local residents and town.

2.5.3 Lagoon Drainage Route

The proposed expanded lagoon would follow the existing licensed discharge route to the Brokenhead River. The drainage route from the discharge pipe of cell #5 passes under PTH 12/44 through culverts and then flows through approximately 1,690 m of ditch in a north direction between the E and W ½ of 12-13-07-E. The existing storage cell #6 joins the discharge ditch approximately 800 m from the storage cell #5 discharge pipe location. The proposed new storage cells would join the discharge ditch approximately 500 m from the storage cell #5 discharge pipe location. The effluent then flows through approximately 840 m of ditch in a west direction on the south side of Mile Road 77 N, the discharge route then enters the Bachman Drain. The Bachman Drain runs north along the west side of Mile Road 41 E for approximately 3,290 m, the drain then crosses eastward under Mile Road 41 E and travels approximately 6,350 m east along Mile Road 76 N to the Brokenhead River. The total discharge route length from cell #5 to the Brokenhead River is approximately 12,950 m and the discharge route length from the proposed new storage cells to the Brokenhead River is approximately 12,450 m. The drainage route is shown on Plan L3 attached in Appendix E.

2.5.3.1 Fish Species Information

The Manitoba Conservation and Water Stewardship Fisheries Branch was contacted regarding any potential concerns with fish species along the drainage

route and in the Brokenhead River. The Fisheries Branch indicated nutrient loading has been identified as a major concern for the Brokenhead River waterbody, ensuring effluent from the lagoon meets or exceeds the Manitoba Water Quality Standards, Objectives and Guidelines is very important.

The Fish Inventory and Habitat Classification System (FIHCS) lists the common shiner, fathead minnow, central mudminnow and brook stickleback for the Bachman Drain. This indicates the Bachman Drain does support small bodied species with the potential to provide seasonal habitat for larger bodied species during spring.

The FIHCS lists the black bullhead, blacknose shiner, blacksided darter, brook stickleback, brown bullhead, burbot, carp, central mudminnow, chestnut lamprey, common shiner, fathead minnow, finescale dace, freshwater drum, hornyhead chub, Johnny darter, longnose dace, mimic shiner, northern pike, pearl dace, rock bass, shorthead redhorse, smallmouth bass, tadpole madtom, walleye, white sucker, yellow perch, stonecat, northern redbelly dace, brook trout, brown trout and rainbow trout for the Brokenhead River. The FIHCS also notes the general fisheries use is recreational angling and commercial net. The River was last stocked in 2003 with 300 18+ cm brook trout. Other species which have been stocked at the River are rainbow trout, walleye and smallmouth bass.

In 1991 the waterbody was rated with a Habitat Classification of 3 which has moderate limitations to the production of fish. Surplus nutrients from agriculture and nonpoint source were noted as limiting factors with a major concern as well as flow levels below optimum. Currently there are no special fishing regulations for the Brokenhead River.

Based on the above information the Fisheries Branch indicated the Brokenhead River provides habitat for a number of large and small bodied species either year round or for seasonal access for spawning, nursery and feeding.

Impacts to fish along the discharge route are unlikely as the lagoon effluent would be discharged after fish spawning has normally occurred and only when the treated effluent meets current Manitoba Conservation water quality guidelines for surface discharge including nutrient reduction.

See the March 12, 2012 email correspondence from Manitoba Conservation and Water Stewardship – Fisheries Branch.

2.5.3.2 Water Quality Information

Manitoba Conservation and Water Stewardship were contacted for water quality data in the Brokenhead River. Summarized water quality data from selected parameters are provided below. The water quality data is an average of all water quality testing done along the Brokenhead River between 1973 – 2013.

Table B: Average Water Quality in the Brokenhead River

Parameter	Average Concentration	Unit
Ammonia Dissolved	0.05	mg/L
Total Coliform	720	MPN/100mL
Fecal Coliform	230	MPN/100mL
Nitrogen Dissolved NO_3 & NO_2	0.16	mg/L
Nitrogen Total Kjeldahl (TKN)	1.1	mg/L
Biochemical Oxygen Demand	1.5	mg/L
Oxygen Dissolved	8.7	mg/L
Phosphorus Total (P)	0.096	mg/L
Conductivity (at 25C)	459	uS/cm
Total Suspended Solids (TSS)	22.7	mg/L
Turbidity	11.5	NTU

*Parameters below the detectable limit were assumed to be at the detectable limit for the purposes of averaging.

2.5.4 Access Road

The proposed new lagoon cells would be accessed by a road running off the existing service road on the north side on PTH 12/44. The existing service road terminates approximately 150 m from the lagoon. The road will run approximately 150 m east and 45 m north.

A new approach and truck turnaround is proposed to be constructed to access the upgraded pump system at the existing storage cell #5. The road will run approximately 55 m south from PTH 12/44 to the pump station building. The road will include a turnaround area for trucks.

2.5.5 Population Contributing Effluent

The current and future (design year 20) populations contributing effluent to the lagoon is discussed below.

2.5.5.1 Town of Beausejour Population on Piped Wastewater Collection System

The population contributing effluent to the Town of Beausejour lagoon was estimated based on historic census population data available from Statistics Canada from 1991 to 2011. The following table presents the population data with the annual growth rates for each time period. The average growth rate over the 20 year period from 1991 to 2011 is also presented.

Table C: Census population and annual growth rates for the Town of Beausejour

Year	Population	Annual Population Growth Rate (%)
1991	2,636	0.80
1996	2,712	0.58
2001	2,772	0.44
2006	2,823	0.37
2011	3,126	2.15
Average Growth From 1991 – 2011 (20 years)		0.93

Future growth in the Town will be based on the potential new lots that can be developed within the town boundaries. According to municipal officials there are 3 subdivisions with a total of 350 potential new lots for development within the Town boundaries. A standard occupancy rate for new developments of 3.5 people/residence will be used for the purposes of growth calculations. In total, 1,225 people can be expected to be added to the 2012 population. The growth will be assumed to occur over a 20 year period from 2012 to 2032. The current 2013 population will be estimated by applying the average growth rate from 2006 to 2011 to the 2011 population. The following table summarizes the current estimated population and design year 20 population.

Table D: Projected Beausejour growth rates from 2006 - 2032

Year	Population	Annual Population Growth Rate (%)
2011	3,126	-
2013	3,247	2.15
2032	4,419	1.64

The average annual growth rate from 2013 to 2032 is approximately 1.64% which is lower than the average annual growth rate observed from 2006 to 2011 of 2.15%. This lower growth rate is due to assuming 350 potential future new lots will be occupied within a 20 year period as indicated by municipal officials.

2.5.5.2 Town of Beausejour Population on Septic Tanks and Holding Tanks

According to a review completed by the Town of Beausejour on February 11, 2009, within the town boundaries there are 60 residential lots serviced by septic tanks connected to a low pressure sewer and seven lots serviced by holding tanks. The lots serviced by holding tanks consist of one residence and six commercial properties. All of these lots are serviced by the town water supply. It can be assumed that the resident on a holding tank will be serviced by the piped wastewater collection system in the future. The residents on septic tanks can be treated as residents on the gravity sewer wastewater collection system because all organic and hydraulic loadings from the residents are treated by the lagoon.

The wastewater production from the commercial holding tanks was evaluated and found to be 0.05% of the total wastewater sent to the lagoon. The wastewater from holding tanks was deemed negligible and not included in the future loading calculations.

2.5.5.3 Bussed-in Student Population

According to the Sunrise School Division Transportation Department there are approximately 700 rural students who are bussed into Beausejour for school. The transportation department notes that this number is an estimate. An equivalent full time resident occupancy factor of 1/3 was assumed for the bussed-in student population which results in a current equivalent population of 233 people. A growth rate of 0.5% was applied to the bussed in student population from 2013 to design year 20 (2032).

The design year 20 (2032) bussed in student population is assumed to be 774 students with an equivalent full time occupancy of 258 people.

2.5.5.4 Out of Town Employees

Beausejour is home to the Eastman region Manitoba Government building. Each Government department was contacted to determine the number of employees that work in Beausejour but reside outside of Town. The total number of commuter employees is 44 with an equivalent full time resident occupancy factor of 1/3 resulting in an equivalent full time population of 15 people. A growth rate of 0.5% was applied to the out of town employee population from 2012 to design year 20 (2032).

The design year 20 (2032) population of out of town employees is assumed to be 49 with an equivalent full time occupancy of 16 people.

No other populations are assumed to contribute wastewater to the Town of Beausejour lagoon.

A complete summary of the current population and projected year 20 population for the lagoon are shown in Table 1 attached in Appendix B.

2.5.6 Lagoon Loading

The required size of the lagoon is based on the projected year 20 population contributing wastewater to the lagoon. Hydraulic loadings to the lagoon were based on lift station hour meter readings from 2005 – 2011.

The current and future lagoon loadings are summarized in Table 1, Appendix B.

2.5.6.1 Organic Loading

The organic loading calculation is based upon the organics in typical residential wastewater. A value of 0.076 kg BOD_5/person/day was utilized to estimate the organic loading from the residents within the Town of Beausejour that are connected to the existing piped wastewater collection system.

The current daily organic loading is approximately 265.7 kg BOD_5/day (3,497 equivalent people x 0.076 kg BOD_5/person/day) from the Town of Beausejour residents serviced by the piped wastewater collection system.

The future daily organic loading is calculated to be 356.7 kg BOD_5/day (4,693 equivalent people x 0.076 kg BOD_5/person/day) from the residents serviced by the piped wastewater collection system.

2.5.6.2 Hydraulic Loading

The Town of Beausejour has significant infiltration into their gravity sewer system which results in a much higher per capita wastewater production rate than normal.

JRCC was provided the pump hour meter readings for lift station #1 and lift station #6 (the lift stations that pump effluent to the lagoon) from 2005 to 2011. Calculations were performed to determine the total effluent sent to the lagoon each year. Total water consumption from the WTP meters from 2005 to 2011 was also provided to compare to the total wastewater production. By subtracting the total water consumption from the total effluent production, the total infiltration from each year can be determined.

Table 2 attached in Appendix B, summarizes the total wastewater production, total water consumption and total infiltration from 2005 - 2011. The table also displays the values on a per capita basis. The population used in the per capita wastewater production calculations was for the permanent population of the Town of Beausejour only. The bussed-in students and out of town employee populations were not included. This does not affect the total hydraulic loadings to the lagoon only the calculated value for daily per capita loadings.

From the table, the average per capita water consumption from 2005 - 2011 was 357 L/person/day. The average per capita infiltration is calculated to be 198 L/person/day and the maximum per capita infiltration was 381 L/person/day in 2010. A "typical" infiltration rate used in design is approximately 15% of the water consumption. In this case the "typical" design infiltration rate would be 54 L/person/day based on the average water consumption rate of 357 L/person/day. The actual average infiltration rate observed from 2005 to 2011 of 198 L/person/day is approximately 3.7 times higher than the "typical" design value or 56% infiltration. The highest per capita infiltration rate was observed in 2010 at 381 L/person/day which is approximately 7.1 times greater than the "typical" design infiltration rate or 107% infiltration.

An Assessment of Sanitary Sewer Piping for Lift Station #4 and #6 Catchment Area was conducted by JRCC in May of 2011. The report made recommendations to reduce the infiltration in the Town, however, the extent of the reduction that can be achieved is not known.

Design of the wastewater treatment lagoon expansion will be based on using all available land at the proposed site for construction of facultative lagoon expansion cells. If all available space is utilized the maximum per capita wastewater production would be 511 L/person/day which results in an infiltration rate of 43% or 154 L/person/day.

The current average daily hydraulic loadings to the lagoon would be 1,659 m^3/day and the 230 day hydraulic storage requirements would be 381,620 m^3.

The design year 20 average daily hydraulic loadings to the lagoon would be 2,258 m^3/day and the 230 day hydraulic loadings would be 519,365 m^3.

2.5.7 Existing Lagoon Capacity

The following section summarizes the current organic and hydraulic capacities of the existing lagoon based on aerial photography and as built drawings. The inside walls of

the primary and storage cell dikes are assumed to have a slope of 4:1 and the invert of the discharge pipe in the storage cells is assumed to be located 0.3 m from the cell floor.

2.5.7.1 Existing Organic Capacity

The organic capacity of a wastewater treatment lagoon is dictated by the primary cell liquid surface area at an operating height from the cell floor of 0.75 m. The Beausejour lagoon has four primary cells and the total treatment capacity is the total surface area from all four cells, which is approximately 104,500 m^2. Based on a standard treatment capacity for a facultative lagoon of 56 kg BOD_5/ha/day, the lagoon is capable of treating 585.2 kg BOD_5/day. This treatment capacity corresponds to an equivalent population of 7,700 people based on a typical organic loading of 0.076 kg BOD_5/person/day.

2.5.7.2 Existing Hydraulic Capacity

The hydraulic capacity of a lagoon is determined by the total of the storage volume above a 0.75 m height in the primary cells and the total volume of the storage cell above the invert of the discharge pipe to the maximum liquid level. It is assumed that the discharge pipe elevation in the storage cells is 0.3 m above the cell floor elevation. The Beausejour lagoon has four primary cells and 2 storage cells. The total hydraulic capacity of the lagoon is calculated to be 281,440 m^3. Based on the average per capita wastewater production of 511 L/person/day the current lagoon is suitable for the hydraulic loadings of 2,394 people.

2.5.8 Expansion Cell Size Requirements

The existing lagoon is currently overloaded hydraulically. Lagoon expansion is required to meet both the current and future hydraulic storage requirements. Lagoon expansion cell requirements are described below.

2.5.8.1 Existing Facultative Primary Cells

The organic loading capacity of the lagoon primary cell exceeds the projected design year 20 organic loadings and therefore does not require expansion. The primary cells of the existing lagoon are capable of treating 585.2 kg BOD_5/day or an equivalent population of 7,700 people. This is 228.5 kg BOD_5/day or 3,007 people in excess of the projected design year 20 loadings to the lagoon.

2.5.8.2 Storage Cell for Facultative Wastewater Storage

The new lagoon storage cells will require a total storage of 237,925 m^3 based on a design year 20, 230 day hydraulic storage requirement of 519,365 m^3 and the existing storage of 281,440 m^3.

The new storage cells would require a total flat bottom area of approximately 192,086 m^2 (47.5 acres) based on a maximum liquid level in the cells of 1.5 m, 4:1 slopes for the inside and outside dikes and a 0.3 m invert height above the cell floor

Because of the large storage volume required, three new storage cells will be constructed to limit the size of each cell to reduce wave action in the cells. The sizes of the three new cells are as follows:

Table E: Summary of New Cell Sizes

Cell	Flat Bottom Area	Storage Volume
Cell #7 (south)	67,100 m^2	85,480 m^3
Cell #8 (north)	67,100 m^2	85,480 m^3
Cell #9 (west)	57,550 m^2	73,640 m^3
TOTAL NEW CELLS	**191,750 m^2**	**244,600 m^3**

The total storage volume in the new cells will be 6,675 m^3 greater than the design year 20 projected hydraulic loadings.

Manitoba Conservation was contacted regarding a deeper storage cell than 1.5 m. MB Conservation indicated that secondary storage cells deeper than 1.5 m would not be permitted unless aeration was added. The Beausejour lagoon expansion cells will have a 1.5 m deep liquid level.

2.5.9 Geotechnical and Topographic Investigation

As part of the feasibility study for the lagoon expansion completed by JRCC in 2012, three potential sites were investigated. The chosen site was deemed "Site C" during the site investigations. The following sections briefly describe the previous geotechnical investigation performed, background soils information and an in-depth description of the geotechnical soils investigation at the chosen site.

Site C was selected based on the available clay soils for an insitu liner and the land availability for purchase.

2.5.9.1 Existing Geotechnical Information

Previous Geotechnical Investigations by Others

A geotechnical investigation was performed by Dyregrov and Burgess Consulting Geotechnical Engineers for construction of storage cell #6 in November of 1988. 16 test holes were drilled within the northern half of the

SE¼ of Section 12-13-07E. The general soil stratigraphy found was a thin layer of organic topsoil over a lacustrine clay over a glacial till.

The report indicated that the silty clay and clay that existed on the site may be used to construct a suitable lagoon liner, however, not in their insitu state due to cracks, fissures, slickensides and other structural defects. The report recommended re-working and re-compacting the clay soils in thin lifts to form the horizontal lagoon liner. The report recommended a vertical cut-off wall extend below the defective clay to a depth of at least 2.4 m below the ground surface.

Five test holes were also excavated by UMA Engineering Ltd. in March of 1990 at the proposed storage cell #6 site. The average soil profile from the test holes was a layer of topsoil an average of 0.3 m thick followed by a layer of silty, fissured clay to a depth of 1.7 m followed by a layer of high plastic clay with some silt pockets observed to a maximum depth of 3.4 m followed by a silty till with sand and cobbles. The test holes were excavated to a depth between 1.6 m and 3.7 m below ground.

The existing storage cell #6 was constructed with a re-worked and re-compacted clay liner. Four constant head permeability tests were performed on samples from the re-worked and re-compacted clay liner after construction. The samples achieved permeabilities of 4.44×10^{-8} cm/sec, 4.15×10^{-8} cm/sec, 1.20×10^{-8} cm/sec and 2.33×10^{-9} cm/s. All four samples passed the Manitoba Conservation guideline of a hydraulic conductivity of 1×10^{-7} cm/s. This shows that the upper layer of silty clay soil is likely suitable for use as a re-worked and re-compacted clay liner.

Geotechnical Investigations by JRCC on Site A and B

A geotechnical investigation was performed on Site A located north and northeast of the existing storage cell #6 in the NE1/4 and SE1/4 of 12-13-7-E and site B located northwest of the existing storage cell #6 in the NW1/4 of 12-13-7-E. The following is a brief summary of the geotechnical investigation.

Based on the onsite geotechnical investigation of Sites A and B the general soil profile consisted of topsoil followed by a silty clay layer followed by a high plastic clay layer followed by a silty till layer. Based on laboratory Plasticity Index analysis the upper silty clay layer was shown to be not suitable for use as an insitu clay liner and additional laboratory analysis is required to determine if it is suitable for use as a re-worked and re-compacted lagoon liner. The high plastic clay layer beneath the silty clay was shown to be

suitable for use as an insitu clay liner. The silty till layer was shown to be not suitable for use as a clay liner. It is recommended that if a lagoon expansion cell was constructed on Site A, the layer of silty clay soils at the cell floor be re-worked and re-compacted to form the liner. If a lagoon was constructed on Site B, an insitu clay liner starting approximately 2.1 m from the ground surface may be possible with some risk of not meeting Manitoba Conservation guidelines.

GW Driller's Well Logs

Four driller's well logs from 12-13-7 E were reviewed. The well logs indicate the soil profile consists of varying layers of clay, silty clay and till underlain by limestone. The clay extended to an average depth of 5.5 m below the ground surface followed by 8.7 m of till, followed by limestone to a maximum recorded depth of 36.0 m.

The average static groundwater level recorded in the wells ranged from 1.5 m above the ground surface to 1.8 m below the ground surface with an average static water level 0.5 m below the ground surface.

2.5.9.2 Geotechnical Investigation of Proposed Site

The complete geotechnical and topographic investigation report from the proposed site is attached in Appendix C complete with test logs and a test hole location plan. The following section is a summary of the report.

Test Holes

Nine test holes (TH11 – TH19) were drilled at Site C, located west and south west of the existing storage cell #6 in the SW1/4 of 12-13-7-E, to determine the suitability of the soils for use as a clay lagoon liner on May 15, 2012.

The soil profile consisted of an average of 0.5 m of grey/black medium-high plastic clay with some silt and sand, organic from 0 m to 0.2 m. The following layer observed from an average of 0.5 m to 1.4 m was a brown, medium plastic silty clay with trace sand which was followed by a grey high plastic clay with trace silt from an average of 1.4 m to 3.7 m. The final layer was a grey/brown wet, soft, till with silt, sand, clay and trace gravel from an average of 3.7 m to the termination of the test holes at an average depth of 5.4 m.

Bedrock was not encountered in any of the test holes, however, all test holes with the exception of TH15 – TH17 were terminated due to auger refusal in dense, stony till. Caving of the test holes was observed in all test holes

immediately after drilling in the till layer, an average of 0.7 m from the bottom of the test holes.

Groundwater

Short-term groundwater conditions were assessed in each test hole by observing standing water elevations in the holes prior to backfilling. Some test holes were left open for a period of time to observe the short term water infiltration into the test holes. Standing water was observed in TH12, TH13, TH16, TH17 and TH19 at depths ranging from 2.1 m – 4.1 m below the ground surface with an average depth of 3.4 m. TH11 had a standing water elevation 2.4 m below the ground surface after being left open for approximately 4 hours. TH12 and TH16 had standing water elevations 1.2 m below the ground surface after being left for approximately 4 hours and 2 hours, respectively.

It is noted that the standing water observed in the test holes is likely from a confined groundwater aquifer in the wet till layer observed beneath the high plastic clay layer.

Laboratory Analysis

Five representative bagged soil samples, two Shelby tube samples and one bagged soil sample to be re-worked and re-compacted and tested for hydraulic conductivity were submitted to the National Testing Laboratories Limited (NTL) for analysis.

Laboratory classification analysis of the bagged soil samples indicated that three of the samples were CH (two deemed a fat clay and one deemed a fat clay with sand) and two samples were CL (one deemed a lean clay and one deemed a sandy lean clay). The Plasticity Index of the samples classified as CH varied between 34 and 57 and the percentage of clay varied between 51.8% and 91.0%. The Plasticity Index of the samples classified as CL varied between 12 and 31 and the percentage of clay varied between 36.1% and 49.4%. Based on past experience, the laboratory has commented that homogeneous soils with a plasticity index greater than 25 and a clay content greater than 50% would typically be expected to have a hydraulic conductivity of 1 x 10^{-7} cm/sec or less. Plasticity Index analysis (i.e. Atterberg limits) of the soils indicated that all of the bagged soil samples deemed a CH were considered to have potential for use as an insitu clay liner or a re-moulded and re-compacted clay liner.

The sample from TH14 0.6 – 1.5 m (CL) was deemed suitable for use as an insitu liner or when re-worked and re-compacted based on an undisturbed

Shelby Tube sample taken in the same layer which achieved a hydraulic conductivity of 4.9 x 10^{-8} cm/sec. The sample from TH14 4.6 - 5.5 m (CL) was deemed not suitable for use as a lagoon liner insitu or when re-worked and re-compacted.

Two Shelby tube samples (TH14 0.8 - 1.4 m and TH14 2.1 - 2.7 m) were submitted to NTL to determine the insitu hydraulic conductivity for potential use as a lagoon liner. The samples achieved hydraulic conductivities (k_{20}) of 4.9 x 10^{-8} cm/sec and 1.5 x 10^{-8} cm/sec, respectively. Both Shelby tubes had hydraulic conductivities lower than the Manitoba Conservation requirement of 1 x 10^{-7} cm/sec and are therefore deemed suitable for use as an insitu clay lagoon liner.

A bagged soil sample from the silty clay layer, TH16 0.6 - 1.5 m was re-worked and re-compacted and tested for hydraulic conductivity. The sample achieved hydraulic conductivity (k_{20}) of 1.2 x 10^{-8} cm/sec, which is lower than the Manitoba Conservation requirement of 1 x 10^{-7} cm/sec. This shows the soil layer is suitable for use as a re-worked and re-compacted clay lagoon liner.

Lagoon Liner

Based on the laboratory plasticity analysis all the soil layers had potential for use as an insitu clay lagoon liner or when re-worked and re-compacted with the exception of the till layer found an average of 3.7 - 5.4 m below the ground surface.

The grey high plastic clay layer observed from an average of 1.4 - 3.7 m below ground was deemed suitable for use as an insitu clay liner by Plasticity Index analysis and was confirmed by the Shelby tube sample from TH14 2.1 - 2.7 m that achieved a hydraulic conductivity of 1.5 x 10^{-8} cm/sec.

A similar layer of high plastic clay was tested during the previous geotechnical investigation at Site A and was deemed suitable for use as an insitu liner. This was confirmed by the Shelby tube sample from TH3 1.8 - 2.4 m, which achieved a hydraulic conductivity of 1.1 x 10^{-8} cm/sec.

The top elevation of the high plastic clay layer at Site C varied from 1.1 to 1.8 m below the existing ground surface and extended to between 2.7 to 4.6 m below the ground surface. The total thickness of the high plastic clay layer varied from 1.7 m to 3.0 m thick.

The final elevation of the cell floor would have to be maintained a maximum of 1.1 m below the existing ground elevation so the high plastic clay layer is

not reduced in thickness. If during construction test holes revealed the high plastic clay layer was less than 1.0 m thick in some locations due to the till layer extending higher than observed in the test holes, the area would have to be excavated to 1.0 m below the cell floor elevation and replaced with high plastic clay soil from a borrow area.

Overburden soils below the organic topsoil could be used for the inner and outer dike construction and high plastic clay soils from a borrow pit could be excavated and re-compacted and re-worked to construct the vertical cut-off walls which would tie-in a minimum of 1.0 m into the horizontal clay liner observed to be an average of 1.4 m below the ground surface.

The clay soils 1.0 m below the cell floor elevation under the inside dike slope would be re-worked and re-compacted to ensure the hydraulic conductivity requirements are met.

2.5.9.3 Topography of Site C

A topographic GPS survey of the test hole locations and existing ground across the proposed lagoon expansion Site C was completed on May 15, 2012 along with the geotechnical investigation. The existing ground at the proposed expansion site was a relatively flat agricultural field. From the topographic survey data, the existing ground elevations varied from 238.76 m to 239.71 m with an average elevation of approximately 239.16 m. No drainage ditches or other topographic features were observed on the site.

2.5.10 Upgraded Pump Station and Forcemain

Currently wastewater from cell #5 is discharged into a 1,500 mm precast concrete manhole via a 250 mm pipe from cell #5. From the manhole the effluent can be discharged by gravity through a 250 mm pipe to the discharge ditch or pumped via a 150 mm forcemain to cell #6. According to Town personnel effluent can flow by gravity to cell #6, however the flow rate is very low. There is currently one Flygt Model # 3085.181, 1.8 kW (2.4 Hp) submersible pump to direct liquid to cell #6. According to town officials the pump has an actual pumping rate of approximately 15.8 - 18.9 L/s (250 - 300 gal/min). This results in approximately 30 days to fill cell #6. With the construction of the new expansion cells the pumping capacity will be increased by installation of a new pumping system.

A tee connection would be added to the existing forcemain from cell #5 to cell #6 and piping would be installed into the proposed new storage cell #7. A valve would be installed north of the tee connection and on the piping to the new cell. This way flow could be controlled between the new storage cells and the existing storage cell #6.

The existing forcemain from cell #5 to cell #6 is a 720 m long 150 mm polyethylene series 60 pipe.

A Flygt NP 3153.181, 11.2 kW (15 Hp) pump with a 217 mm impeller would be installed with a duty point at approximately 40 L/s (634 gal/min) at a head of approximately 15.5 m (22 psi). This would provide sufficient flow through the existing forcemain to fill cell #6 and the proposed new cells (a combined volume of 306,345 m^3) in approximately 87 days. If in future a second 150 mm pipe was installed to run in parallel with the existing forcemain the same pump would operate at approximately 85 L/s (1,350 gal/min) at a head of approximately 8.5 m (12 psi). This would result in a fill time for cell #6 and the proposed new cells of approximately 41 days.

Currently the pump station is serviced by single phase power, however, the proposed new pump would require three phase power. According to local Manitoba Hydro personnel 3 phase power lines exist on the north side of PTH 12/44 and would be brought to the pump station during construction.

The upgrades to the pump station would include a simplex control panel complete with stands, millitronics and a float back-up, a submersible mag meter with remote reading and a lifting davit and cable for removing the pump. A second stand-by pump was also included in the budget capital costs.

A building would be constructed near the existing pump station to house the required new pumps and electronics. The building would also house the chemical addition system for phosphorus reduction as described in the next section.

2.5.10.1 Additional Building Requirements for Phosphorus Reduction

As discussed in Section 2.5.11.2, a chemical feed system will be installed for reduction of phosphorous. The chemical storage tank and chemical feed system will also be housed in the pump building located near the existing storage cell #5.

The chemical feed system would mix alum with the wastewater coming from the primary cells. The wastewater would then either be directed by gravity to the existing cell #5 or pumped to the north side of PTH 12/44 to the existing storage cell #6 and the proposed storage cells #7 - 9.

The building will store the mixing manhole/pump chamber, chemical storage tanks and chemical feed system.

A cross section of the existing primary cells to the proposed manhole and the existing forcemain is shown on Plan L6 attached in Appendix E.

2.5.11 Lagoon Regulatory Requirements

2.5.11.1 Province of Manitoba Design Objectives

The Province of Manitoba Design Objectives for Standard Sewage Lagoons is used as a guideline in the layout and design of the lagoon.

Organic Loading

Although a lagoon operates at various organic efficiencies throughout the year an average organic treatment rate of 56 kg BOD_5/ha/day at 0.75 m depth in the primary cell has been utilized.

Hydraulic Loading

The lagoon cannot be discharged between November 1 and June 15 (230 day winter storage period) per current guidelines. 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 volume from the invert of the discharge pipe (0.3 m) to the maximum liquid level (1.5m).

Lagoon Liner

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

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, for discharged effluent. The effluent standards specific to Beausejour lagoon would be:

- 200 fecal coliforms/100 mL or 200 E. coli/100 mL
- 25 mg/L BOD
- 25 mg/L TSS
- 1 mg/L Total Phosphorus.

2.5.11.2 Nutrient Management Regulations and Testing

New nutrient reduction guidelines were released in the *Manitoba Water Quality Standards, Objectives, and Guidelines,* November 28, 2011. The

regulations include province wide standards for phosphorus reduction and where site-specific conditions warrant, nitrogen reduction. Under the new nutrient standards, a 1.0 mg/L phosphorus limit immediately applies for all new, expanding or modified wastewater treatment facilities. 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 mg/L phosphorus limit. Nutrient reduction strategies include, but are not limited to, effluent irrigation, trickle discharge or constructed wetlands.

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 document 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 Town of Beausejour lagoon is sized to treat the wastewater of 4,693 equivalent full time residents and therefore it is expected that with a new environmental license the phosphorus reduction guideline will apply and the nitrogen reduction guideline will not.

A phosphorus testing program was developed and results of the testing is described below

Phosphorous Concentrations in the Existing Lagoon

A nutrient sampling and testing program was developed for the existing Beausejour lagoon. The nutrient concentration of the lagoon wastewater was tested on an approximately monthly basis with samples taken from the primary cell #1 and the primary cell #4. Two samples (A and B) were taken from each location. The total phosphorous concentrations found in the cells are summarized in the following table.

Table F: Phosphorous Concentrations in the Existing Lagoon Primary Cells

Location	Total Phosphorus Concentration (mg/L)			
	Nov 15/2011	**February 23/2012**	**April 16/2012**	**May 23/2012**
Cell 1-A	3.63	7.08	4.05	3.48
Cell 1-B	0.50	8.22	4.10	3.53
Average Cell 1	**4.32**			

Location	Total Phosphorus Concentration (mg/L)			
	Nov 15/2011	February 23/2012	April 16/2012	May 23/2012
Cell 4-A	0.85	9.02	4.26	1.60
Cell 4-B	0.89	8.95	4.03	1.55
Average Cell 4	**3.89**			

Total phosphorus testing was continued during spring the spring and fall discharges of 2012 from storage Cell #5 and Cell #6. Testing was completed prior to discharge and once per week during discharge. A total of eight tests were completed from each cell from April 24 - October 29 of 2012. A summary of the phosphorus test results during discharge are shown on the following table.

Table G: Phosphorous Concentrations in the Existing Lagoon Storage Cells

Date	Cell #	Total Phosphorus	Unit
24-Apr-12	Cell 5	3.99	mg/L
18-May-12	Cell 5	1.37	mg/L
23-May-12	Cell 5	1.15	mg/L
23-Jul-12	Cell 5	1.82	mg/L
30-Jul-12	Cell 5	2.22	mg/L
24-Sep-12	Cell 5	0.817	mg/L
12-Oct-12	Cell 5	4.61	mg/L
17-Oct-12	Cell 5	1.93	mg/L
AVERAGE	**Cell 5**	**2.24**	**mg/L**
24-Apr-12	Cell 6	1.53	mg/L
30-May-12	Cell 6	2.63	mg/L
04-Jun-12	Cell 6	2.74	mg/L
11-Jun-12	cell 6	2.97	mg/L
18-Jun-12	Cell 6	1.3	mg/L
17-Sep-12	Cell 6	1.35	mg/L
23-Oct-12	Cell 6	3.5	mg/L
29-Oct-12	Cell 6	2.03	mg/L
AVERAGE	**Cell 6**	**2.26**	**mg/L**

Based on the results of the testing phosphorous reduction measures will be implemented for the Beausejour lagoon. The average phosphorus concentration in primary cell #4 is lower than primary cell #1 showing there may be some natural phosphorus reduction within the primary cells. The average phosphorus concentration in the storage cells is lower than the primary

cells showing there may be some natural phosphorus reduction in the storage cells as well.

Full test results from the primary cell samples completed by ALS Laboratories Ltd. and Maxxam Laboratories are attached in Appendix D.

Based upon the new guidelines and the nutrient testing program results, the following options were considered to address nutrient management, with particular emphasis on phosphorus reduction for the Beausejour lagoon.

2.5.11.3 Phosphorus Reduction Options Investigated

The following section summarizes the various options for phosphorus reduction in the Beausejour lagoon that were investigated.

Phosphorus Reduction by Surface Chemical Treatment

This option involves application of chemicals such as alum or ferric to wastewater in the storage cells to reduce the level of phosphorus in the treated effluent, if prior to discharge the phosphorus concentration in the wastewater is found to be greater than 1.0 mg/L. The chemical would have to be broadcast onto the surface of the storage cells utilizing a gas driven pump and spray system from the top of the dike, or from a boat on the surface of the storage cell. Mechanical mixing with the propeller of a boat would be required to obtain adequate contact between the chemical and the wastewater. With mixing, the alum or ferric creates flocculation of the turbidity and phosphorus which results in settlement to the bottom of the lagoon cell. The effluent can then be discharged from the storage cell with a reduced level of phosphorus. This option could possibly be used for the Beausejour lagoon to obtain a phosphorus upper limit of 1.0 mg/L. The phosphorus level in the treated effluent must be tested after application of the chemical and if the phosphorous is not at or below 1.0 mg/L, spreading of the chemical on the storage cell surface may have to be repeated. Based on the large surface area of the storage cells, this option may be expensive and additional studies would have to be completed to determine the effectiveness of the chemical addition to estimate required loading rates.

This methodology would be very operator intensive and would be logistically difficult to complete. With this phosphorus reduction methodology the chemical will have to be overdosed by approximately two or three times to achieve the required phosphorus reduction as it is difficult to control the amount of chemical provided, the mixing will be inefficient and the required chemical dosage is difficult to determine.

Phosphorus Reduction by Chemical Addition, Pumping and Settling

Phosphorus in the Beausejour lagoon could be reduced by alum or ferric addition in a manhole between the primary cells and the storage cells. The chemical would mix with the wastewater in a manhole and form flocs which would settle to the bottom of the storage cells as sludge. Nelson Environmental recommends a minimum hydraulic retention time in the mixing manhole of two minutes. Typically this methodology of adding chemical is utilized with up-flow sand filters to filter out the phosphorous, without the filters the effectiveness of this methodology is not well known. Since the Manitoba Conservation guidelines have only recently been introduced few if any facultative lagoons in Manitoba are equipped to reduce phosphorous.

A pipe could be installed from the primary cells to the upgraded pumping station so that the chemical could be added to the wastewater in the mixing manhole. From the manhole, the wastewater mixed with chemical could be sent to the existing storage cell #5, the existing storage cell #6 or the new facultative cells. This way phosphorus settling could occur in the storage cell #5 as well as the existing and proposed cells north of PTH 12/44. A building would be required at the upgraded pump station to house the chemical feed tank and equipment as well as the upgraded pumping system. The building would have to be heated as alum and ferric must be maintained at a minimum of 20^{o}C to avoid difficulties with pumping. Plan L6, in Appendix E, shows a cross section of the gravity sewer pipe that would have to be installed from the existing primary cell #4 to the proposed building.

Once the system is operational, the rate of chemical addition can be altered based on phosphorous test results in the primary cells. If the chemical feed system is unsuccessful at consistently reducing the total phosphorous concentration to 1.0 mg/L, surface spreading of chemical may also be required on a case by case basis or a filtration system may be installed as described in the next section.

The amount of chemical required to reduce phosphorus to 1.0 mg/L with this methodology would be much less than by surface application because the chemical can be added to the effluent at a controlled dosage rate with better mixing and adjusted based on experimental test results.

Phosphorus Reduction by Filtration

A chemical addition and filtration system could be utilized to reduce the phosphorus concentration in the lagoon. The effluent could be pumped from the storage cells to a filtration building and filtered through a continuous backwash sand filter or a cloth disk filter. A chemical flocculent such as alum

or ferric 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 settles out into sludge. The sludge can accumulate in the lagoon for approximately 20 - 25 years and then will have to be removed.

This level of treatment is costly as equipment and housing in a high building is required as well as operating costs and chemical costs.

This methodology would add significant cost to the project.

Phosphorus Reduction by Constructed Wetlands

Constructed wetlands are used to polish treated effluent from a lagoon, and have the potential to provide nutrient reduction. However, they can require large land areas for construction, have increased odour potential, can favour mosquito breeding (due to vegetation type, very shallow effluent, and minimal wind action), can cause higher *E. coli* concentrations due to increase wildlife including mammals, waterfowl, reptiles and amphibians and add cost to the project. In addition, the use of constructed/engineered wetlands requires further investigation regarding their effectiveness under climatic conditions in Manitoba. While some natural wetland plant species exist in the existing discharge ditches, they would need to be maintained to ensure the proper plant species are present and possibly harvested on occasion to remove the nutrients from the system. Due to the uncertain effectiveness of the system, the large land area required and the increased cost, the use of constructed/engineered wetlands for the Beausejour lagoon was not considered feasible.

Public Awareness

In conjunction with nutrient reduction methods through treatment, preventative measures can also be taken to reduce nutrients in the wastewater influent. As the majority of the influent to the Beausejour lagoon would be residential in nature, the Town is encouraged to inform residents and schools in the community of nutrient reducing strategies, such as using non-phosphate based soap and cleaning products for domestic use and composting food waste instead of using a garburator. This would reduce the amount of phosphorus being released into the lagoon and reduce the requirements for treatment.

2.5.11.3 Phosphorus Reduction Option Selected - Chemical Addition, Pumping and Settling

The selected phosphorus reduction option is chemical addition, pumping and settling in the storage cells. A building would be constructed around the expanded pump station to house the pumping equipment controls and the

chemical feed tank and related equipment. Chemical dosage can be adjusted based on laboratory test results from the storage cells.

The sludge containing the phosphorus would accumulate in the lagoon cells and require removal after approximately 20 - 25 years. Based on file data, facultative lagoons in Manitoba without phosphorus reduction systems have some natural phosphorus reduction by settling in the lagoon. With the chemical addition and settling system, additional phosphorus will bind with the alum and settle out. When sludge is removed from the lagoon, some of the phosphorus would likely remain bound to the alum in the sludge potentially causing difficulty for plant uptake if the sludge was land applied. However, the sludge would also contain the phosphorus not chemically bound which would be available for plant uptake. At the time of sludge removal, the best practice technology for use of nutrients, organic matter and energy will be reviewed and evaluated.

2.5.12 Summary of Selected Design Criteria

A list of design parameters pertinent to the new lagoon expansion cells is provided below:

- A design year 20 (2032) total equivalent population of 4,693 people including Town residents, bussed-in students and commuter employees.
- A design year 20 (2032) organic loading of 356.7 kg BOD_5/day
- A average per capita water consumption of 357 L/person/day and an infiltration rate of 154 L/person/day (43%) for a total wastewater production of 511 L/person/day
- An average daily hydraulic loading of 2,258 m^3/day resulting in a 230 day storage requirement of 519,365 m^3
- An organic capacity in the existing primary cells (#1-4) of 585.2 kg BOD_5/day which corresponds to an equivalent population of 7,700 people
- An existing hydraulic capacity in the top half of the primary cells (#1 - 4) and the total usable volume of the storage cells (#5 and #6) of 281,440 m^3
- Maximum liquid level in the new storage cells of 1.5 m
- Construction of three new facultative storage cells with a combined hydraulic storage volume above of 244,600 m^3
- Use of the existing discharge route to the Brokenhead River
- An allowable discharge period of June 15 – October 31 with multiple storage cells permitted to be discharged at once

- Extension of the service road north of P.T.H. 12/44 to access the new cells
- Construction of a building to house an upgraded pump system and a chemical storage and feed system for phosphorus reduction
- Construction of a barbed wire fence around the new storage cells
- A discharge pipe invert of 0.3 m above the floor of the new storage cells
- A minimum 1.0 m thick insitu clay liner
- A 3.0 m wide vertical cut-off wall constructed with re-worked clay soils will extend a minimum of 1.0 m into the horizontal clay liner and extend to the top of dike elevation
- The soils 1.0 m below the inside dike slope from the cell floor elevation to 1.0 m below the cell floor elevation will be re-worked and re-compacted to reduce the risk of removing the dike if Manitoba Conservation guidelines are not met from the insitu clay liner
- Valve markers will be installed at the new discharge and intercell pipe locations.

2.5.13 Lagoon Construction Details

2.5.13.1 General, Conceptual Liner Design and Construction Techniques

Conceptual plans for the new lagoon expansion cells are provided in Appendix E.

Prior to construction of the new storage cells, the topsoil would be removed from the expansion area and stockpiled. Approximately 50% of the outside of the dike is permitted to be constructed with topsoil. The topsoil will also be used as dressing on the dikes and perimeter ditches. The new storage cell would be excavated to the cell floor elevation. The surface of the cell floor would be scarified to a depth of 150 mm and compacted once final grades are met.

The clay soils from 1.0 m below the cell floor elevation under the inner dike side slopes would be excavated and re-worked and re-compacted with a sheepsfoot roller to 95% Standard Proctor Density on a maximum 150 mm (6”) compacted lift. A limited range of moisture content will be permitted. 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 and material too dry shall be wetted.

The vertical cut-off walls will be constructed with excavated clay soils from a borrow pit. The cut-off wall will extend from the top of dike elevation to an

elevation 1.0 m below the top of the high plastic clay soil. This high plastic clay soil was found to start at an average depth below ground of 1.4 m. The vertical cut-off wall will be construction with similar construction techniques as the re-worked and re-compacted potion of the horizontal liner, as described above.

The new storage cell bottom will be 2.5 m lower than the top of dike. The inner and outer dikes would be constructed at 4:1 slopes. A new discharge pipe will be installed in each of the new storage cells at an elevation 0.3 m above the cell floor. Rip rap would be installed at the intercell and discharge piping locations. Silt fencing would be placed along the discharge ditch which runs between the west and east ½ of 12-13-07 E. Perimeter ditches would be constructed surrounding the new lagoon cells. Upon completion of construction, the excess topsoil that was stripped off the new cell area would be placed on the outside of the dikes and the area would be seeded. A new barb wire fence surrounding the lagoon expansion cells would be constructed.

2.5.13.2 Construction Details

All topsoil would be removed to a depth of approximately 200 mm from the entire new cell areas.

Construction of lagoon liner (cell bottom and cut-off walls) would be in accordance with the following specifications:

1. The liner shall be constructed of clay;
2. The liner shall be at least one metre in thickness;
3. The liner shall have a hydraulic conductivity of 1 x 10^{-7} cm/second or less at all locations;

Prior to placement of the embankment material and liner material to be compacted, the foundation would be scarified to a depth of 150 mm (6 in.) compacted with a minimum of eight passes of a sheepsfoot roller. Complete foundation preparation shall be approved by the Engineer before any embankment or liner material is placed. Embankment (both common topsoil and relatively impermeable soil) and liner material (high plastic clay soil), would be compacted with a minimum of eight passes of a sheepsfoot roller on a 150 mm (6 in.) compacted lift. The lagoon bottom will be graded to a tolerance of ± 50 mm (2 in.).

The lagoon construction specifications would 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 would not be less than 1,200 mm (4 ft.).

Each roller would 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 foot would be at least 200 mm (8 in.) long and would have a minimum foot area of at least 4,500 mm^2 (7 sq. in.).

A limited range of moisture content would be permitted. 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 (2 in.).

The specifications would state that the dikes and embankment are to be seeded with a grass such as brome.

The outer slope and perimeter drainage system would prevent surface drainage from entering into the lagoon and the ponding of surface drainage around the perimeter of the lagoon.

2.5.14 Lagoon Maintenance

Maintenance of the expanded lagoon will include:

- Maintaining the fencing, gate and lock
- Ensuring the gate is locked at all times and only the local septic haulers and Town Public Works department have access to the site
- Refilling phosphorus reduction chemical at the pump station and adjusting dosage rates based on laboratory testing of the lagoon effluent
- Maintaining the upgraded pumping system from the primary cells to the storage cells
- Maintaining the intercell and discharge piping and valves
- Maintaining grass cover on dikes to a height of no more than 0.3 m in height
- Maintain a program to prevent and remove burrowing animals
- Clearing of snow from the lagoon approach and truck turnaround.

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. During the summer the lagoon would be aerobic at the surface, facultative in the middle and anaerobic at the bottom. Minimal to no treatment would occur in the winter due to the ice cover on the surface; the treatment process would predominantly be anaerobic during winter. 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.

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 as the construction area will meet the minimal setback distances from residences.

Environmental management practices to mitigate the above potential impacts to the air are provided in Section 4.1 of this report.

3.1.2 Water

Pollutants that may be released into surface and ground water during the operation of the lagoon include coliforms, organic wastes, suspended solids, and other materials that are typically disposed of into the sewer system in the Town of Beausejour. Pollutants in the wastewater are expected to be residential in nature.

Pollutants that have a potential to be released into the surface or ground water during the lagoon upgrade 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 cells. Effluent discharged from the lagoon would flow through ditches to the Bachman Drain and eventually reach the Brokenhead River. There is also potential to impact surface water via sedimentation from soil erosion in the discharge stream during the construction works.

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

Groundwater

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

Environmental management practices to mitigate the above potential impacts to water are provided in Section 4.2 of this report.

3.1.3 Land

The land would be significantly altered by construction of the new lagoon dikes and perimeter ditching. Fencing would be installed around the perimeter of the new lagoon cells.

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

Disturbed areas can be impacted through soil erosion if not covered or re-vegetated. Environmental management practices to mitigate the above potential impacts to the land are provided in Section 4.3 of this report.

3.2 Wildlife

The proposed lagoon site is located in the “Interlake Plain” Ecoregion of Canada. Characteristic wildlife includes white-tailed deer, black bear, moose, beaver, coyote, snowshoe hare and eastern cottontail. The ecoregion also includes habitat for waterfowl and other colonial birds including cormorant, gull, tern, horon, American white pelican and grebe.

The Manitoba Conservation Data Centre was contacted regarding the proposed lagoon project and indicated that there were no occurrences of rare species at the proposed lagoon expansion site in their database. Refer to the Manitoba Conservation Wildlife and Ecosystem Branch, February 24, 2012 email correspondence, attached in Appendix B.

Impacts to wildlife and wildlife habitat are not expected, as the lagoon expansion is to be located on agricultural land which is regularly disturbed by farming activities.

3.3 Fisheries

Impacts to fish along the discharge route are unlikely as the lagoon effluent would be discharged after fish spawning has normally occurred and only when the treated effluent meets current Manitoba Conservation water quality guidelines for surface discharge including nutrient reduction.

3.4 Forestry

There are no potential impacts to forestry as the area of lagoon expansion has been previously cleared due to agriculture and no forestry areas would be impacted.

3.5 Vegetation

Characteristic vegetation in the Interlake Plain ecoregion is classified as being closed cover of tall to low trembling aspen with secondary quantities of balsam poplar, an understory of tall shrubs, and a ground cover of mixed herbs. White spruce and balsam fir are the climax species but are not well represented.

Manitoba Conservation Wildlife and Ecosystem Protection Branch was contacted regarding occurrences of rare or endangered vegetative species in their database at the proposed lagoon expansion site. There were no occurrences of rare species identified at the development site. Refer to Manitoba Conservation Wildlife and Ecosystem Protection Branch email correspondence dated January 9, 2013, attached in Appendix B.

No significant impacts to vegetation in the development area are anticipated, as the site is currently agricultural land which is disturbed regularly through farming activities.

3.6 Noise Impacts

There is a potential for noise impacts in the immediate area due to the heavy equipment utilized during construction. Mitigation measures described in Section 4.4 below will be in place during the construction works. Other than maintenance vehicles (for lagoon effluent sampling or mowing grass) or septic 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. Mitigation measures described in Section 4.5 below will be in place during the construction works.

3.8 Heritage Resources

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. Refer to the Manitoba Historic Resources Branch March 7, 2012 memorandum, in Appendix B.

While impacts to historic or heritage resources are not expected at the site, there is a potential for an unexpected discovery when excavating an area which has not previously been excavated. Mitigation measures described in Section 4.6 below will be in place during the construction works.

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. In addition the community would have increased wastewater capacity upon completion of the project, which will encourage future development and growth in the community.

3.10 Aesthetics

The lagoon expansion is not expected to have adverse impacts on the general aesthetics of the area, as the lagoon construction would occur adjacent to the existing lagoon cells.

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

The existing primary cell is currently oversized by approximately 55% and in design year 20 is projected to be oversized by approximately 40%. The organic loading rate will affect the odours generated from a wastewater treatment lagoon during peak organic loading. Nuisance odours are typically a result of organic over-loading. With an oversized primary cell the organic loading rate will be much lower than permitted by Manitoba Conservation and therefore odour nuisance is 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 odours to drift toward the town, as Beausejour is located south and southwest of the lagoon. Also, the new storage cells will be located further from the Town than the existing primary cells and storage cell #5. Furthermore, the proposed lagoon upgrade would be located a minimum of 460 metres from the nearest resident, as required by Manitoba Conservation.

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

4.2 Mitigation of Impacts to Water

4.2.1 Surface Water

Impacts to surface water from discharge of lagoon effluent are not expected, as the lagoon effluent would not be discharged unless Tier I Manitoba Water Quality Standards, Objectives and Guidelines are met, as follows:

1. The organic content of the effluent, as indicated by the five day biochemical oxygen demand would not be greater than 25 mg/L
2. The total suspended solids would not be greater than 25 mg/L
3. The fecal coliform content of the effluent, as indicated by the MPN index would not be greater than 200 per 100 ml of sample, or Escherichia coli content not greater than 200 per 100 ml of sample
4. The total phosphorus content of the effluent would not exceed 1 mg/L.

Erosion from excess material stockpiles would be prevented by the use of silt fencing at drainage locations and by either covering the soil stockpiles or seeding with grass. Clean rock (free of fine materials) from an appropriate land-based source would be utilized to eliminate occurrence of erosion at the lagoon discharge outlet. Silt fencing would be installed in the perimeter ditching during construction and should remain in place until grass growth is established. 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 specification should state wording similar to the following:

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

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.

There would be no impacts to navigation as a result of the lagoon project, as the discharge route to the Brokenhead River is not a navigable body of water. If flooding

occurs along the drainage route, the Town must not discharge the lagoon. The discharge should not cause or contribute to flooding in or along the drainage route.

4.2.2 Groundwater

Seepage of effluent from the lagoon is unlikely to affect groundwater as the new lagoon storage cells would utilize a clay liner, having a hydraulic conductivity of 1×10^{-7} cm/sec or less, as required by Manitoba Conservation guidelines.

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 in Section 4.2.1 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 during construction, 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 dikes would be constructed with a 4:1 slope and the dike tops, outside slopes and soil stockpiles would be seeded with grass. The discharge outlet location would be covered with rip-rap to eliminate soil erosion into the ditch during discharge events.

4.4 Mitigation of Noise Impacts

To minimize the potential for noise impacts, specification should indicate that construction equipment and transport vehicles should have mufflers working properly, and construction activities should be limited to daylight hours only.

4.5 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.

4.6 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 Town, Manitoba Historic Resources Branch and any other authority as may be required.

5.0 RESIDUAL AND CUMULATIVE EFFECTS

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

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

6.0 MONITORING AND FOLLOW-UP

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

Monitoring of the lagoon operation is to be conducted by a trained lagoon operator, who is to ensure the lagoon is operated under the requirements of the 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 discharge, and is to ensure water quality guidelines as described in the environmental licence are met. 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.

Funding for this project will be through the Town and other possible derived sources i.e. MWSB. No additional approvals, licences or permits are required for the lagoon construction and operation.

8.0 PUBLIC CONSULTATION

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

Public consultation by the Town of Beausejour has not been conducted to date for the residents of Beausejour. Public comments will be received by Manitoba Conservation through the public registry during the Environmental Act Proposal review period.

9.0 CONCLUSION

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

The proponent would like to complete the requirements of the Environment Act Proposal as soon as possible so that the lagoon construction can begin by the time specified in Section 2.5.1 above.

J. R. Cousin Consultants Ltd. requests that a draft copy of the license be forwarded for review prior to the issue of the final license.

APPENDIX

Appendix A

Land Title (Sent separately upon availability)

Crown Lands & Property Agency, February 22, 2012 Email Correspondence

Manitoba Infrastructure and Transportation, April 12, 2012 Email Correspondence

Appendix B

Table 1: Population, Hydraulic, and Organic Loading Projections for the Town of Beausejour

Table 2: Average Effluent Production, Water Consumption and Infiltration for the Town of Beausejour

Manitoba Conservation and Water Stewardship Fisheries Branch, March 12, 2012 Email Correspondence

Manitoba Conservation Wildlife and Ecosystem Protection Branch, February 24, 2012 Email Correspondence

Manitoba Historic Resources Branch, March 7, 2012 Memorandum

Appendix C

Town of Beausejour Geotechnical and Topographic Investigation for the Wastewater Treatment Lagoon Expansion at Site C

Appendix D

Maxxam Test Results 2011-11-15

ALS Test Results 2012-02-23

ALS Test Results 2012-04-16

ALS Test Results 2012-05-23

Appendix E

Plan L1: Proposed Lagoon Expansion Location with Setbacks to Nearest Residents

Plan L2: Proposed Lagoon Expansion Layout with Test Hole Locations

Plan L3: Lagoon Discharge Route

Plan L4: Perimeter Dike, Intercell Dike, Valve, Valve Marker, Rip Rap and Ditch Details

Plan L5: Gate, Fence, Lock, Site Marker, Silt Fence and Access Road Details

Plan L6: Cross Section from Existing Lagoon to Proposed Building

Appendix A

Land Title (Sent separately upon availability)

Crown Lands & Property Agency, February 22, 2012 Email Correspondence

Manitoba Infrastructure and Transportation, April 12, 2012 Email Correspondence

Land Title (Sent separately upon availability)

Crown Lands & Property Agency, February 22, 2012 Email Correspondence

Brett McCormac

From: Little, Karen (CLPA) [Karen.Little@gov.mb.ca]
Sent: February 22, 2012 2:08 PM
To: 'Brett McCormac'
Subject: RE: Beausejour Lagoon Expansion - Mines and Minerals

Good afternoon Brett, according to our records this date, the mines & minerals and sand & gravel in Section 12-13-7 EPM were originally granted in 1879 to individuals. The Crown has no interests.

To determine the current ownership to these under-rights you will need to do title searches at the Winnipeg Land Titles Office.
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

An Agency of MB Infrastructure and Transportation

From: Brett McCormac [mailto:bmccormac@jrcc.ca]
Sent: February-22-12 10:43 AM
To: Little, Karen (CLPA)
Subject: Beausejour Lagoon Expansion - Mines and Minerals

Hi Karen,

J.R. Cousin Consultants Ltd. (JRCC) is preparing an Environmental Act Proposal for expansion of the Beausejour Lagoon. The lagoon expansion cell is proposed to be located within 12-13-07-E.

Could you please confirm the owner of the mineral rights for this property.

Brett McCormac, E.I.T.
Environmental Engineer-in-Training

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

Manitoba Infrastructure and Transportation, April 12, 2012 Email Correspondence

Brett McCormac

From: Clary-Lemon, Christopher (MIT) [Christopher.Clary-Lemon@gov.mb.ca]
Sent: April 12, 2012 8:51 AM
To: 'Brett McCormac'
Cc: Clary-Lemon, Christopher (MIT)
Subject: RE: Beausejour Lagoon Expansion - Setback Distance From PTH 44

Good morning Brett –

I have had the chance to discuss your inquiry with several people in my Branch. While the following guidance should not be considered Highway Planning and Design's consent / concurrence with the proposed works, it should assist JRCC in developing a plan that meets fewer regulatory hurdles.

To begin, the proposed development is located north of a concurrent section of PTH 12 and PTH 44. As is common practice when two highways travel on the same alignment, the lower number highway is named. Thus, all future references will be to PTH 12 (not PTH 44).

- The 'controlled area' along PTH 12 in this location is established as 76.2m (250 feet) from the right-of-way limits. A permit is required from the Highway Traffic Board (HTB) for any construction within the control lines and for the change in use for the land.

- Any berm constructed as part of the lagoon expansion should be a minimum of 22.86m (75 feet) from the PTH 12 right-of-way. This distance is measured from the right-of-way to the outside toe of the berm.

- If any pipes are proposed to cross Departmental roads (including PTH 12), JRCC should contact MIT's Regional Operations (Steinbach) to enter into an agreement. Please let me know if contact information is required.

If there is anything else I can be of assistance with, please let me know.

Thank you,
Chris

Chris Clary-Lemon, P.Eng., P.E.
MIT - Highway Planning and Design Branch
Phone: 204.945.5225

From: Brett McCormac [mailto:bmccormac@jrcc.ca]
Sent: April-10-12 10:07 AM
To: Clary-Lemon, Christopher (MIT)
Cc: Jack Douglas; Jeff Matychak; Jerry Cousin
Subject: Beausejour Lagoon Expansion - Setback Distance From PTH 44

Hello Christopher,

The Beausejour wastewater treatment lagoon requires expansion. The existing lagoon has four primary cells and one secondary cell located south of P.T.H. 44 in the N ½ of 1-13-07 EPM and an additional secondary cell located north of P.T.H. 44 in the SE¼ of 12-13-07 EPM. A new lagoon expansion cell is proposed to be constructed north of P.T.H. 44 in the SW¼ of 12-13-07 EPM in the area shown on the attached plan. What is the minimum setback distance that you require from the lagoon dikes to P.T.H. 44?

If you have any questions or require any additional information, please don't hesitate to contact me.

Thank you,

Brett McCormac, E.I.T.
Environmental Engineer-in-Training

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

Appendix B

Table 1: Population, Hydraulic, and Organic Loading Projections for the Town of Beausejour

Table 2: Average Effluent Production, Water Consumption and Infiltration for the Town of Beausejour

Manitoba Conservation and Water Stewardship Fisheries Branch, March 12, 2012 Email Correspondence

Manitoba Conservation Wildlife and Ecosystem Protection Branch, February 24, 2012 Email Correspondence

Manitoba Historic Resources Branch, March 7, 2012 Memorandum

Table 1

POPULATION, HYDRAULIC, AND ORGANIC LOADING PROJECTIONS FOR THE TOWN OF BEAUSEJOUR

Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10	Col 11	Col 12	Col 13	Col 14	Col 15
		POPULATION					ORGANIC LOADING			HYDRAULIC LOADING				
PROJECT YEAR	YEAR	GROWTH PER YEAR Town of Beausejour on Piped System*	GROWTH PER YEAR Bussed-in Students (1/3) Equivalent Population		GROWTH PER YEAR Commuter Employees (1/3) Equivalent Population		DAILY PER CAPITA BOD Piped and Holding Tanks	DAILY BOD PRODUCTION Total	SURFACE AREA REQ'RD AT 0.75 M DEPTH	DAILY/CAPITA WATER DEMAND Piped System	INFILTRATION 43% of daily per capita water demand (Piped Systems only)	DAILY/CAPITA EFFLUENT PRODUCTION	TOTAL DAILY WASTEWATER PRODUCTION**	230 Day WASTEWATER PRODUCTION
		1.64%	0.50% Actual	Equivalent	0.50% Actual	Equivalent	(kg)	(Col 3 + Col 5 + Col 7) * Col 8 (kg)	(Col 9/56 kgBOD$_5$/ha) * 1000 (m^2)	(L/person/day)	Col 11 * 0.43 (L/person/day)	(L/person/day)	(Col 3 * Col 13)/1000 (m^3)	Col 14 * 230 (m^3)
0	2012	3,194	700	233	44	15	0.076	261.6	46,713	357	154	511	1,632	375,391
1	2013	3,247	704	235	45	15	0.076	265.7	47,455	357	154	511	1,659	381,620
2	2014	3,300	708	236	45	15	0.076	269.9	48,192	357	154	511	1,686	387,849
3	2015	3,354	711	237	45	15	0.076	274.1	48,939	357	154	511	1,714	394,196
4	2016	3,409	715	238	45	15	0.076	278.3	49,703	357	154	511	1,742	400,660
5	2017	3,464	718	239	46	15	0.076	282.6	50,468	357	154	511	1,770	407,124
6	2018	3,521	722	241	46	15	0.076	287.1	51,259	357	154	511	1,799	413,823
7	2019	3,579	725	242	46	15	0.076	291.5	52,060	357	154	511	1,829	420,640
8	2020	3,637	729	243	46	15	0.076	296.0	52,865	357	154	511	1,859	427,457
9	2021	3,697	733	244	47	16	0.076	300.7	53,702	357	154	511	1,889	434,508
10	2022	3,757	736	245	47	16	0.076	305.4	54,530	357	154	511	1,920	441,560
11	2023	3,819	740	247	47	16	0.076	310.2	55,390	357	154	511	1,952	448,847
12	2024	3,881	744	248	47	16	0.076	315.0	56,249	357	154	511	1,983	456,134
13	2025	3,945	747	249	47	16	0.076	319.9	57,131	357	154	511	2,016	463,656
14	2026	4,009	751	250	48	16	0.076	324.9	58,022	357	154	511	2,049	471,178
15	2027	4,075	755	252	48	16	0.076	330.0	58,936	357	154	511	2,082	478,935
16	2028	4,141	759	253	48	16	0.076	335.2	59,850	357	154	511	2,116	486,692
17	2029	4,209	762	254	48	16	0.076	340.4	60,786	357	154	511	2,151	494,684
18	2030	4,278	766	255	49	16	0.076	345.8	61,745	357	154	511	2,186	502,793
19	2031	4,348	770	257	49	16	0.076	351.2	62,714	357	154	511	2,222	511,020
20	2032	4,419	774	258	49	16	0.076	356.7	63,695	357	154	511	2,258	519,365

*Based on 350 potential new lots with an average occupancy of 3.5 people/residence and all residents on septic tanks and holding tanks converted to piped system

**Col 14 calculates hydraulic loadings based on the Town of Beausejour population only (Col 3) because Table 2 calculates the per capita hydraulic loadings based on census data which does not include bussed in students and out of town employees. This will not affect the total wastewater production quantity beacuse per capita wastewater production was calculated based on town residents only.

Table 2

AVERAGE EFFLUENT PRODUCTION, WATER CONSUMPTION AND INFILTRATION FOR THE TOWN OF BEAUSEJOUR

Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
Year	**Population ***	**Total Effluent Production From Lift Station Hour Meters (m^3)**	**Total Water Consumption From WTP Well Meters (m^3)**	**Average Per Capita Water Consumption (L/person/day)** **Col 4/365/Col 2*1000**	**Total Infiltration (m^3)** **Col 3 - Col 4**	**Average Infiltration Per Capita (L/person/day)** **Col 6/365/Col 2*1000**
2005	2,814	667,492	367,442	358	300,051	292
2006	2,823	504,062	502,707	488	1,355	1
2007	2,882	557,898	384,311	365	173,587	165
2008	2,941	522,792	473,976	442	48,817	45
2009	3,001	618,995	326,743	298	292,251	267
2010	3,063	739,821	314,255	281	425,567	381
2011	3,126	576,357	307,759	270	268,597	235
AVE				**357**		**198**

*Total population of Beausejour estimated based on Canada Census data

Manitoba Conservation and Water Stewardship Fisheries Branch, March 12, 2012 Email Correspondence

Brett McCormac

From: Janusz, Laureen R (MWS) [Laureen.Janusz@gov.mb.ca]
Sent: March 12, 2012 12:45 PM
To: 'Brett McCormac'
Cc: Leroux, Doug (MWS)
Subject: Beausejour Lagoon Expansion - Fisheries for Brokenhead River

Importance: High

Hi Brett,

Sorry for the delay in responding.

The Fisheries Inventory and Habitat Classification System (FIHCS) has the following species noted for **Bachman Drain**: common shiner, fathead minnow, central mudminnow, brook stickleback.

For **Brokenhead River** the following species are noted in the FIHCS: black bullhead, blacknose shiner, blacksided darter, brook stickleback, brown bullhead, burbot, carp, central mudminnow, chestnut lamprey, common shiner, fathead minnow, finescale dace, freshwater drum, hornyhead chub, Johnny darter, longnose dace, mimic shiner, northern pike, pearl dace, rock bass, shorthead redhorse, smallmouth bass, tadpole madtom, walleye, white sucker, yellow perch, stonecat, northern redbelly dace, brook trout, brown trout and rainbow trout (see stocking history below).

FIHCS also notes the following:
General Fisheries Use: recreational angling and commercial net
In 1991 the Habitat Classification for this waterbody was rated as a 3: has moderate limitations to the production of fish. Surplus nutrients from agriculture and nonpoint source were noted as limiting factors with a major concern as well as flow levels below optimum.
Stocking History at PTH 1 crossing: last stocking was in 2003 with 300 18+cm brook trout. Other species stocked: rainbow trout, walleye, smallmouth bass.

More site specific, in the summer of 1995 students conducted a Fisheries and Riparian Study on the Brokenhead River. This study is also reflected in the Brokenhead River Watershed Study done by Aquatic and Environmental Consultants Ltd ~2002. From just downstream of where the effluent will enter the Brokenhead River to the mouth the following species were captured: emerald shiner; Johnny darter; northern red belly dace; mimic shiner, spottail shiner, white sucker, rock bass, silver redhorse, northern pike, freshwater drum, tadpole madtom, brook stickleback, central mudminnow, logperch, walleye, mooneye, goldeye, yellow perch, shorthead redhorse, channel catfish and carp. Note some species here not reflected in FIHCS. This study may not have been entered into the database.

There are no special fishing regulations for the Brokenhead River.

Brett as indicated from the above information, Bachman Drain does support small bodies species with the potential to provide seasonal habitat for larger bodied species during spring and the Brokenhead River provides habitat for a number of large and small bodied species either year round or for seasonal access for spawning, nursery and feeding. Given nutrient loading has been identified as a major concern for this waterbody, ensuring effluent from the lagoon meets or exceeds the Manitoba Water Quality Standards, Objectives and Guidelines is very important. I have cc'd the Regional Fisheries Manager in Lac du Bonnet should he have additional information/correction or concerns. Thank you.

Laureen Janusz
Fisheries Science and Fish Culture Section
Fisheries Branch
Conservation and Water Stewardship

Phone: 204 945-7789
Cell: 204 793-1154
Email: Laureen.Janusz@gov.mb.ca

From: Brett McCormac [mailto:bmccormac@jrcc.ca]
Sent: February-22-12 11:31 AM
To: Janusz, Laureen R (MWS)
Subject: Beausejour Lagoon Expansion - Fisheries

Hi Laureen,

J.R. Cousin Consultants Ltd. (JRCC) is preparing an Environmental Act Proposal for expansion of the Beausejour Lagoon. The lagoon expansion cell is proposed to be located within 12-13-07-E.

The proposed expanded lagoon would follow the existing licenced discharge route to the Brokenhead River. The drainage route from the discharge pipe of cell 6 consists of approximately 940 m of ditch in a north direction between the NE and NW ¼ Section of 12-13-07-E, then approximately 840 m of ditch in a west direction on the south side of Mile Road 77 N, the discharge route then enters the Bachman Drain. The Bachman Drain runs north along the west side of Mile Road 41 E for approximately 3,290 m, the drain then crosses eastward under Mile Road 41 E and travels approximately 6,350 m east along Mile Road 76 N to the Brokenhead River. A plan of the discharge route is attached.

Could you please respond with any comments or concerns you have with the proposed project. Also, could you please provide a list of the fish species that are found in the Brokenhead River, if available.

Thank you,

Brett McCormac, E.I.T.
Environmental Engineer-in-Training

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

Manitoba Conservation Wildlife and Ecosystem Protection Branch, February 24, 2012 Email Correspondence

Brett McCormac

From: Friesen, Chris (CON) [Chris.Friesen@gov.mb.ca]
Sent: February 24, 2012 10:59 AM
To: 'Brett McCormac'
Subject: RE: Beausejour Lagoon Expansion - Species at Risk

Brett

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. Also, 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 and Ecosystem Protection Branch, Manitoba Conservation.

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: Brett McCormac [mailto:bmccormac@jrcc.ca]
Sent: February-22-12 11:23 AM
To: Friesen, Chris (CON)
Subject: Beausejour Lagoon Expansion - Species at Risk

Hi Chris,

J.R. Cousin Consultants Ltd. (JRCC) is preparing an Environmental Act Proposal for expansion of the Beausejour Lagoon. The lagoon expansion cell is proposed to be located within 12-13-07-E.

Could you please confirm there are no 'species at risk' known to exist on the property.

Brett McCormac, E.I.T.
Environmental Engineer-in-Training

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

Manitoba Historic Resources Branch, March 7, 2012 Memorandum

Manitoba

Memorandum

Date: March 7th, 2012

To: Brett McCormac
Environmental Engineer-in-Training
J.R. Cousin Consultants Ltd.

Phone #: (204) 489-0474

From: Jenny Payment
Impact Assessment Archaeologist
Historic Resources Branch
Main Floor
213 Notre Dame Ave
Wpg, MB R3B 1N3
Phone #: (204) 945-4768

Subject: Beausejour Lagoon Expansion

HRB FILE: AAS-11-3875

Further to your memo regarding the above mentioned development project, I have examined the location in conjunction with Historic Resources Branch records for areas of potential concern. The Historic Resources Branch has **no concerns** with the proposed development.

If at any time heritage resources are encountered in association with this project during any development, the Historic Resources Branch may require that a heritage resource management strategy be implemented by the developer to mitigate the effects of development on any heritage resources.

If you have any questions or comments, please feel free to contact me (Jenny Payment), by phone (see above), or by email: Jen.Payment@gov.mb.ca.

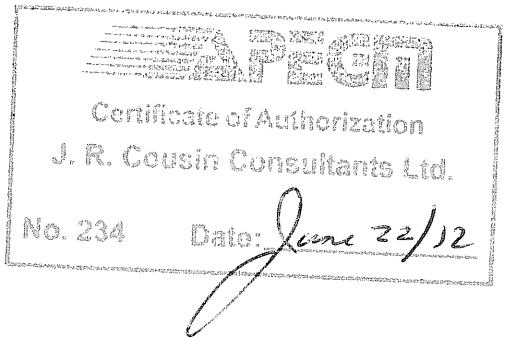
Jenny Payment

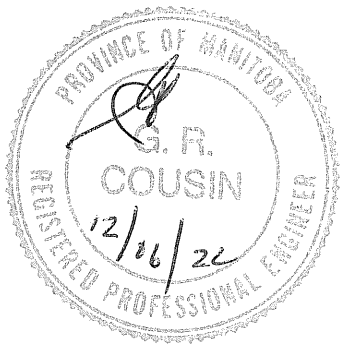
Appendix C

Town of Beausejour Geotechnical and Topographic Investigation for the Wastewater Treatment Lagoon Expansion at Site C

TOWN OF BEAUSEJOUR

Geotechnical and Topographic Investigation for the Wastewater Treatment Lagoon Expansion Site C





Prepared by: J. R. Cousin Consultants Ltd.
91A Scurfield Blvd.
Winnipeg, Manitoba
R3Y 1G4

June 2012

ACKNOWLEDGMENTS

To prepare this report various sources of information were investigated and researched. The firm of J. R. Cousin Consultants Ltd. wishes to thank the Town of Beausejour who assisted with organization and onsite works.

REMARKS

Conclusions reached in this report are based upon the generalization of data available to us at the time of forming our opinions. Information in this document may rely on previous studies, investigative work and data by others. JRCC cannot be responsible for actual site conditions proved to be at variance with any generalized data. This report was completed in accordance with generally accepted professional engineering principles and practice. Any use of this report by a third party is the responsibility of the third party, JRCC accepts no responsibility for third party decisions or actions based on the report. No other warranty or guarantee expressed, implied or statutory is made.

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APPENDIX

1.0 INTRODUCTION

J. R. Cousin Consultants Ltd. (JRCC) conducted a geotechnical and topographical investigation for the proposed wastewater treatment lagoon expansion for the Town of Beausejour. Two potential lagoon expansion sites were investigated during a previous geotechnical investigation conducted in December of 2011. The current investigation was for a third potential expansion site referred to as "Site C". Site C is located west and southwest of the existing Beausejour lagoon secondary cell #6 in the SW ¼ of Section 12-13-07 EPM.

Nine test holes were drilled at the site to determine the suitability of the soils for use as a clay lagoon liner. Test hole locations are shown on Plan 1 attached in the Appendix.

This report outlines the findings of the geotechnical and topographic investigation at the proposed new lagoon expansion Site C and evaluates the soils to determine their suitability for use as a lagoon liner as well as any potential difficulties associated with construction.

2.0 BACKGROUND

The existing Beausejour lagoon consists of four primary cells (Cells #1 - 4), a secondary cell (Cell #5) south of PTH 44 and an additional secondary cell (Cell #6) north of PTH 44. The existing lagoon is hydraulically overloaded and requires expansion.

2.1 Past Geotechnical Investigations by JRCC

JRCC completed a geotechnical and topographical investigation of potential lagoon expansion sites east, north and northwest of the existing Beausejour lagoon secondary Cell #6. The report indicated that the general soil profile from the sites was a topsoil layer followed by a medium plastic, silty, sandy clay followed by a high plastic clay above a till layer.

The medium plastic, silty, sandy clay was shown by laboratory analysis not to be suitable for use as an insitu liner, but may be suitable for a re-worked and re-compacted liner. The high plastic clay layer was shown to be suitable for use as an insitu clay liner, however, the thickness of the clay lense was less than 1.0 m is some locations. The till layer was shown by laboratory analysis not be suitable for use as a lagoon liner insitu or when re-worked and re-compacted.

The report recommended a re-worked and re-compacted clay liner for construction of an expansion cell east or north of the existing Cell #6. The report indicated the possibility of an insitu clay liner if the cell was constructed northwest of the existing cell #6, however there would be some risk of not maintaining the minimum 1.0 m thick liner.

Test hole logs from the previous geotechnical investigation are attached in the Appendix.

2.2 Past Geotechnical Investigations by Others

A geotechnical investigation was performed by Dyregrov and Burgess Consulting Geotechnical Engineers as subconsultants to Reid Crowther and Partners Ltd. for construction of secondary Cell #6 in November of 1988. Sixteen test holes were drilled within the northern half of the SE¼ of Section 12-13-07E. The general soil stratigraphy found was a thin layer of organic topsoil over a lacustrine clay over a glacial till. The lacustrine clay was classified as highly plastic and had a Plasticity Index in excess of 60. The clay varied in thickness from 1.4 m to 4.9 m with a trend for a greater thickness of clay to the north and west of the property. The upper 0.6 – 1.8 m of the clay was noted as being silty with a Plasticity Index of 20 – 25. The soil samples were noted to have cracks, fissures, slickensides and other secondary structural defects. The surface of the glacial till layer sloped downward to the north and to the west, varying between 1.4 and 4.4 m below ground. The glacial till was classified as a heterogeneous mixture of clay, silt, sand and gravel materials with frequent cobbles and boulders.

The report indicated that the silty clay and clay that existed on the site may be used to construct a suitable lagoon liner, however, not in their insitu state due to cracks, fissures, slickensides and other structural defects. The report recommended re-working and re-compacting the clay soils in thin lifts to form the horizontal lagoon liner. The report recommended a vertical cut-off wall extend below the defective clay to a depth of at least 2.4 m below the ground surface.

Five test holes were also excavated by UMA Engineering Ltd. in March of 1990 at the proposed secondary Cell #6 site. The average soil profile from the test holes was a layer of topsoil an average of 0.3 m thick followed by a layer of silty, fissured clay to a depth of 1.7 m followed by a layer of high plastic clay with some silt pockets observed to a maximum depth of 3.4 m followed by a silty till with sand and cobbles. The test holes were excavated to a depth between 1.6 m and 3.7 m below ground.

Four constant head permeability tests were performed on samples from the re-worked and re-compacted clay liner after construction of Cell #6. The samples achieved permeabilities of 4.44×10^{-8} cm/sec, 4.15×10^{-8} cm/sec, 1.20×10^{-8} cm/sec and 2.33×10^{-9} cm/sec. All four samples passed the Manitoba Conservation guideline of a hydraulic conductivity of 1×10^{-7} cm/sec. This shows that the upper layer of silty clay soil is suitable for use as a re-worked and re-compacted clay liner.

2.3 GW Driller's Well Logs

Four driller's well logs from 12-13-7 E were reviewed. The well logs indicate the soil profile consists of varying layers of clay, silty clay and till underlain by limestone. The clay extended to an average depth of 5.5 m below the ground surface followed by 8.7 m of till, followed by limestone to a maximum recorded depth of 36.0 m.

The average static groundwater level recorded in the wells ranged from 1.5 m above the ground surface to 1.8 m below the ground surface with an average static water level 0.5 m below the ground surface.

GW Driller's Well logs are included in the Appendix.

3.0 TOPOGRAPHIC INVESTIGATION

A topographic GPS survey of the test hole locations and existing ground across the proposed lagoon expansion Site C was completed on May 15, 2012 along with the geotechnical investigation. The existing ground at the proposed expansion site was a relatively flat agricultural field. From the topographic survey data, the existing ground elevations varied from 238.76 m to 239.71 m with an average elevation of approximately 239.16 m.

Contour lines from the topographic survey are shown on Plan 1 in the Appendix.

4.0 GEOTECHNICAL FIELD INVESTIGATION

The onsite geotechnical investigation for the proposed lagoon expansion Site C was conducted on May 15, 2012. Paddock Drilling Ltd. was employed to conduct the test holes using a track-mounted drill rig under direct supervision by JRCC's field representative.

Nine test holes (TH11 – TH19) were drilled during the geotechnical investigation. Test holes were drilled to a depth of 6.1 m (20') or auger refusal. Test hole locations are shown on Plan 1, attached in the Appendix.

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. Five selected bagged soil samples from the test holes were sealed and submitted to National Testing Laboratories Ltd. (NTL) for testing. Two Shelby tube samples (TH14 0.8 – 1.4m and TH14 2.1 – 2.7 m) were also sent to NTL to determine the insitu hydraulic conductivity. One bagged sample (TH16 0.6 – 1.5 m) was sent to NTL to determine the re-worked and re-compacted hydraulic conductivity. Details of the laboratory analysis are provided in Section 5.0 of this report. Following completion of drilling, an assessment of the short term groundwater conditions was completed. All test holes were then backfilled with bentonite mixed with the auger cuttings.

4.1 Soil Profile

Details of each individual soil profile, including depth and description of each layer as well as comments on bedrock and groundwater infiltration can be found in the test hole logs attached in the Appendix. The following is a summary of the soil profile at the proposed lagoon expansion Site C.

The soil profile consisted of an average of 0.5 m of grey/black medium-high plastic clay with some silt and sand, organic from 0 m to 0.2 m. The following layer observed from an average of 0.5 m to 1.4 m was a brown, medium plastic silty clay with trace sand which was followed by a grey high plastic clay with trace silt from an average of 1.4 m to 3.7 m. The final layer was a grey/brown wet, soft, till with silt, sand, clay and trace gravel from an average of 3.7 m to the termination of the test holes at an average depth of 5.4 m.

Bedrock was not encountered in any of the test holes, however, all test holes with the exception of TH15 – TH17 were terminated due to auger refusal in dense, stony till. Caving of the test holes was observed in all test holes immediately after drilling in the till layer, an average of 0.7 m from the bottom of the test holes.

4.2 Groundwater

Short-term groundwater conditions were assessed in each test hole by observing standing water elevations in the holes prior to backfilling. Some test holes were left open for a period of time to observe the short term water infiltration into the test holes. Standing water was observed in TH12, TH13, TH16, TH17 and TH19 at depths ranging from 2.1 m – 4.1 m below the ground surface with an average depth of 3.4 m. TH11 had a standing water elevation 2.4 m below the ground surface after being left open for approximately 4 hours. TH12 and TH16 had standing water elevations 1.2 m below the ground surface after being left for approximately 4 hours and 2 hours, respectively.

It is noted that the standing water observed in the test holes is likely from a confined groundwater aquifer in the wet till layer observed beneath the high plastic clay layer.

Groundwater in the test holes depends on high static groundwater conditions and on seasonal conditions, i.e. snowmelt and rainy seasons. Other assumptions relating to the groundwater elevation cannot be made at this time, as water levels will normally fluctuate seasonally.

Contractors will be made aware of the geotechnical conditions encountered onsite, as dewatering and trench stabilization may be required during construction, depending on the depth of excavation determined during final design.

5.0 LABORATORY TESTING, ANALYSIS AND DISCUSSION

Representative soil samples from the proposed lagoon site were submitted to The National Testing Laboratories Limited (NTL) for testing and analysis. The testing and analysis included determining 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).

The Shelby tube samples were subjected to a hydraulic conductivity test (ASTM D5084-03). The bagged sample which was tested for re-worked hydraulic conductivity was compacted using ASTM D698, Method C.

Laboratory classification analysis of the bagged soil samples indicated that three of the samples were CH (two deemed a fat clay and one deemed a fat clay with sand) and two samples were CL (one deemed a lean clay and one deemed a sandy lean clay). The Plasticity Index of the samples classified as CH varied between 34 and 57 and the percentage of clay varied between 51.8% and 91.0%. The Plasticity Index of the samples classified as CL varied between 12 and 31 and the percentage of clay varied between 36.1% and 49.4%. Based on past experience, the laboratory has commented that homogeneous soils with a plasticity index greater than 25 and a clay content greater than 50% would typically be expected to have a hydraulic conductivity of 1×10^{-7} cm/sec or less. Plasticity Index analysis (i.e. Atterberg limits) of the soils indicated that all of the bagged soil samples deemed a CH were considered to have potential for use as an insitu clay liner or a re-moulded and re-compacted clay liner. The sample from TH14 0.6 – 1.5 m was deemed suitable for use as an insitu liner or when re-worked and re-compacted based on an undisturbed Shelby Tube sample taken in the same layer which achieved a hydraulic conductivity of 4.9×10^{-8} cm/sec. The sample from TH14 4.6 – 5.5 m was deemed not suitable for use as a lagoon liner insitu or when re-worked and re-compacted. See Table 1 of the NTL Test Results, in the Appendix.

NTL indicates that the bagged soil samples suitability for use as a clay liner is dependent upon the soils being homogeneous with no preferential flow paths. It is also 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. These silt and sand layers along with rocks, boulders or fissures in the soil can create preferential flow paths which can lead to an increased hydraulic conductivity.

Two Shelby tube samples (TH14 0.8 – 1.4 m and TH14 2.1 – 2.7 m) were submitted to NTL to determine the insitu hydraulic conductivity for potential use as a lagoon liner. The samples achieved hydraulic conductivities (k_{20}) of 4.9×10^{-8} cm/sec and 1.5×10^{-8} cm/sec, respectively. Both Shelby tubes had hydraulic conductivities lower than the Manitoba Conservation requirement of 1×10^{-7} cm/sec and are therefore deemed suitable for use as an insitu clay lagoon liner.

A bagged soil sample from TH16 0.6 – 1.5 m was re-worked and re-compacted and tested for hydraulic conductivity. The sample achieved hydraulic conductivity (k_{20}) of 1.2×10^{-8} cm/sec, which is lower than the Manitoba Conservation requirement of 1×10^{-7} cm/sec. This shows the soil layer is suitable for use as a re-worked and re-compacted clay lagoon liner.

Details of The National Testing Laboratories test results and analysis, dated June 5, 2012 are attached in the Appendix.

6.0 LAGOON LINER REQUIREMENTS

6.1 Current Guidelines

Manitoba Conservation guidelines require that a standard wastewater treatment lagoon clay liner be 1.0 metre in thickness and have a hydraulic conductivity (i.e. the potential rate of fluid movement through the soil) of 1 x 10^{-7} cm/sec or less. This low rate is to protect the underlying groundwater from lagoon seepage. Generally, the higher a soil's plasticity the more likely a soil can achieve a hydraulic conductivity of 1 x 10^{-7} cm/sec.

6.2 Typical Lagoon Liner Construction Options

The liner of a lagoon can be constructed by using the insitu (undisturbed) soils if the soils can consistently achieve a hydraulic conductivity of 1 x 10^{-7} cm/sec or less in their insitu conditions.

If the insitu soils cannot be used the liner can be constructed by excavating and re-compacting suitable high plastic clay soils to form the liner.

If the clay content of the soils is so low that even when excavated and re-compacted, the soils cannot consistently achieve a hydraulic conductivity of 1 x 10^{-7} cm/sec, a liner constructed of high plastic clay from a borrow pit, or a synthetic geomembrane liner would be required.

6.3 Liner Options for the Beausejour Lagoon Expansion Site C

Based on the laboratory plasticity analysis all the soil layers had potential for use as an insitu clay lagoon liner or when re-worked and re-compacted with the exception of the till layer found an average of 3.7 – 5.4 m below the ground surface.

6.3.1 Insitu Clay Liner

6.3.1.1 Silty Clay Layer from 0.5 – 1.4 m

Based on the laboratory analysis, the medium plastic silty clay layer observed an average of 0.5 – 1.4 m below the ground surface was deemed to have limited potential for use as an insitu clay liner. The Shelby tube sample taken from TH14 0.8 m – 1.4 m achieved a hydraulic conductivity of 4.9 x10-8 cm/s, which is lower than the Manitoba Conservation requirements indicating the possible suitability for use of the soil layer as an insitu liner.

A similar layer of medium-high plastic, silty, clay soil was analyzed during the geotechnical investigation of Site A and Site B in December of 2011. The Shelby tube sample from TH3 0.6 – 1.2 m achieved a hydraulic conductivity of 9.5 x 10^{-6} cm/sec, which failed to meet the Manitoba Conservation requirements.

Although the Shelby tube sample taken during the current geotechnical investigation did pass the insitu hydraulic conductivity requirements, if the layer was used as part of an insitu liner there would be significant risk of not meeting the hydraulic conductivity requirements in some locations, based on the hydraulic conductivity results of the previous investigation on a similar clay layer.

The soil layer is not of sufficient depth to act as the entire 1.0 m thick liner, but could be utilized in conjunction with the high plastic clay soils below to form the liner of the lagoon. Again, if this layer of soil was used as the lagoon liner, there would be some risk of not meeting the Manitoba Conservation requirements in all locations.

6.3.1.2 High Plastic Clay Layer from 1.4 – 3.7 m

The grey high plastic clay layer observed from an average of 1.4 – 3.7 m below ground was deemed suitable for use as an insitu clay liner by Plasticity Index analysis and was confirmed by the Shelby tube sample from TH14 2.1 – 2.7 m which achieved a hydraulic conductivity of 1.5×10^{-8} cm/sec.

A similar layer of high plastic clay was tested during the previous geotechnical investigation and was deemed suitable for use as an insitu liner. This was confirmed by the Shelby tube sample from TH3 1.8 – 2.4 m, which achieved a hydraulic conductivity of 1.1×10^{-8} cm/sec.

The top elevation of the high plastic clay layer at Site C varied from 1.1 to 1.8 m below the existing ground surface and extended to between 2.7 to 4.6 m below the ground surface. The total thickness of the high plastic clay layer varied from 1.7 m to 3.0 m thick.

If the high plastic clay layer was used as an insitu liner, there would be some risk of not maintaining the Manitoba Conservation requirement of a minimum 1.0 m thick liner across the entire cell. The final elevation of the cell floor would have to be maintained a maximum of 1.1 m below the existing ground elevation so the high plastic clay layer is not reduced in thickness. If during construction test holes revealed the high plastic clay layer was less than 1.0 m thick in some locations due to the till layer extending higher into the high plastic clay layer than observed in the test holes, the area would have to be excavated to 1.0 m below the cell floor elevation and replaced with high plastic clay soil from a borrow area.

6.3.2 Re-Worked Clay Liner

The lagoon liner could be constructed by re-working and re-compacting the soils 1.0 m below the cell floor elevation. The cell floor elevation would be determined during final design and depending on the final elevation, the soils below the cell floor would likely be a mixture of the silty clay from an average of 0.5 – 1.4 m below the ground elevation and the high plastic clay from an average of 1.4 – 3.7 m below the ground. Both of these soil layers have been shown to be suitable for use a re-worked and re-compacted lagoon liner. This liner construction technique would require significantly more earthwork than utilizing an insitu liner and would result in significantly higher costs. However, the risk of not meeting the Manitoba Conservation liner requirements would be very low.

For all sites, overburden soils below the organic topsoil could be used for the inner and outer dike construction and high plastic clay soils from a borrow pit could be excavated and re-compacted and re-worked to construct the vertical cut-off walls which would tie-in a minimum of 1.0 m into the horizontal clay liner observed to be an average of 1.4 m below the ground surface.

7.0 SUMMARY AND RECOMMENDATIONS

7.1 Summary

The topography of the proposed site was a relatively flat agricultural field with an average elevation of approximately 239.16 m.

Soils at the proposed lagoon site were investigated by JRCC. Representative soil samples were analyzed by The National Testing Laboratories Ltd. to determine their suitability for use as an insitu lagoon liner or a re-worked and re-compacted lagoon liner.

Based on the laboratory Plasticity Index analysis, all of the bagged soil samples submitted, with the exception of TH14 4.6 – 5.5 m, have some potential for use as an insitu lagoon liner, with risk of not meeting guidelines in all locations and strong potential for use as a re-worked and re-compacted lagoon liner. The Shelby tube samples from TH14 0.8 – 1.4 m and TH14 2.1 – 2.7 m achieved hydraulic conductivities lower than the Manitoba Conservation requirements showing they may be suitable for use as an insitu clay lagoon liner. The re-worked and re-compacted sample from TH16 0.6 – 1.5 m achieved a hydraulic conductivity lower than the Manitoba Conservation requirements showing it is likely suitable for use as a re-worked and re-compacted clay liner.

The lagoon could be constructed with an insitu layer of high plastic clay soils with risk of not maintaining the Manitoba Conservation requirement of a minimum 1.0 m thick liner across the entire cell. The liner could also be constructed by re-working and re-compacting the soils 1.0 m below the cell floor elevation with little risk of not meeting Manitoba Conservation guidelines.

7.2 Recommendations

It is recommended that a lagoon expansion cell constructed at Site C be lined with an insitu clay liner from the high plastic layer of soils observed an average of 1.4 – 3.7 m below the existing ground surface. The clay layer was observed to be a minimum of 1.7 m thick, which is greater than the Manitoba Conservation requirement of a 1.0 m thick clay liner. The expansion cell must be constructed a maximum of 1.1 m below the existing ground so that the high plastic clay liner is not reduced in thickness by excavation of the cell. There is some risk that the lagoon liner will be less than 1.0 m thick in some locations if the till layer extends higher into the high plastic clay than observed in the test holes. If this is determined during construction, the area of liner less than 1.0 m thick will have to be excavated and high plastic clay from a borrow pit will have to be re-worked and re-compacted to ensure a minimum 1.0 m thick liner in all locations. A contingency in the construction budget would have to be included to account for this risk.

It is not recommended to utilize the silty medium plastic clay observed from an average of 0.5 – 1.4 m as part of the insitu liner due to the insitu hydraulic conductivity results from the previous geotechnical investigation. The layer of silty, medium plastic clay above the high plastic clay liner will act as a supplementary barrier from lagoon seepage.

It is recommended high plastic clay soils from a borrow pit be excavated and re-worked and re-compacted to construct the vertical cut-off walls which would tie-in a minimum of 1.0 m into the horizontal clay liner observed to be an average of 1.4 m below the ground surface.

It is also recommended that the clay soils 1.0 m below the cell floor elevation under the inside dike slope be re-worked and re-compacted. If when the lagoon horizontal liner is tested by Manitoba Conservation it does not pass the requirements near the perimeter dikes, the dike would have to be removed to re-work and re-compact the clay soils beneath. If during lagoon construction the clay soils beneath the inside dike slope are re-worked and re-compacted, there will be little risk of not meeting the Manitoba Conservation requirements.

The entire horizontal liner could be constructed by re-working and re-compacting the soils 1.0 m below the cell floor elevation to form the lagoon liner. This option would result in much higher construction costs but would reduce the risks of not meeting the 1.0 m liner thickness requirement.

7.3 Closure

The conclusions and recommendations in this report are based on the results of the site investigation and laboratory analysis. In addition, soil and groundwater conditions between test hole locations were generalized to provide an overall assessment of the geotechnical site conditions. If conditions that appear different from those encountered at the test hole locations as described in this report, or if the assumptions stated herein are not in agreement with the design, JRCC should be informed so the recommendations can be reviewed and adjusted as required.

The geotechnical investigation and topographic review was conducted for identifying geotechnical and topographic conditions suitable for construction of the Beausejour lagoon expansion at Site C. Although no environmental issues were identified during the geotechnical investigation and topographic review, it does not necessarily follow that such issues do not exist. If the client or any other parties have any environmental concerns regarding the proposed site and works, an appropriate environmental assessment must be conducted.

It is not uncommon for soil conditions to be highly variable across a site. Previous construction activities and placement of fill at a site can augment the variability of soil conditions, especially surficial soil conditions. A contingency must be included in any construction budget to allow for potential variations in soil conditions, which may result in modification of the design and construction procedures.

APPENDIX

Plan 1: Proposed Lagoon Expansion Site C with Test Hole Locations and Topographic Contour Lines

Test Hole Logs

Past JRCC Test Hole Logs

National Testing Laboratories Ltd. Test Results, dated June 14, 2012

GW Driller's Well Logs

Plan 1: Proposed Lagoon Expansion Site with Test Hole Locations and Topographic Contour Lines

SCALE BAR
(IN METRES)

50 0 25 50 100 150 200 250

1:2500

No.	REVISIONS	DATE	INITIALS

B.M. ELEV.

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.

ENGINEER'S SEAL

PRELIMINARY

J. R. Cousin Consultants Ltd.
Consulting Engineers and Project Managers
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Engineering Excellence since 1981

CODE: B-353.05
DESIGNED BY: JC
DRAWN BY: BM
REVIEWED BY: JC

PROJECT: BEAUSEJOUR LAGOON EXPANSION

TITLE: PROPOSED LAGOON EXPANSION SITE C WITH TEST HOLE LOCATIONS AND TOPOGRAPHIC CONTOUR LINES

SCALE:	DATE:	PLAN:	SHEET:
1:2500	12/05/17	1	1 of 1

Jun 22, 2012 - 9:13am R:\300-353 Beausejour\353.05 Lagoon Study and Environmental Submission\04 Drawings\dwg\Section\Site C Test Hole Locations.dwg

Test Hole Logs

J. R. Cousin Consultants Ltd.

TEST HOLE LOGS

SYMBOL INDEX


GW. : Well graded gravels and gravel sand mixtures, little or no fines


GP. : Poorly graded gravels, gravel - sand mixtures, little or no fines


GM. : Silty gravels, gravel-sand-silt mixtures


GC. : Clayey gravels, gravel-sand-clay mixtures


SW. : Well graded sands, gravelly sands, little or no fines


SP. : Poorly graded sands, or gravelly sands, little or no fines


SM. : Silty sands, sand-silt mixtures


SC. : Clayey sands, sand-clay mixtures


ML. : Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity


CL. : Inorganic clays of low plasticity, gravelly clays, sandy or silty clays, lean clays


OL. : Organic silts and organic silty clays of low plasticity


CI. : Inorganic clays of medium or intermediate plasticity


MH. : Inorganic silts, fine sandy or silty soils


CH. : Inorganic clays of high plasticity, fat clays


OH. : Organic clays of medium to high plasticity, organic silts


Pt. : Peat, humus, swamp soils with high organic contents


TOPSOIL

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 due to the limited number of test holes as compared to that of an unlimited number of test holes. Every effort is made to evaluate the information by methods generally recognized. The soil logs 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 : Beausejour

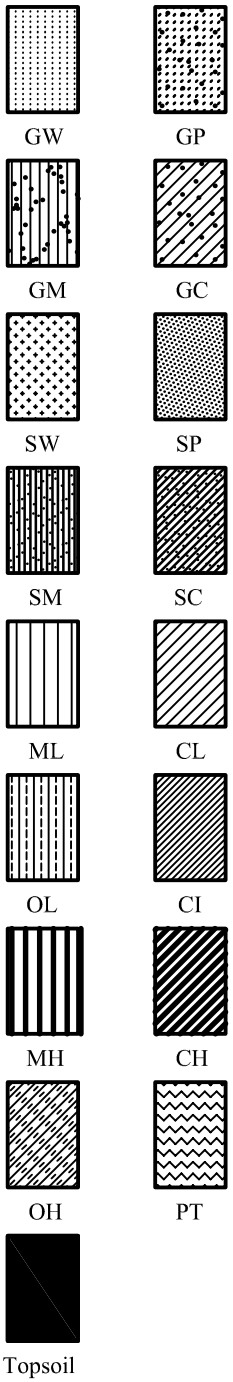
DATE : May 15, 2012

ELEVATION: 239.523

PROJECT : Lagoon Study and Environmental Submission

TEST HOLE # 11

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	TOPSOIL - Black, organic, dry, loose, roots
2'	CLAY - Medium plastic, light brown, with silt and sand inclusions, moist, stiff
1m / 4'	
6'	CLAY - High plastic, grey, trace silt, moist, soft, uniform
2m / 8'	
3m / 10'	CLAY TILL - Medium plastic, with silt, sand and stones, very wet, very soft
12'	
4m / 14'	CLAY TILL - Medium plastic, with silt, sand and stones, moist, stiff
16'	
5m	
18'	
6m / 20'	AUGER REFUSAL IN STONY TILL @ 4.8 m. AFTER DRILLING, OPEN TO 4.65 m, DRY. AFTER 4 HOURS, STANDING WATER 2.4 m - 4.5 m



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : Beausejour

DATE : May 15, 2012

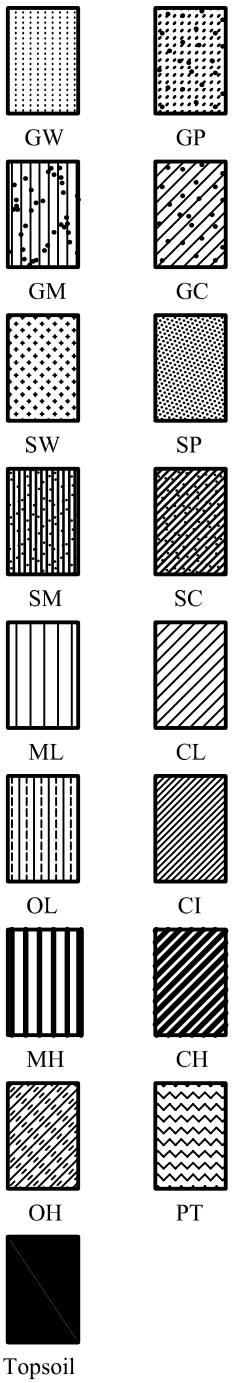
ELEVATION: 239.253

PROJECT : Lagoon Study and Environmental Submission

TEST HOLE # 12

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	TOPSOIL - Black, organic, dry, loose, roots
2'	CLAY - Medium plastic, brown, with silt and sand, wet, soft
1m / 4'	
6'	CLAY - High plastic, grey, trace silt, moist, soft, uniform
2m	
8'	CLAY - High plastic, grey, silty with some small stones
3m / 10'	
12'	CLAY - High plastic, grey, very wet, very soft, uniform
4m / 14'	
16'	CLAY TILL - Low plastic, very wet, very soft, sand, silt and stones
5m	
18'	
6m / 20'	

AUGER REFUSAL IN STONY DENSE TILL @ 4.95 m.
AFTER DRILLING, OPEN TO 4.65 m. WATER 4.2 m - 4.95 m
AFTER 4 HOURS, STANDING WATER 1.6 m - 4.65 m



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : Beausejour

DATE : May 15, 2012

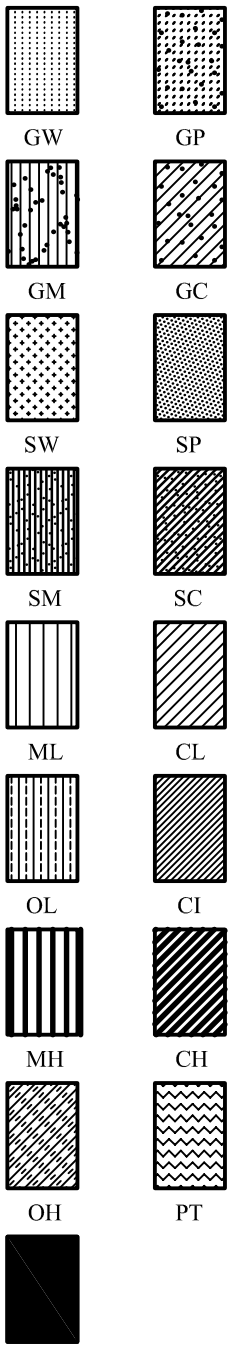
ELEVATION: 239.004

PROJECT : Lagoon Study and Environmental Submission

TEST HOLE # 13

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m – 0	TOPSOIL - Black, clayey, stiff, organic
2'	
1m – 4'	CLAY - Medium plastic, light brown, with silt and sand inclusions, moist, stiff
6'	
2m – 8'	CLAY - High plastic, grey, trace silt, moist, soft, uniform
3m – 10'	
12'	CLAY - High plastic, grey, trace silt, very moist, very soft, uniform
4m – 14'	CLAY TILL - Medium plastic, with silt, sand and stones, very wet, very soft
16'	
5m – 18'	
6m – 20'	

AUGER REFUSAL IN DENSE CLAY TILL WITH LARGE STONES @ 4.5 m.
AFTER DRILLING, OPEN TO 4.35 m. WATER 4.05 m - 4.35 m



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : Beausejour

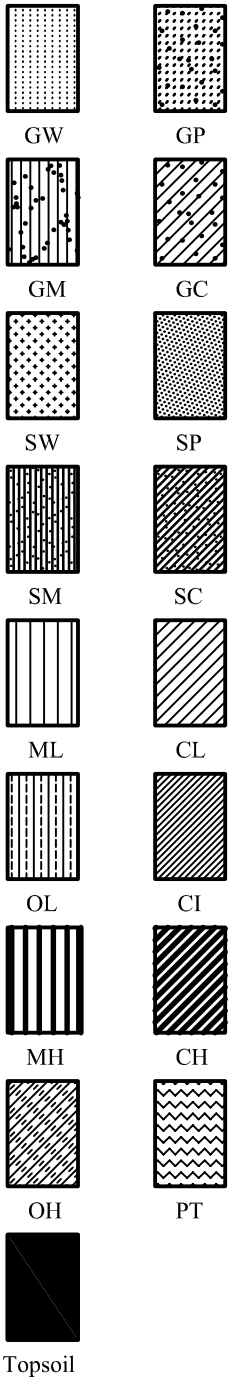
DATE : May 15, 2012

ELEVATION: 238.975

PROJECT : Lagoon Study and Environmental Submission

TEST HOLE # 14

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	TOPSOIL - Black/grey clayey, stiff, organic
2'	
1m	CLAY - Medium plastic, brown/tan, with silt and sand inclusions, moist, stiff
4'	
6'	
2m	
8'	
3m / 10'	CLAY - High plastic, grey, trace silt, moist, soft, uniform
12'	
4m	
14'	
16'	CLAY TILL - Medium plastic, with silt, sand and stones, very wet, very soft
5m	
18'	
6m / 20'	AUGER REFUSAL IN DENSE CLAY TILL @ 5.4 m. AFTER DRILLING, OPEN TO 5.25 m, DRY.



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : Beausejour

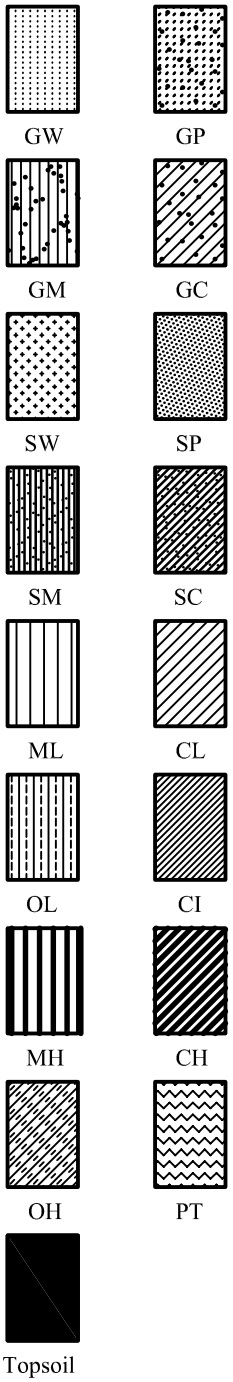
DATE : May 15, 2012

ELEVATION: 239.155

PROJECT : Lagoon Study and Environmental Submission

TEST HOLE # 15

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	TOPSOIL - Medium plastic, grey, clay, moist, hard
	2'	
1m		
	4'	CLAY - Medium plastic,brown, silty with sand inclusions, moist, stiff
	6'	
2m		
	8'	
3m	10'	CLAY - High plastic, grey, trace silt, moist, soft, uniform
	12'	
4m		
	14'	
	16'	
5m		CLAY TILL - Medium plastic, with silt, sand and stones, very wet, very soft
	18'	
6m	20'	AUGER REFUSAL @ 5.7 m. AFTER DRILLING, OPEN TO 5.7 m, DRY.



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : Beausejour

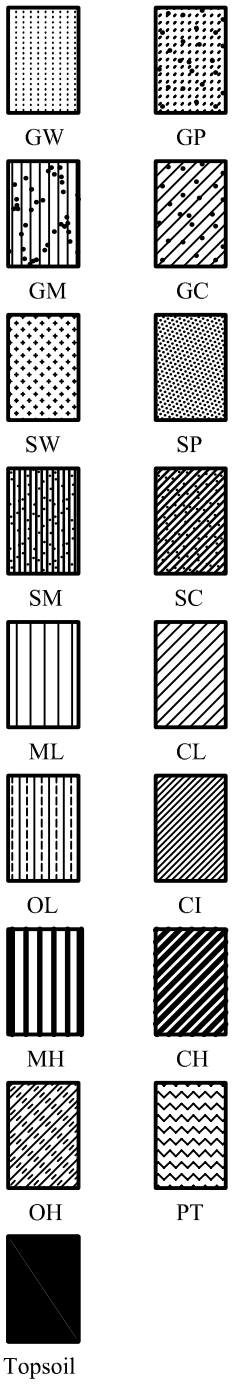
DATE : May 15, 2012

ELEVATION: 238.873

PROJECT : Lagoon Study and Environmental Submission

TEST HOLE # 16

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	TOPSOIL - Grey, clayey, stiff, organic
2'	
1m / 4'	CLAY - Medium plastic, brown/tan, silty, sandy, moist, stiff
6'	
2m / 8'	CLAY - High plastic, grey, some silt, moist, soft, uniform
3m / 10'	
12'	
4m / 14'	CLAY TILL - Medium plastic, sandy, silty, with stones, very wet, very soft
16'	
5m / 18'	CLAY TILL - Medium plastic, sandy, silty, with stones, saturated, very soft
6m / 20'	AUGER REFUSAL @ 5.7 m. AFTER DRILLING, OPEN TO 4.8 m, WATER FROM 3.6 m - 3.9 m. AFTER 2 HOURS, WATER FROM 1.2 m - 4.8 m



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TEST HOLE LOG SHEET

LOCATION : Beausejour

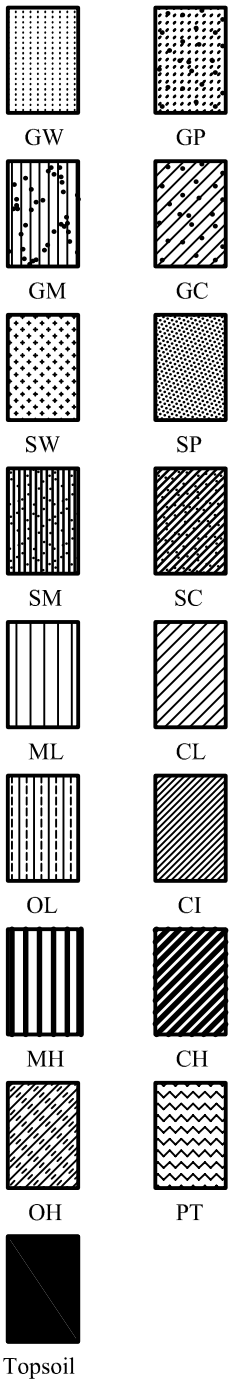
DATE : May 15, 2012

ELEVATION: 239.073

PROJECT : Lagoon Study and Environmental Submission

TEST HOLE # 17

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m – 0	TOPSOIL - Medium plastic, grey, clay
2'	
1m – 4'	CLAY - Medium plastic, light brown, silty, sandy, moist, stiff
6'	
2m – 8'	CLAY - High plastic, grey, trace silt, moist, soft, uniform
3m – 10'	
12'	
4m – 14'	TILL - Very wet, very soft
16'	
5m – 18'	
6m – 20'	AFTER DRILLING, OPEN TO 3.3 m, WATER FROM 3.0 m - 3.3 m.



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : Beausejour

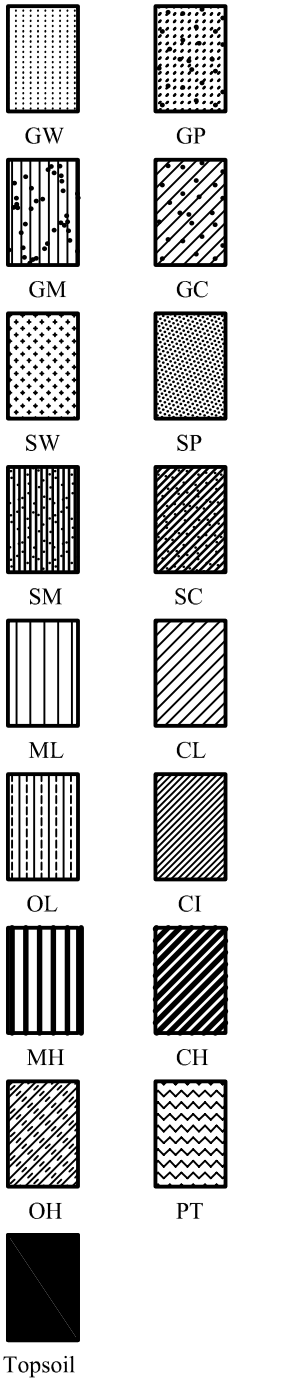
DATE : May 15, 2012

ELEVATION: 239.112

PROJECT : Lagoon Study and Environmental Submission

TEST HOLE # 18

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	TOPSOIL - Dry, organic
	2'	CLAY - Medium plastic, light brown, sandy, silty, moist, stiff
1m	4'	
	6'	
2m	8'	CLAY - High plastic, grey, trace silt, moist, soft, uniform
3m	10'	
	12'	
4m	14'	CLAY TILL - Low plastic, sandy, silty, moist, soft
	16'	
5m	18'	
6m	20'	AUGER REFUSAL AT 5.55 m IN DENSE TILL WITH LARGE STONES. OPEN TO 5.25 m.



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TEST HOLE LOG SHEET

LOCATION : Beausejour

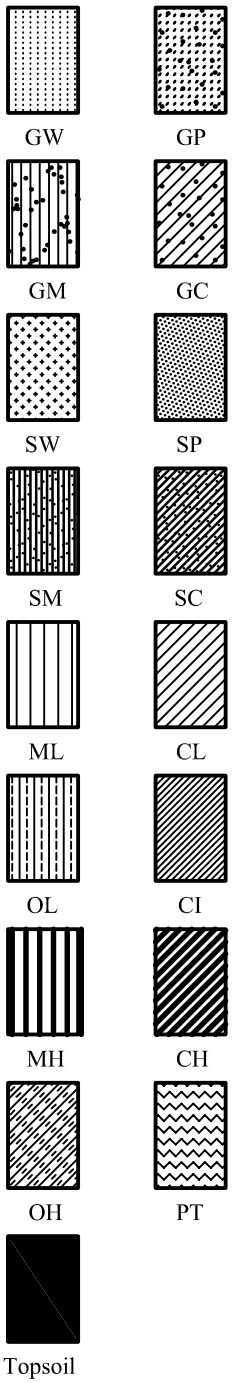
DATE : May 15, 2012

ELEVATION: 239.334

PROJECT : Lagoon Study and Environmental Submission

TEST HOLE # 19

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	TOPSOIL - Medium plastic, grey/black, clay
	2'	CLAY - Medium plastic, light brown, sandy, silty, moist, stiff
1m	4'	
	6'	CLAY - High plastic, grey, trace silt, moist, soft, uniform
2m	8'	
3m	10'	
	12'	CLAY TILL - Medium plastic, with silt, sand and stones, very wet, very soft
4m	14'	
	16'	
5m	18'	
6m	20'	AUGER REFUSAL AT 4.65 m IN DENSE TILL WITH LARGE STONES. OPEN TO 3.6 m. WATER FROM 2.1 m - 3.6 m.



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Past JRCC Test Hole Logs

J. R. Cousin Consultants Ltd.

TEST HOLE LOGS

SYMBOL INDEX


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Pt. : Peat, humus, swamp soils with high organic contents


TOPSOIL

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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : 5550831.28 N
678729.41 E

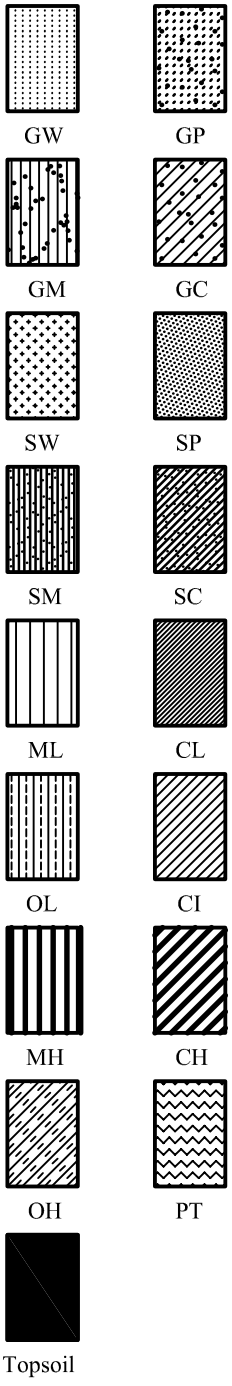
DATE : December 8, 2011

ELEVATION : 238.909 m

PROJECT : Town of Beausejour - Wastewater Treatment Lagoon Expansion

TEST HOLE # 1

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	TOPSOIL - black, organic
	2'	
1m		
	4'	CLAY - Medium plastic, brown, hard, moist, silt pockets, trace sand
	6'	
2m		
	8'	
3m		CLAY - High Plastic, grey, wet, soft, some silt, trace sand
	10'	
	12'	
4m		
	14'	SILTY TILL - grey/brown, very soft, very wet, sandy, gravelly, trace low plastic clay
	16'	
5m		
	18'	
6m	20'	BOTTOM OF HOLE: 6.0m NOTE - no water infiltration observed in the hole, no bedrock encountered, sloughing of the hole observed at 3.6m



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : 5551084.44 N
678713.62 E

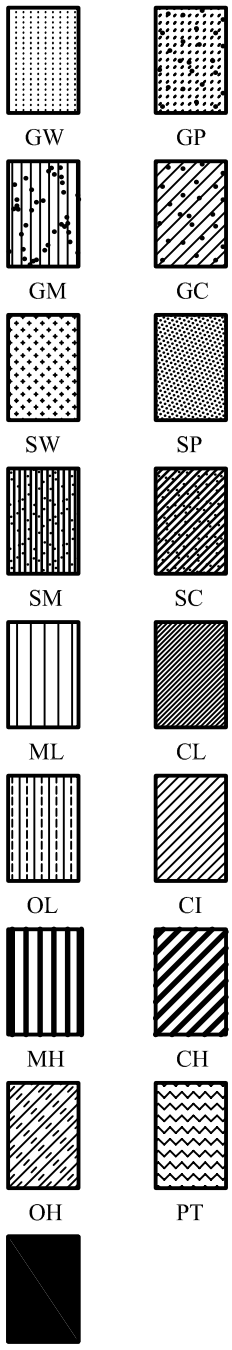
DATE : December 8, 2011

ELEVATION : 238.941 m

PROJECT : Town of Beausejour - Wastewater Treatment Lagoon Expansion

TEST HOLE # 2

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	TOPSOIL - black, organic
	2'	
1m		
	4'	CLAY - Medium plastic, brown, hard, moist, silt pockets, trace sand
	6'	
2m		
	8'	CLAY - High Plastic, grey, wet, soft, some silt, trace sand
3m	10'	
	12'	
4m		SILTY TILL - grey/brown, very soft, very wet, sandy, gravelly, trace low plastic clay
	14'	
	16'	
5m		
	18'	BOTTOM OF HOLE: 5.6m NOTE - hole terminated on boulder at 5.6m, standing water observed in the hole at 4.8m, no sloughing of the hole observed
6m	20'	



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : 5551136.62 N
678454.63 E

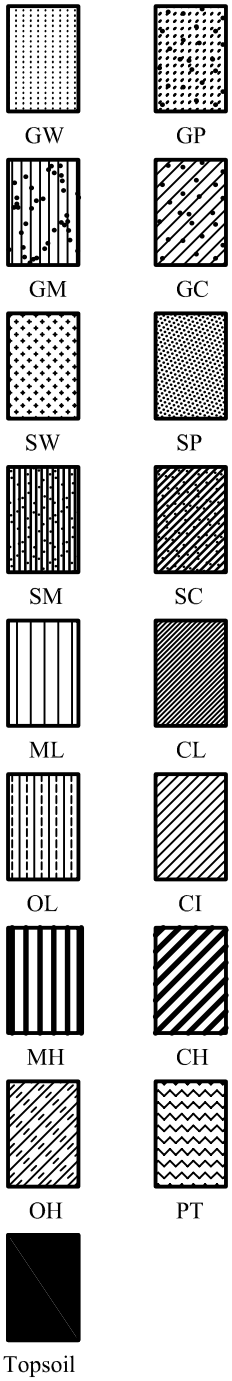
DATE : December 8, 2011

ELEVATION : 238.649 m

PROJECT : Town of Beausejour - Wastewater Treatment Lagoon Expansion

TEST HOLE # 3

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	TOPSOIL - black, organic
2'	
1m / 4'	CLAY - Medium plastic, brown, hard, moist, silt pockets, trace sand
6'	
2m / 8'	CLAY - High Plastic, grey, hard, moist, trace silt
3m / 10'	
12'	
4m / 14'	CLAY - High Plastic, grey, wet, soft, some silt, trace sand
16'	
5m / 18'	SILTY TILL - grey/brown, very soft, very wet, sandy, gravelly, trace low plastic clay
6m / 20'	BOTTOM OF HOLE: 6.0m NOTE - no water infiltration observed in the hole, no bedrock encountered, sloughing of the hole observed at 3.6m



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : 5550980.92 N
678465.40 E

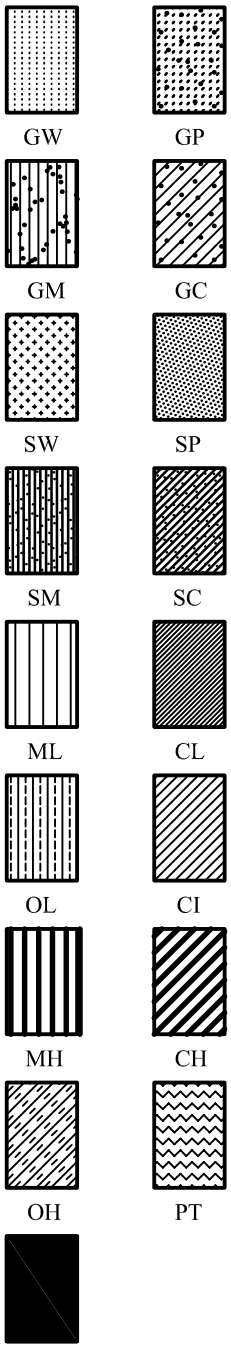
DATE : December 8, 2011

ELEVATION : 238.671 m

PROJECT : Town of Beausejour - Wastewater Treatment Lagoon Expansion

TEST HOLE # 4

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	TOPSOIL - black, organic
	2'	
1m		
	4'	CLAY - Medium plastic, brown, hard, moist, silt pockets, trace sand
	6'	
2m		
	8'	
3m		
	10'	CLAY - High Plastic, grey, firm, moist, trace silt
	12'	
4m		
	14'	CLAY - High Plastic, grey, wet, soft, some silt, trace sand
	16'	
5m		
	18'	SILTY TILL - grey/brown, very soft, very wet, sandy, gravelly, trace low plastic clay
6m	20'	BOTTOM OF HOLE: 6.0m NOTE - no water infiltration observed in the hole, no bedrock encountered, sloughing of the hole observed at 4.4m



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : 5550957.88 N
678279.40 E

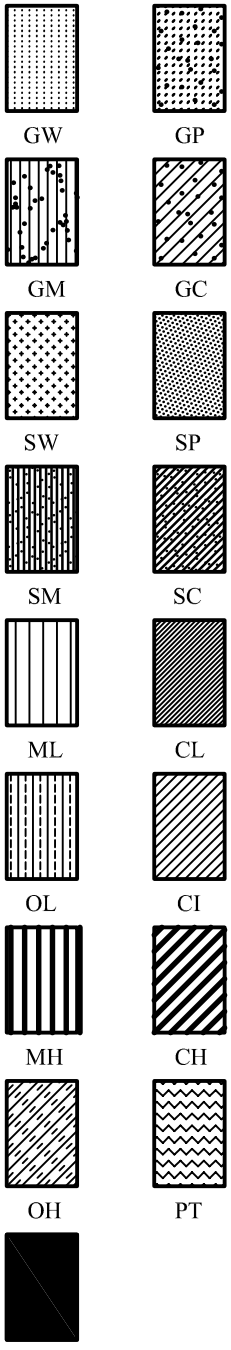
DATE : December 8, 2011

ELEVATION : 238.632 m

PROJECT : Town of Beausejour - Wastewater Treatment Lagoon Expansion

TEST HOLE # 5

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	TOPSOIL - black, organic
	2'	
1m		
	4'	CLAY - Medium plastic, brown, hard, moist, silt pockets, trace sand
	6'	
2m		
	8'	
3m		
	10'	CLAY - High Plastic, grey, firm, moist, trace silt
	12'	
4m		
	14'	CLAY - High Plastic, grey, wet, soft, some silt, trace sand
	16'	
5m		
	18'	SILTY TILL - grey/brown, very soft, very wet, sandy, gravelly, trace low plastic clay
6m	20'	BOTTOM OF HOLE: 6.0m NOTE - no water infiltration observed in the hole, no bedrock encountered, no sloughing of the hole observed



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : 5551128.59 N
678277.25 E

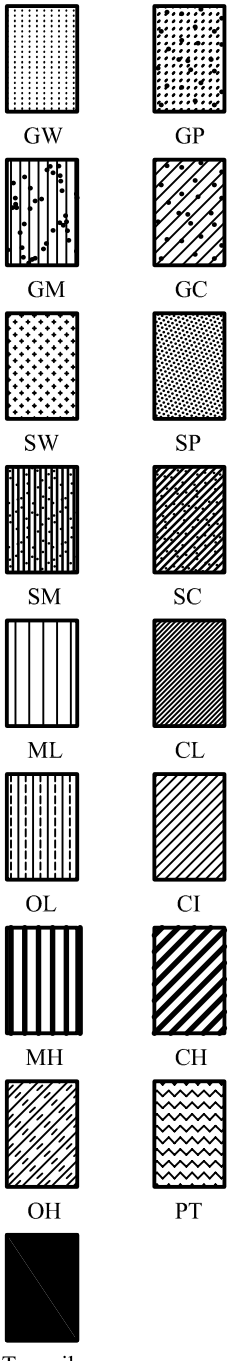
DATE : December 8, 2011

ELEVATION : 238.614 m

PROJECT : Town of Beausejour - Wastewater Treatment Lagoon Expansion

TEST HOLE # 6

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	TOPSOIL - black, organic
2'	
1m / 4'	CLAY - Medium plastic, brown, hard, moist, silt pockets, trace sand
6'	
2m / 8'	CLAY - High Plastic, grey, firm, moist, trace silt
3m / 10'	
12'	
4m / 14'	CLAY - High Plastic, grey, wet, soft, some silt, trace sand
16'	
5m / 18'	SILTY TILL - grey/brown, very soft, very wet, sandy, gravelly, trace low plastic clay
6m / 20'	BOTTOM OF HOLE: 6.0m NOTE - no water infiltration observed in the hole, no bedrock encountered, sloughing of the hole observed at 3.2m



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : 5551227.24 N
677980.24 E

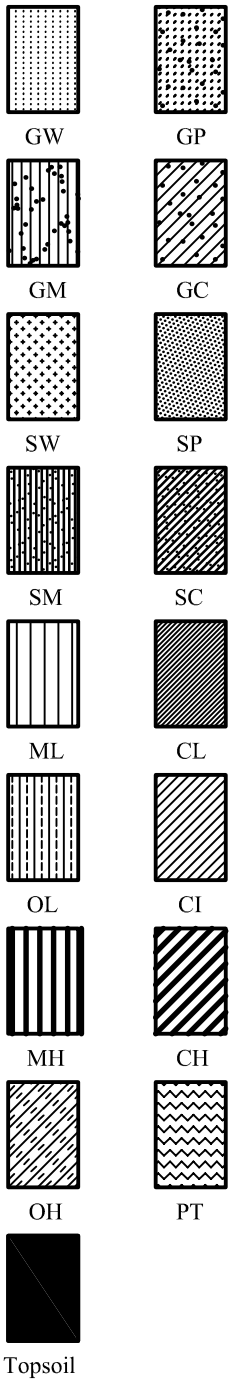
DATE : December 8, 2011

ELEVATION : 238.662 m

PROJECT : Town of Beausejour - Wastewater Treatment Lagoon Expansion

TEST HOLE # 7

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	TOPSOIL - black, organic
2'	
1m / 4'	CLAY - Medium plastic, brown, hard, moist, silt pockets, trace sand
6'	
2m / 8'	
	CLAY - High Plastic, grey, firm, moist, trace silt
3m / 10'	
12'	
4m / 14'	CLAY - High Plastic, grey, wet, soft, some silt, trace sand
16'	
5m / 18'	
6m / 20'	BOTTOM OF HOLE: 6.0m NOTE - no water infiltration observed in the hole, no bedrock encountered, sloughing of the hole observed at 1.5m



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : 5551221.26 N
677774.14 E

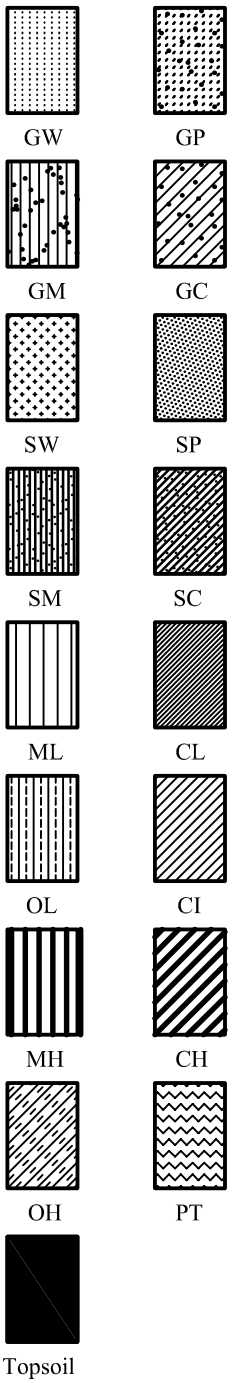
DATE : December 8, 2011

ELEVATION : 238.441 m

PROJECT : Town of Beausejour - Wastewater Treatment Lagoon Expansion

TEST HOLE # 8

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	TOPSOIL - black, organic
	2'	
1m		CLAY - Medium plastic, brown, hard, moist, silt pockets, trace sand
	4'	
	6'	
2m		
	8'	
3m	10'	CLAY - High Plastic, grey, firm, moist, trace silt
	12'	
4m		
	14'	CLAY - High Plastic, grey, wet, soft, silt pockets, trace sand
	16'	
5m		
	18'	SILTY TILL - grey/brown, very soft, very wet, sandy, gravelly, trace low plastic clay
6m	20'	BOTTOM OF HOLE: 6.0m NOTE - no water infiltration observed in the hole, no bedrock encountered, sloughing of the hole observed at 3.2m



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : 5551025.45 N
677802.64 E

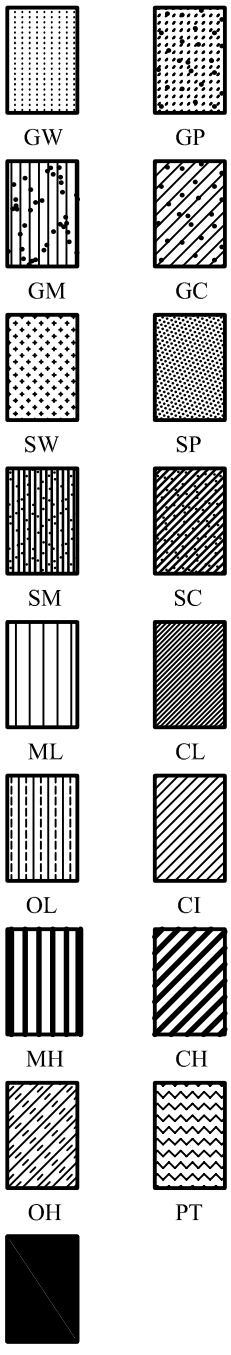
DATE : December 8, 2011

ELEVATION : 238.900 m

PROJECT : Town of Beausejour - Wastewater Treatment Lagoon Expansion

TEST HOLE # 9

DEPTH OF SAMPLE		FIELD CLASSIFICATION
0m	0	TOPSOIL - black, organic
	2'	
1m		
	4'	CLAY - Medium plastic, brown, hard, moist, silt pockets, trace sand
	6'	
2m		
	8'	CLAY - High Plastic, grey, firm, moist, trace silt
3m	10'	CLAY - High Plastic, grey, wet, soft, silt pockets, trace sand
	12'	
4m		
	14'	
	16'	SILTY TILL - grey/brown, very soft, very wet, sandy, gravelly, small stones, trace low plastic clay
5m		
	18'	
6m	20'	BOTTOM OF HOLE: 6.0m NOTE - no water infiltration observed in the hole, no bedrock encountered, sloughing of the hole observed at 2.2m



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J. R. Cousin Consultants Ltd.

TEST HOLE LOG SHEET

LOCATION : NOT RECORDED

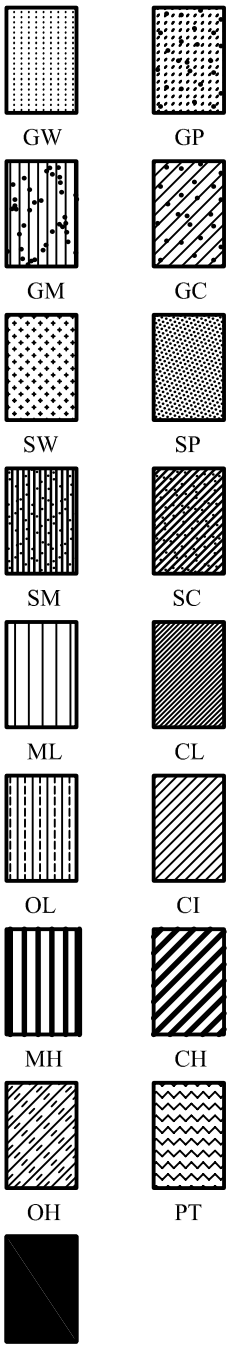
DATE : December 8, 2011

ELEVATION : NOT RECORDED

PROJECT : Town of Beausejour - Wastewater Treatment Lagoon Expansion

TEST HOLE # 10

DEPTH OF SAMPLE	FIELD CLASSIFICATION
0m / 0	TOPSOIL - black, organic
2'	TOPSOIL - black, organic, with low plastic clay
1m / 4'	CLAY - Medium plastic, brown, hard, moist, silt pockets, trace sand
6' / 2m	
8'	CLAY - High Plastic, grey, firm, moist, trace silt
3m / 10'	
12'	
4m / 14'	CLAY - High Plastic, grey, wet, soft, some silt, trace sand
16' / 5m	
18'	SILTY TILL - grey/brown, very soft, very wet, sandy, gravelly, trace low plastic clay
6m / 20'	BOTTOM OF HOLE: 6.0m NOTE - no water infiltration observed in the hole, no bedrock encountered, sloughing of the hole observed at 3.2m



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National Testing Laboratories Ltd Test Results, dated June 14, 2012

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

199 Henlow Bay
Winnipeg, MB R3Y 1G4
Phone (204) 488-6999
Fax (204) 488-6947
Email info@nationaltestlabs.com
www.nationaltestlabs.com

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

June 14, 2012

Project: Beausejour Lagoon Expansion

Attention: Brett McCormac

Soil samples were submitted to our laboratory on May 18, 2012. The following tests were conducted on selected soil samples:

- water content (ASTM D2216)
- particle size analysis (ASTM D422)
- liquid limit, plastic limit, and plasticity index (ASTM D4318)
- soil classification (ASTM D2487)
- hydraulic conductivity (ASTM D5084)
- visual classification

The test results for the soil samples are summarized in the following tables and in the attached particle size analysis and hydraulic conductivity reports.

An assessment of the bagged soil samples was conducted to determine whether the soil represented by the bagged samples could be used in-situ as a landfill liner and would obtain a hydraulic conductivity of less than 1.0×10^{-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 1.0×10^{-7} cm/sec or less. All of the bagged samples with the exception of bagged sample TH14 at 4.6-5.5 m satisfied these criteria and are considered suitable for use as a lagoon liner. Although the bagged sample TH14 at 0.6 – 1.5 m did not meet the criteria noted above, a Shelby tube sample over the same interval which was tested for hydraulic conductivity had a hydraulic conductivity of less than 1.0×10^{-7} cm/sec. on the basis of the hydraulic conductivity test result this sample is considered suitable to be used as a lagoon liner. Our comments regarding the potential use of the material 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.

The hydraulic conductivity results for the Shelby tube samples and the remoulded sample are less than the specified maximum hydraulic conductivity value of 1.0×10^{-7} cm/s for lagoon liners.

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

Farouk Fourar-Laidi, B.Sc., EIT
Geotechnical Engineering

THE NATIONAL TESTING LABORATORIES LIMITED

SUMMARY OF WATER CONTENT, PARTICLE SIZE, ATTERBERG LIMITS, SOIL CLASSIFICATION TEST DATA
BEAUSEJOUR LAGOON EXPANSION

Testhole	Depth (m)	Visual Classification	Water Content (%)	Gravel (%) 75 to 4.75 mm	Sand (%)			Silt (%) <0.075 to 0.005 mm	Clay (%) <0.005 mm	Liquid Limit	Plastic Limit	Plasticity Index	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
					Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm								
TH13	0-0.8	black, firm, moist, high plasticity silty clay and sandy	29.6	0.0	0.1	1.1	22.2	24.8	51.8	58.0	21	37	CH (Fat clay with sand)	yes	yes
TH14	0.6-1.5	brown, firm, moist, medium plasticity silty clay with trace sand	31.2	0.0	0.0	0.1	2.0	48.5	49.4	49	18	31	CL (Lean clay)	See Note 4	See note 5
TH14	1.5-4.6	brown, firm, moist, high plasticity clay with trace silt and trace sand	30.0	0.2	0.1	0.5	1.7	6.5	91.0	81	24	57	CH (Fat clay)	yes	yes
TH14	4.6-5.5	brown, firm, moist, low plasticity silty clay and sandy with trace gravel	52.3	4.8	4.2	8.5	15.6	30.8	36.1	22	10	12	CL (Sandy lean clay)	no	no
TH16	0.6-1.5	brown, firm, moist, high plasticity silty clay with trace sand	15.0	0.0	0.1	0.3	1.2	46.1	52.3	52	18	34	CH (Fat clay)	yes	yes

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.
4. Based on the hydraulic conductivity test performed on the Shelby tube the soil is suitable to be used as a lagoon liner when re-moulded and re-compacted
5. Based on the hydraulic conductivity test performed on the Shelby tube the soil is suitable to be used as a lagoon liner without being reworked

THE NATIONAL TESTING LABORATORIES LIMITED

TABLE 2
HYDRAULIC CONDUCTIVITY SUMMARY
BEAUSEJOUR LAGOON EXPANSION

Testhole	Depth (m)	Hydraulic Conductivity, "k_{20}"
TH14	0.8 – 1.4	4.9×10^{-8} cm/s
TH14	2.1 – 2.7	1.5×10^{-8} cm/s
TH16	0.6 – 1.5	1.2×10^{-8} cm/s

Note: The soil sample was compacted into 70 mm molds using the compactive effort outlined in standard test method ASTM D698, Method C prior to testing

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

PARTICLE SIZE ANALYSIS
ASTM D422

J.R. Cousin Consultants Ltd.
91A Scurfield Blvd.
Winnipeg, Manitoba
R2M 5N3

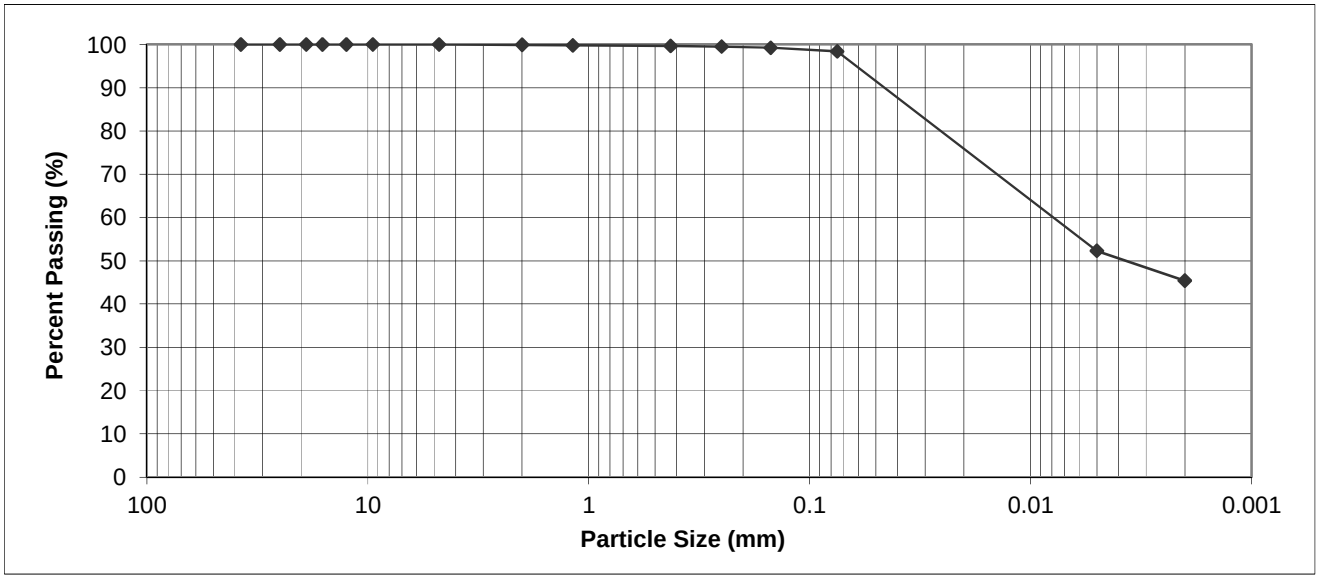
PROJECT: Beausejour Lagoon Expansion

Attention: Brett McCormac

PROJECT NO.: JRC-1208

SAMPLED BY: Client
SAMPLE ID: TH16 at 0.6-1.5 m

DATE RECEIVED: May 18, 2012
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	100.0
9.50 mm	100.0
4.75 mm	100.0
2.00 mm	99.9

PARTICLE SIZE	PERCENT PASSING
1.18 mm	99.8
0.425 mm	99.6
0.250 mm	99.5
0.150 mm	99.3
0.075 mm	98.4
0.005 mm	52.3
0.002 mm	45.4
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			
0.0	0.1	0.3	1.2	46.1	52.3	NT*

NT* Sample not tested for colloids

June 5, 2012

REVIEWED BY: Farouk Fourar-Laidi, B.Sc., EIT

199 Henlow Bay, Winnipeg, Manitoba R3Y 1G4 Phone (204) 488-6999 Fax (204) 488-6947 Email info@nationaltestlabs.com

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

PARTICLE SIZE ANALYSIS
ASTM D422

J.R. Cousin Consultants Ltd.
91A Scurfield Blvd.
Winnipeg, Manitoba
R2M 5N3

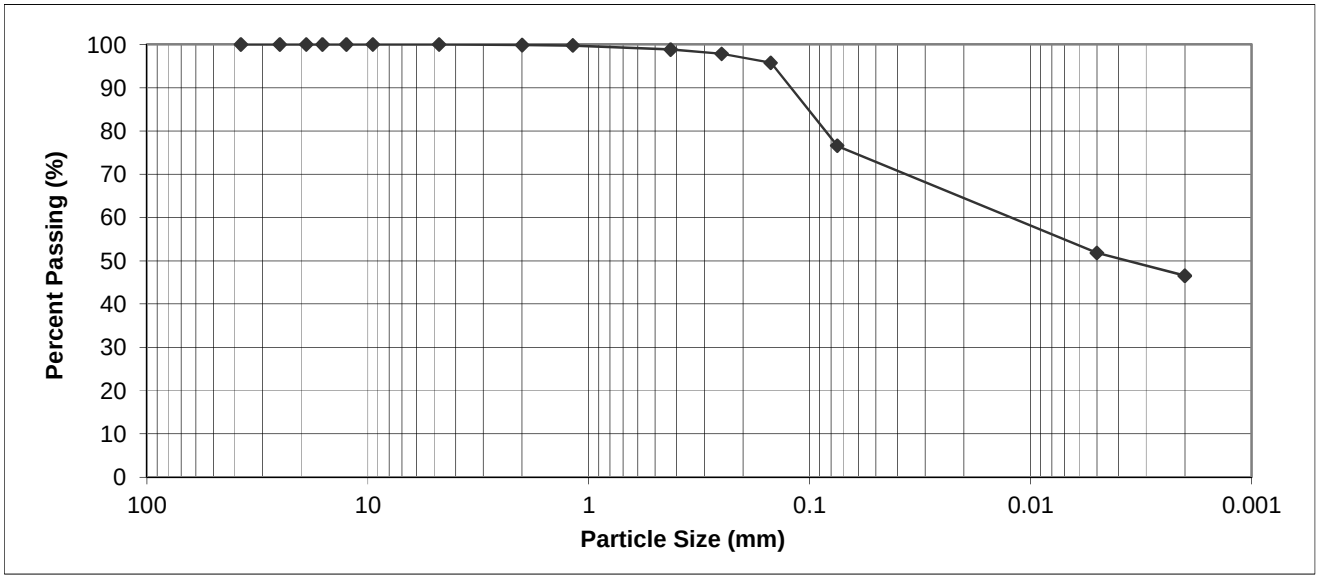
PROJECT: Beausejour Lagoon Expansion

Attention: Brett McCormac

PROJECT NO.: JRC-1208

SAMPLED BY: Client
SAMPLE ID: TH13 at 0-0.6 m

DATE RECEIVED: May 18, 2012
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	100.0
9.50 mm	100.0
4.75 mm	100.0
2.00 mm	99.9

PARTICLE SIZE	PERCENT PASSING
1.18 mm	99.8
0.425 mm	98.8
0.250 mm	97.9
0.150 mm	95.8
0.075 mm	76.6
0.005 mm	51.8
0.002 mm	46.5
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			
0.0	0.1	1.1	22.2	24.8	51.8	NT*

NT* Sample not tested for colloids

June 5, 2012

REVIEWED BY: Farouk Fourar-Laidi, B.Sc., EIT

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THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

PARTICLE SIZE ANALYSIS
ASTM D422

J.R. Cousin Consultants Ltd.
91A Scurfield Blvd.
Winnipeg, Manitoba
R2M 5N3

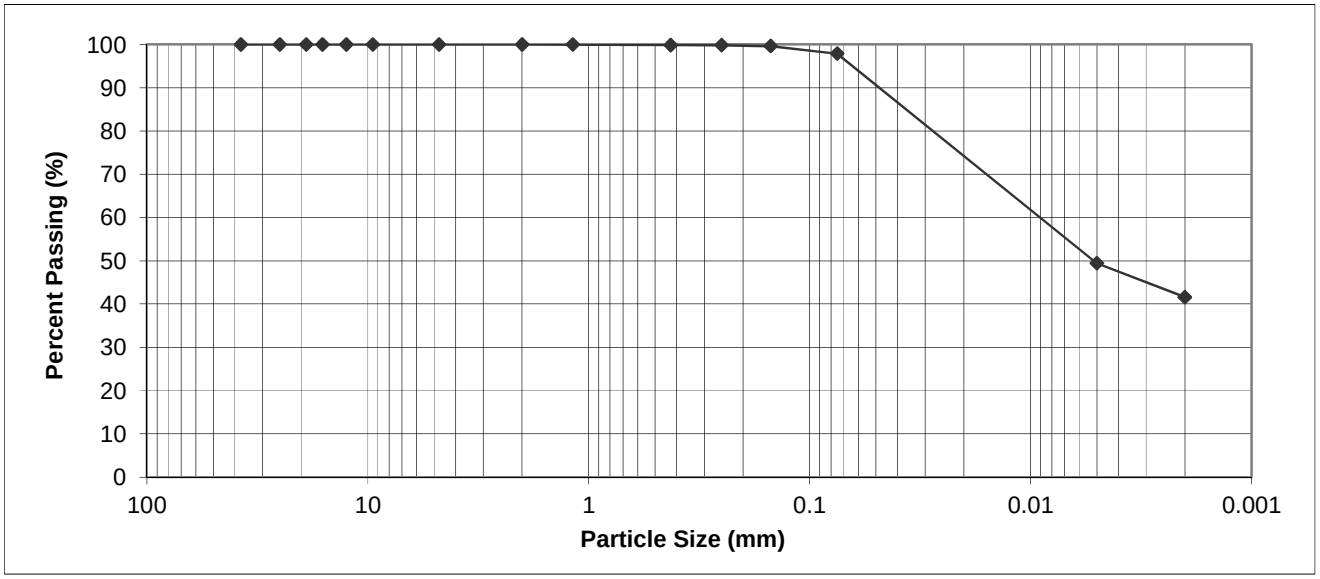
PROJECT: Beausejour Lagoon Expansion

Attention: Brett McCormac

PROJECT NO.: JRC-1208

SAMPLED BY: Client
SAMPLE ID: TH14 at 0.6-1.5 m

DATE RECEIVED: May 18, 2012
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	100.0
9.50 mm	100.0
4.75 mm	100.0
2.00 mm	100.0

PARTICLE SIZE	PERCENT PASSING
1.18 mm	100.0
0.425 mm	99.9
0.250 mm	99.8
0.150 mm	99.6
0.075 mm	97.9
0.005 mm	49.4
0.002 mm	41.6
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			
0.0	0.0	0.1	2.0	48.5	49.4	NT*

NT* Sample not tested for colloids

June 5, 2012

REVIEWED BY: Farouk Fourar-Laidi, B.Sc., EIT

199 Henlow Bay, Winnipeg, Manitoba R3Y 1G4 Phone (204) 488-6999 Fax (204) 488-6947 Email info@nationaltestlabs.com

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

PARTICLE SIZE ANALYSIS
ASTM D422

J.R. Cousin Consultants Ltd.
91A Scurfield Blvd.
Winnipeg, Manitoba
R2M 5N3

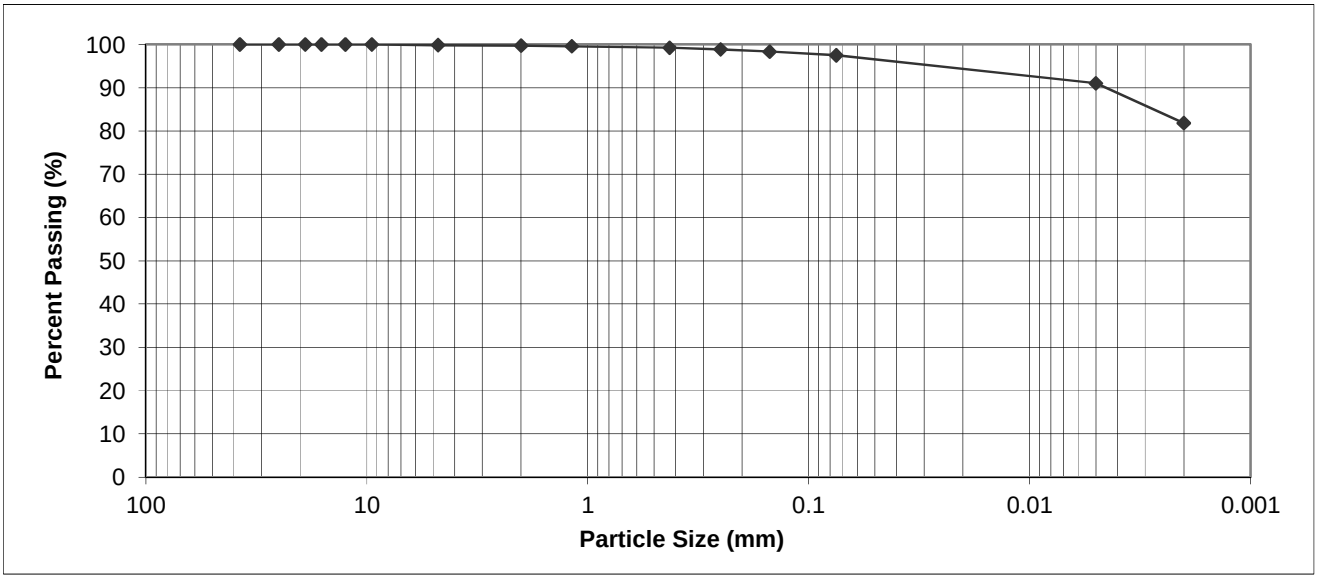
PROJECT: Beausejour Lagoon Expansion

Attention: Brett McCormac

PROJECT NO.: JRC-1208

SAMPLED BY: Client
SAMPLE ID: TH14 at 1.5-4.6 m

DATE RECEIVED: May 18, 2012
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	100.0
9.50 mm	100.0
4.75 mm	99.8
2.00 mm	99.7

PARTICLE SIZE	PERCENT PASSING
1.18 mm	99.5
0.425 mm	99.2
0.250 mm	98.9
0.150 mm	98.3
0.075 mm	97.5
0.005 mm	91.0
0.002 mm	81.8
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			
0.2	0.1	0.5	1.7	6.5	91.0	NT*

NT* Sample not tested for colloids

June 5, 2012

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PARTICLE SIZE ANALYSIS
ASTM D422

J.R. Cousin Consultants Ltd.
91A Scurfield Blvd.
Winnipeg, Manitoba
R2M 5N3

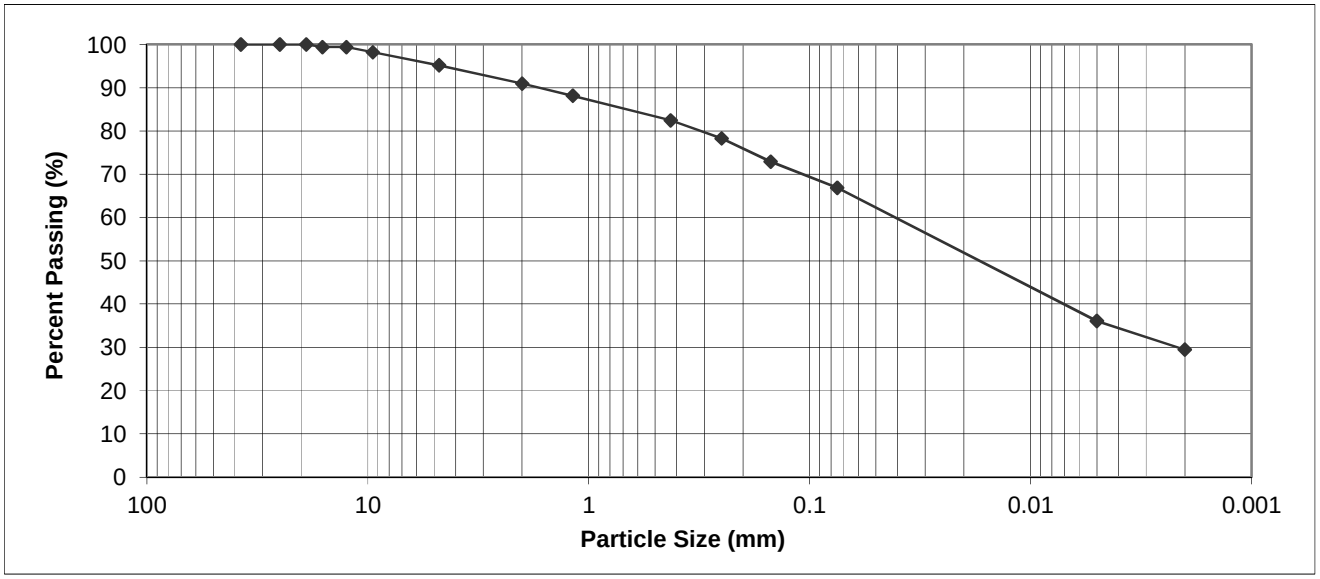
PROJECT: Beausejour Lagoon Expansion

Attention: Brett McCormac

PROJECT NO.: JRC-1208

SAMPLED BY: Client
SAMPLE ID: TH14 at 4.6-5.5 m

DATE RECEIVED: May 18, 2012
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	98.2
4.75 mm	95.2
2.00 mm	91.0

PARTICLE SIZE	PERCENT PASSING
1.18 mm	88.1
0.425 mm	82.5
0.250 mm	78.3
0.150 mm	72.9
0.075 mm	66.9
0.005 mm	36.1
0.002 mm	29.4
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			
4.8	4.2	8.5	15.6	30.8	36.1	NT*

NT* Sample not tested for colloids

June 5, 2012

REVIEWED BY: Farouk Fourar-Laidi, B.Sc., EIT

199 Henlow Bay, Winnipeg, Manitoba R3Y 1G4 Phone (204) 488-6999 Fax (204) 488-6947 Email info@nationaltestlabs.com

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

HYDRAULIC CONDUCTIVITY
ASTM D5084

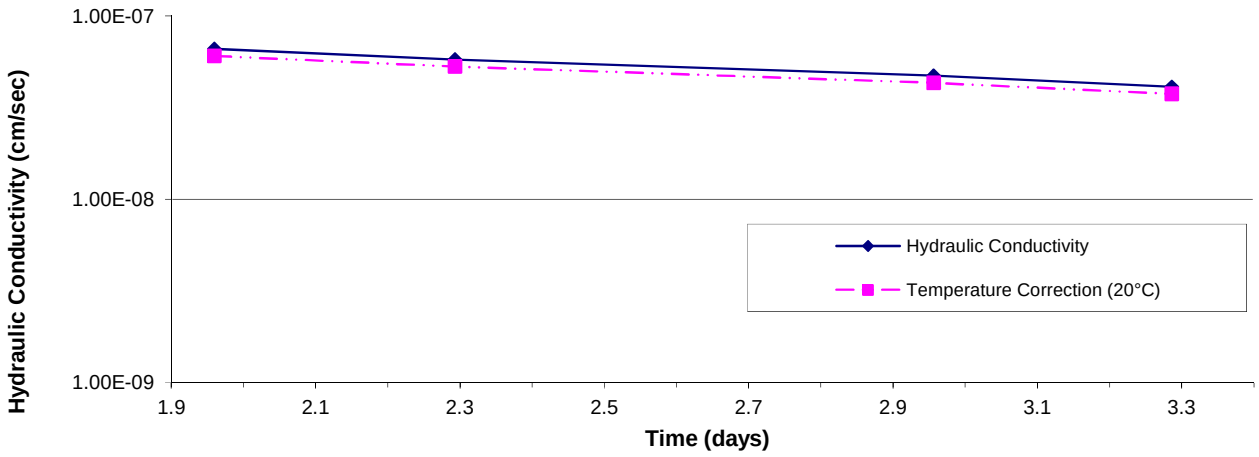
J.R.Cousin Consultants Ltd.
91A Scurfield Blvd.
Winnipeg, Manitoba
R3Y 1G4

PROJECT: Beausejour Lagoon Expansion

Attention: Brett McCormac

SAMPLE I.D.:	**TH14 at 0.8-1.4 m**
SOIL TYPE:	Brown, firm, moist, medium plasticity clay with trace to some silt
DATE TESTED:	May 22 to May 28
CONFINING PRESSURE (kPa):	137.9
EFFECTIVE SATURATION STRESS (kPa):	34.5
HYDRAULIC GRADIENT:	18.9
TYPE OF PERMEANT LIQUID:	De-aired Water
HYDRAULIC CONDUCTIVITY, "k" (cm/s):	5.3E-08
HYDRAULIC CONDUCTIVITY, "k_{20}" (cm/s):	**4.9E-08**

	Height (mm)	Diameter (mm)	Wet Mass (g)	Dry Density (g/cm^3)	Water Content (%)	Saturation (%)
Initial Reading	79.7	72.5	629.2	1.478	29.4	95.6
Final Reading	78.3	71.8	631.0	1.528	30.2	105.7



June 5, 2012

REVIEWED BY: Farouk Fourar-Laidi, EIT

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HYDRAULIC CONDUCTIVITY
ASTM D5084

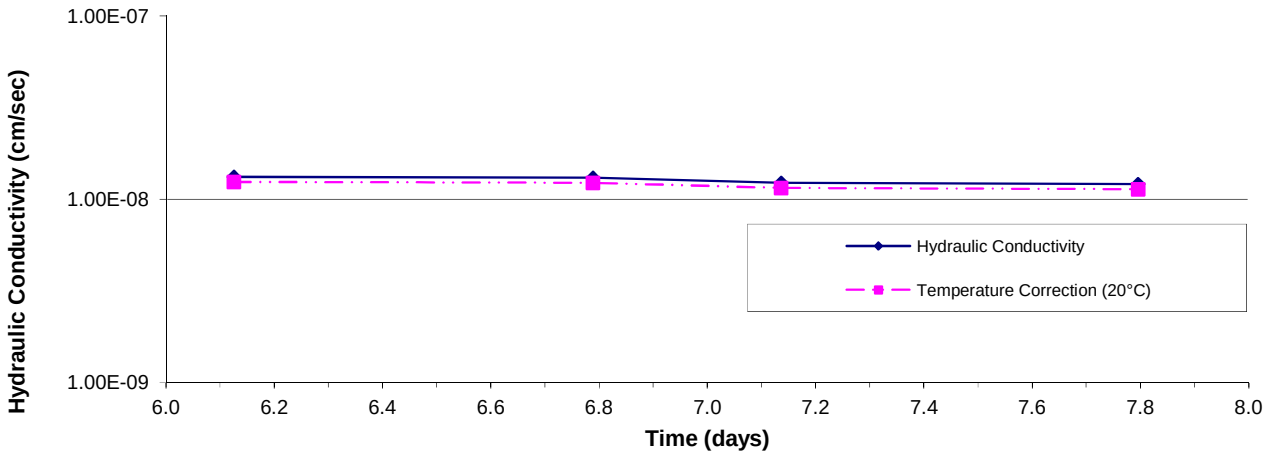
J.R.Cousin Consultants Ltd.
91A Scurfield Blvd.
Winnipeg, Manitoba
R3Y 1G4

PROJECT: Beausejour Lagoon Expansion

Attention: Brett McCormac

SAMPLE I.D.:	**TH14 at 2.1-2.7 m**
SOIL TYPE:	Brown, firm, moist, high plasticity clay with trace silt
DATE TESTED:	May 22 to May 31
CONFINING PRESSURE (kPa):	137.9
EFFECTIVE SATURATION STRESS (kPa):	34.5
HYDRAULIC GRADIENT:	19.3
TYPE OF PERMEANT LIQUID:	De-aired Water
HYDRAULIC CONDUCTIVITY, "k" (cm/s):	1.6E-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	77.9	72.5	547.2	1.120	52.1	99.5
Final Reading	76.8	73.1	548.3	1.107	53.7	100.4



June 5, 2012

REVIEWED BY: Farouk Fourar-Laidi, EIT

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ASTM D5084

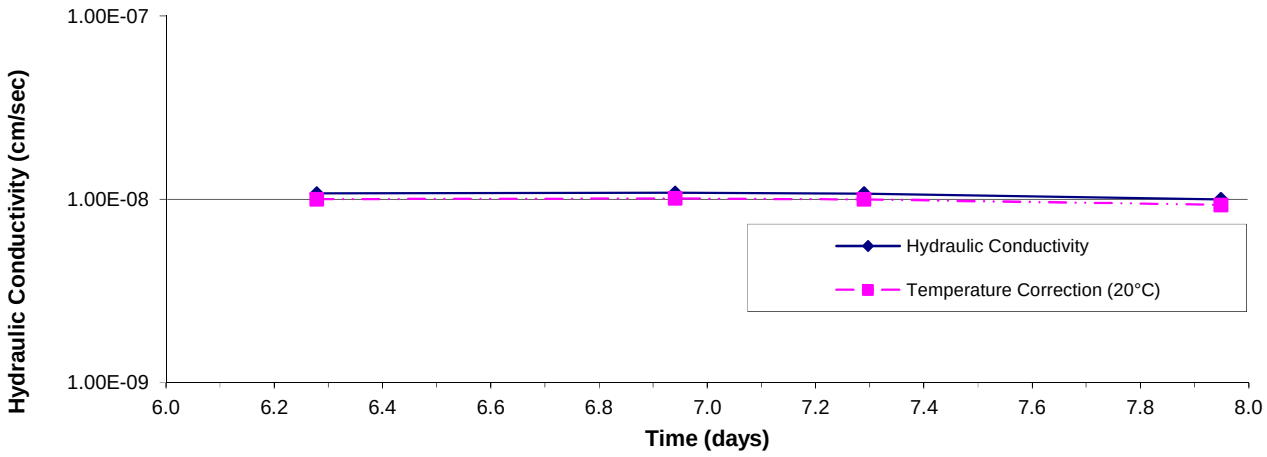
J.R.Cousin Consultants Ltd.
91A Scurfield Blvd.
Winnipeg, Manitoba
R3Y 1G4

PROJECT: Beausejour Lagoon Expansion

Attention: Brett McCormac

SAMPLE I.D.:	**TH16 at 0.6-1.5 m**
SOIL TYPE:	brown, firm, moist,high plasticity silty clay with trace sand
DATE TESTED:	May 22 to May 31
CONFINING PRESSURE (kPa):	137.9
EFFECTIVE SATURATION STRESS (kPa):	34.5
HYDRAULIC GRADIENT:	19.1
TYPE OF PERMEANT LIQUID:	De-aired Water
HYDRAULIC CONDUCTIVITY, "k" (cm/s):	1.3E-08
HYDRAULIC CONDUCTIVITY, "k_{20}" (cm/s):	**1.2E-08**

	Height (mm)	Diameter (mm)	Wet Mass (g)	Dry Density (g/cm^3)	Water Content (%)	Saturation (%)
Initial Reading	79.0	71.9	625.6	1.510	29.0	99.0
Final Reading	77.7	71.7	622.3	1.529	29.5	103.6



Note: Sample was compacted into 70 mm mold using the compactive effort outlined in standard test method ASTM D698, Method C prior to testing

June 5, 2012

REVIEWED BY: Farouk Fourar-Laidi, EIT

199 Henlow Bay, Winnipeg, Manitoba R3Y 1G4 Phone (204) 488-6999 Fax (204) 488-6947 Email info@nationaltestlabs.com

GW Driller’s Well Logs

LOCATION: NE12-13-7E

Well_PID: 74060
Owner: J BAKER
Driller: Paul Slusarchuk Well Drilling LTd.
Well Name: FARMYARD
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 678562.765
UTMY: 5551353.38
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1992 May 25

WELL LOG

From (ft.)	To (ft.)	Log
0	20.0	CLAY
20.0	34.0	TILL SOME SILTY LAYER
34.0	39.5	RUBBLE LIMESTONE SOME CLAY
39.5	74.0	LIMESTONE
74.0	75.0	SHALE

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	40.0	casing	4.00			INSERT	GALVANIZED
40.0	74.0	open hole	4.00				
3.0	30.0	casing grout					CEMENT

Top of Casing: 2.5 ft. below ground

PUMPING TEST

Date: 1992 May 25
Flowing Rate: 15.0 Imp. gallons/minute
Water level before pumping: 5.0 ft. above ground
Pumping level at end of test: ?? ft. below ground
Test duration: hours, minutes
Water temperature: ?? degrees F

REMARKS

LOT 2

LOCATION: NW12-13-7E

Well_PID: 13187
Owner: UNIV OF MANITOBA
Driller: UNKNOWN DRILLER
Well Name: TH #21
Well Use: TEST WELL
Water Use:
UTMX: 677758.848
UTMY: 5551329.13
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1969 Jan 01

WELL LOG

From (ft.)	To (ft.)	Log
0	5.0	MODERATE YELLOWISH BROWN SANDY SILT
5.0	20.0	OLIVE GREY LAKE CLAY, NUMEROUS SILT POCKETS
20.0	48.0	LIGHT OLIVE GREY CALCAREOUS, SILTY TILL, GRANITIC AND CARBONATE ROCK FRAGMENTS, TOO ROCKY TO DRILL PAST 48 FEET

No construction data for this well.

Top of Casing: ft. below ground

No pump test data for this well.

REMARKS

1968-1969 BEAUSEJOUR AREA, MCPHERSON PHD THESIS GROUND LEVEL ELEV EST 790 FT

LOCATION: SW12-13-7E

Well_PID: 20973
Owner: M MORRIS
Driller: AQUARIUS WELL DRILLING
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 677780.52
UTMY: 5550517.42
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1974 Jun 13

WELL LOG

From (ft.)	To (ft.)	Log
0	14.0	CLAY
14.0	50.0	GRAVEL& TILL
50.0	81.9	GREY LIMESTONE

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	68.5	casing	4.50			INSERT	BLACK IRON
68.5	81.9	open hole	4.00				

Top of Casing: ft. below ground

PUMPING TEST

Date:
Pumping Rate: 30.0 Imp. gallons/minute
Water level before pumping: 4.0 ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: 1 hours, 30 minutes
Water temperature: ?? degrees F

LOCATION: SW12-13-7E

Well_PID: 137315
Owner: SHIRLEY MCTAVISH
Driller: Echo Drilling Ltd.
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 677400
UTMY: 5550161
Accuracy XY: 1 EXACT [<5M] [GPS]
UTMZ:
Accuracy Z:
Date Completed: 2005 Aug 04

WELL LOG

From (ft.)	To (ft.)	Log
0	2.0	FILL
2.0	54.0	TILL
54.0	118.0	LIMESTONE

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	58.0	CASING	5.00	5.50		INSERT	PVC
58.0	118.0	OPEN HOLE	4.00				
20.0	50.0	CASING GROUT					OTHER

Top of Casing: 2.0 ft. above ground

PUMPING TEST

Date:	2005 Aug 04
Pumping Rate:	50.0 Imp. gallons/minute
Water level before pumping:	6.0 ft. below ground
Pumping level at end of test:	40.0 ft. below ground
Test duration:	??? hours, ?? minutes
Water temperature:	?? degrees F

REMARKS

BEAUSEJOUR. WELL MUST BE VENTED.

Appendix D

Maxxam Test Results 2011-11-15

ALS Test Results 2012-02-23

ALS Test Results 2012-04-16

ALS Test Results 2012-05-23

Attention: Darryl Mazur
TOWN OF BEAUSEJOUR
BOX 1028
BEAUSEJOUR, MB
Canada R0E 0C0

Report Date: 2011/11/21

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B1B0854
Received: 2011/11/15, 13:20

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Total Phosphorus (1)	4	N/A	2011/11/18	BBY6SOP-00013	SM 4500 PE

* Results relate only to the items tested.

(1) This test was performed by Maxxam Vancouver

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

JANELLE KOCHAN, B.Sc., Project Manager,
Email: JKochan@maxxam.ca
Phone# (204) 772-7276 Ext:2209

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

TOWN OF BEAUSEJOUR

Maxxam Job #: B1B0854
Report Date: 2011/11/21

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		CD0871	CD0872	CD0873	CD0874		
Sampling Date		2011/11/15 08:30	2011/11/15 08:30	2011/11/15 08:30	2011/11/15 08:30		
	Units	**CELL # 1 A**	**CELL # 1 B**	**CELL # 4 A**	**CELL # 4 B**	**RDL**	**QC Batch**
Nutrients							
Total Phosphorus (P)	mg/L	3.63	0.501	0.850	0.892	0.050	5375139

RDL = Reportable Detection Limit

Maxxam Analytics International Corporation o/a Maxxam Analytics, Unit D - 675 Berry Street, Winnipeg, MB, R3H 1A7, Tel: (204) 772-7276, Fax: (204) 772-2386 www.maxxam.ca

TOWN OF BEAUSEJOUR

Maxxam Job #: B1B0854
Report Date: 2011/11/21

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
5375139	Total Phosphorus (P)	2011/11/18	98	80 - 120	93	80 - 120	<0.0050	mg/L	NC	20

N/A = Not Applicable
RPD = Relative Percent Difference
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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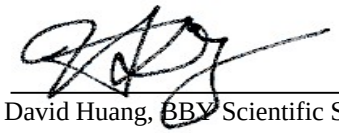
Validation Signature Page

Maxxam Job #: B1B0854

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



David Huang, BBY Scientific Specialist

==========

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Town of Beausejour
ATTN: Jeff Matychak
PO BOX 1028
Beausejour MB R0E 0C0

Date Received: 23-FEB-12
Report Date: 06-MAR-12 14:46 (MT)
Version: FINAL

Client Phone: 204-268-9294

Certificate of Analysis

Lab Work Order #: L1117214

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Robert S. Kitlar
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1117214-1 CELL #1A							
Sampled By: CLIENT on 23-FEB-12 @ 10:00							
Matrix: LAGOON							
Nitrate + Nitrite							
Nitrate as N							
Nitrate-N	<0.25		0.25	mg/L		23-FEB-12	R2329417
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.35		0.35	mg/L		23-FEB-12	
Nitrite as N							
Nitrite-N	<0.25		0.25	mg/L		23-FEB-12	R2329417
Miscellaneous Parameters							
Phosphorus (P)-Total	7.08	DLA	0.10	mg/L		28-FEB-12	R2330843
pH	7.69		0.10	pH units		24-FEB-12	R2329967
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	32.5	DLA	2.5	mg/L		28-FEB-12	R2331069
Temperature supplied by Client							
Temperature, Client Provided	2.2		0.1	Degree C		24-FEB-12	R2329249
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	0.157		0.010	mg/L		29-FEB-12	
pH supplied by Client							
pH, Client Supplied	7.69		0.10	pH		24-FEB-12	R2329249
Note: Lab pH used for calculation of unionized ammonia							
L1117214-2 CELL #4A							
Sampled By: CLIENT on 23-FEB-12 @ 10:00							
Matrix: LAGOON							
Nitrate + Nitrite							
Nitrate as N							
Nitrate-N	0.27		0.25	mg/L		23-FEB-12	R2329417
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.35		0.35	mg/L		23-FEB-12	
Nitrite as N							
Nitrite-N	<0.25		0.25	mg/L		23-FEB-12	R2329417
Miscellaneous Parameters							
Phosphorus (P)-Total	8.22	DLA	0.10	mg/L		28-FEB-12	R2330843
pH	7.89		0.10	pH units		24-FEB-12	R2329967
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	41.8	DLA	2.5	mg/L		28-FEB-12	R2331069
Temperature supplied by Client							
Temperature, Client Provided	0.3		0.1	Degree C		24-FEB-12	R2329249
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	0.273		0.010	mg/L		29-FEB-12	
pH supplied by Client							
pH, Client Supplied	7.89		0.10	pH		24-FEB-12	R2329249
L1117214-3 CELL #1B							
Sampled By: CLIENT on 23-FEB-12 @ 10:00							
Matrix: LAGOON							
Nitrate + Nitrite							
Nitrate as N							
Nitrate-N	<0.25		0.25	mg/L		24-FEB-12	R2330335
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.35		0.35	mg/L		23-FEB-12	
Nitrite as N							

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1117214-3 CELL #1B							
Sampled By: CLIENT on 23-FEB-12 @ 10:00							
Matrix: LAGOON							
Nitrite as N							
Nitrite-N	<0.25		0.25	mg/L		24-FEB-12	R2330335
Miscellaneous Parameters							
Phosphorus (P)-Total	9.02	DLA	0.10	mg/L		28-FEB-12	R2330843
pH	7.63		0.10	pH units		24-FEB-12	R2329967
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	34.4	DLA	2.5	mg/L		28-FEB-12	R2331069
Temperature supplied by Client							
Temperature, Client Provided	2.1		0.1	Degree C		24-FEB-12	R2329249
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	0.144		0.010	mg/L		29-FEB-12	
pH supplied by Client							
pH, Client Supplied	7.63		0.10	pH		24-FEB-12	R2329249
L1117214-4 CELL #4B							
Sampled By: CLIENT on 23-FEB-12 @ 10:00							
Matrix: LAGOON							
Nitrate + Nitrite							
Nitrate as N							
Nitrate-N	<0.25		0.25	mg/L		24-FEB-12	R2330335
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.35		0.35	mg/L		23-FEB-12	
Nitrite as N							
Nitrite-N	<0.25		0.25	mg/L		24-FEB-12	R2330335
Miscellaneous Parameters							
Phosphorus (P)-Total	8.95	DLA	0.10	mg/L		28-FEB-12	R2330843
pH	7.93		0.10	pH units		24-FEB-12	R2329967
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	42.4	DLA	2.5	mg/L		28-FEB-12	R2331069
Temperature supplied by Client							
Temperature, Client Provided	0.2		0.1	Degree C		24-FEB-12	R2329249
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	0.300		0.010	mg/L		29-FEB-12	
pH supplied by Client							
pH, Client Supplied	7.93		0.10	pH		24-FEB-12	R2329249

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

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
NH3-COL-WP	Water	Ammonia by colour	APHA 4500 NH3 F
Ammonia in water samples forms indophenol when reacted with hypochlorite and phenol. The intensity is amplified by the addition of sodium nitroprusside and measured colourmetrically.			
NH3-UNION-CALC-WP	Water	Un-ionized ammonia	Calculation
NO2+NO3-CALC-WP	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-WP	Water	Nitrite as N	EPA 300.1 IC
NO3-IC-WP	Water	Nitrate as N	EPA 300.1 IC
P-T-COL-WP	Water	Phosphorus, Total	APHA 4500 P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous is determined colourimetrically after persulphate digestion of the sample.			
PH-CLIENT-WP	Water	pH supplied by Client	Supplied by client
PH-WP	Water	pH	APHA 4500H
The pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.			
TEMP-CLIENT-WP	Water	Temperature supplied by Client	Result supplied by Client

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

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

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

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

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

Chain of Custody / Analytical Request Form

10-048308

L1117214 Page ___ of ___

L1117214-COFC

Report To	
Company:	Town of Beausejour
Contact:	Jeff Matychak
Address:	Box 1028
Phone:	268-7554 Fax: 268-9294
Invoice To	Same as Report ? (circle) Yes or No (if No, provide details)
	Copy of Invoice with Report? (circle) Yes or No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	
Select:	PDF ✓ Excel Digital Fax
Email 1:	bmccormac@jrcc.ca
Email 2:	matychakj@townofbeausejour.com waterworks@townofbeausejour.com
Client / Project Information	
Job #:	
PO / AFE:	
LSD:	
Quote #:	
ALS Contact:	**Sampler:**

Service Requested: (Rush subject to availability)
- ✓ Regular (Standard Turnaround Times))
- Priority, Date Req'd: _____ (Surcharges apply)
- Emergency (1 Business Day) - 100% Surcharge
- For Emergency < 1 Day, ASAP or Weekend - Contact ALS

Analysis Request
(Indicate Filtered or Preserved, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Dissolved UH3	Nitrate	Nitrite	Ammonia	Total Phosphorus	pH	Temp	Number of Containers
	Cell #1A	Feb 23,12	10:00AM	Lagoon	✓	–	–	–	–	–	3.2°C	
	Cell #4A	↓	↓	Lagoon	✓	✓	✓	✓	✓	✓	3.2°C	
	Cell #1B			Lagoon	✓	–	–	–	–	–	2.1°C	
	Cell #4B			Lagoon	✓	–	–	–	–	–	2.6°C	

Special Instructions / Regulations / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date:	Time:	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
				23 Feb	13:45	5 °C				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY — GENF 18.01 Front

Town of Beausejour
ATTN: JEFF MATYCHAK
PO BOX 1028
Beausejour MB R0E 0C0

Date Received: 16-APR-12
Report Date: 26-APR-12 14:49 (MT)
Version: FINAL

Client Phone: 204-268-9294

Certificate of Analysis

Lab Work Order #: L1134945

Project P.O. #: NOT SUBMITTED
Job Reference: TOWN OF BEAUSEJOUR LAGOON
C of C Numbers:
Legal Site Desc:

Robert S. Kitlar
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1134945-1 CELL #1A							
Sampled By: DARRYL MAZUR on 16-APR-12 @ 08:40							
Matrix: WASTEWATER							
Miscellaneous Parameters							
Nitrate and Nitrite as N	<0.050		0.050	mg/L		26-APR-12	R2356506
Phosphorus (P)-Total	4.05		0.010	mg/L		19-APR-12	R2353745
pH	8.03		0.10	pH units		16-APR-12	R2352992
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	22.6	DLA	1.0	mg/L		24-APR-12	R2355157
Temperature supplied by Client							
Temperature, Client Provided	0.4		0.1	Degree C		16-APR-12	R2351509
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	0.204		0.010	mg/L		24-APR-12	
pH supplied by Client							
pH, Client Supplied	8.03		0.10	pH		16-APR-12	R2351509
Note: Lab pH used to calculate un-ionized ammonia							
L1134945-2 CELL #1B							
Sampled By: DARRYL MAZUR on 16-APR-12 @ 08:40							
Matrix: WASTEWATER							
Miscellaneous Parameters							
Nitrate and Nitrite as N	<0.050		0.050	mg/L		26-APR-12	R2356506
Phosphorus (P)-Total	4.10		0.010	mg/L		19-APR-12	R2353745
pH	8.01		0.10	pH units		16-APR-12	R2352992
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	22.1	DLA	1.0	mg/L		24-APR-12	R2355157
Temperature supplied by Client							
Temperature, Client Provided	0.4		0.1	Degree C		16-APR-12	R2351509
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	0.191		0.010	mg/L		24-APR-12	
pH supplied by Client							
pH, Client Supplied	8.01		0.10	pH		16-APR-12	R2351509
Note: Lab pH used to calculate un-ionized ammonia							
L1134945-3 CELL #4A							
Sampled By: DARRYL MAZUR on 16-APR-12 @ 08:40							
Matrix: WASTEWATER							
Miscellaneous Parameters							
Nitrate and Nitrite as N	<0.050		0.050	mg/L		26-APR-12	R2356506
Phosphorus (P)-Total	4.26		0.010	mg/L		19-APR-12	R2353745
pH	8.13		0.10	pH units		16-APR-12	R2352992
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	20.9	DLA	1.0	mg/L		24-APR-12	R2355157
Temperature supplied by Client							
Temperature, Client Provided	0.4		0.1	Degree C		16-APR-12	R2351509
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	0.238		0.010	mg/L		24-APR-12	
pH supplied by Client							
pH, Client Supplied	8.13		0.10	pH		16-APR-12	R2351509
Note: Lab pH used to calculate un-ionized ammonia							

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1134945-4 CELL #4B							
Sampled By: DARRYL MAZUR on 16-APR-12 @ 08:40							
Matrix: WASTEWATER							
Miscellaneous Parameters							
Nitrate and Nitrite as N	<0.050		0.050	mg/L		26-APR-12	R2356506
Phosphorus (P)-Total	4.03		0.010	mg/L		19-APR-12	R2353745
pH	8.15		0.10	pH units		16-APR-12	R2352992
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	20.4	DLA	1.0	mg/L		24-APR-12	R2355157
Temperature supplied by Client							
Temperature, Client Provided	0.3		0.1	Degree C		16-APR-12	R2351509
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	0.240		0.010	mg/L		24-APR-12	
pH supplied by Client							
pH, Client Supplied	8.15		0.10	pH		16-APR-12	R2351509
Note: Lab pH used to calculate un-ionized ammonia							

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

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
N2N3-COL-WP	Water	Nitrate + Nitrite	APHA4500;2005/LACHAT;1997,1999
The sample is passed through a column containing cadmium granules coated with copper sulphate, reducing nitrate to nitrite. The resulting nitrites plus those originally present in the sample are reacted with sulfanilamide (an organic amine) to form the diazonium salt which is coupled in an acidic solution with N-(1-naphthyl)-ethylenediamine dihydrochloride, to form azo dye. The azo dye intensity is measured by a colorimeter at 520 nm, The Omnion software compares the sample peak areas to a calibration curve and reports the concentration of nitrate-nitrite in the sample as nitrogen. Reference: APHA, AWWA, WPCF, Standard Methods for the Examination of Water and Wastewaters, 20th Edition, Washington, 1998. Method 4500-NO3-I			
NH3-COL-WP	Water	Ammonia by colour	APHA 4500 NH3 F
Ammonia in water samples forms indophenol when reacted with hypochlorite and phenol. The intensity is amplified by the addition of sodium nitroprusside and measured colourmetrically.			
NH3-UNION-CALC-WP	Water	Un-ionized ammonia	Calculation
P-T-COL-WP	Water	Phosphorus, Total	APHA 4500 P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous is determined colourimetrically after persulphate digestion of the sample.			
PH-CLIENT-WP	Water	pH supplied by Client	Supplied by client
PH-WP	Water	pH	APHA 4500H
The pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.			
TEMP-CLIENT-WP	Water	Temperature supplied by Client	Result supplied by Client

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

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

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

Environmental Division

12 - 1329 Niakwa Rd. E.
Winnipeg, Manitoba R2J 3T4

Chain of Custody / Analytical Request Form

CHEMISTRY INFO: (204) 255 9739
MICRO INFO: (204) 255 9740 OR (204) 255 9737

WORK ORDER NO: L1134945

L1134945-COFC

FOR LABORATORY USE ONLY
Sample Condition Upon Receipt: ☐ Acceptable ☐ Frozen ☐ Cold ☐ Ambient ☐ Broken ☐ Leakage ☐ Incorrect Sample Container
COMMENT:

LAB NO.:
DATE RECEIVED: 16APR12
TIME RECEIVED: 10:10
BY:

10°

Date Sampled: APR 16, 12 Time: 8 : 40 A.M. ☐ P.M. ☐

Date Required: ASAP

Location: Town of Beausejour
(Town, Community, City)

Submitter's Name Printed: Darryl Mazur

Sample Submitted By: Darryl Mazur

Community Code Number:

Rural Municipality/LGC/UVD: Town of Beausejour

SAMPLE TYPE

DRINKING WATER
- ☐ Untreated Well
- ☐ Treated Well
- ☐ Treated Municipal
- ☐ Non-Treated Municipal
- ☐ Water-Surface-Raw
- ☐ Water-Surface-Treated

NON-DRINKING WATER
- ☑ Sewage/Waste Water
- ☐ Lake/River
- ☐ Swimming Pool
- ☐ Whirl Pool
- ☐ Other

PURPOSE OF TEST
☐ Private ☐ Real Estate ☐ Water Main

PLEASE PRINT & PRESS FIRMLY

NOTES & CONDITIONS
1. Quote number must be provided to insure proper pricing.
2. Failure to properly complete all portions of this form may delay analysis.
3. ALS's liability limited to cost of analysis.

SERVICE REQUESTED
☐ REGULAR ☑ PRIORITY (50% SURCHARGE) ☐ EMERGENCY (100% SURCHARGE)

LAB NUMBER	SAMPLE IDENTIFICATION
	each Sample ⇒ Dissolved Ammonia, Nitrate+Nitrite - Dissolved, Un-ionized Ammonia, Total Phosphorus, PH
	(1) Cell #1A (2) #1B
	(3) Cell II 4A, #4B (4)
	Temp 4A .4C
	Temp 4B .3C
	Temp 1A .4C
	Temp 1B .4C

ALS CUSTOMER #: QUOTE #:

REPORT TO BE SENT TO
NAME: Jeff Matychak
COMPANY: Town of Beausejour
ADDRESS: Box 1028
CITY/TOWN: Beausejour / PROV.: MB
POSTAL CODE: R0E 0C0
PHONE: 268-7554
BY: MAIL ☐ FAX ☐ (FAX NUMBER)
PICKUP ☐ E-MAIL ☑ matychakj@TownofBeausejour.com (EMAIL ADDRESS)

CC 1
NAME: Brett McCormac
ADDRESS:
CITY/TOWN: / PROV.:
POSTAL CODE:
PHONE:
BY: MAIL ☐ FAX ☐ (FAX NUMBER)
PICKUP ☐ E-MAIL ☑ bmccormac@jrcc.ca (EMAIL ADDRESS)

Analyses required: *NOTE: Use LAB PH for Un-ionized Ammonia calculation

BILLING ADDRESS SAME AS REPORT TO ☑
NAME: C.C. e-mail results to
COMPANY: waterworks@townofBeausejour.com
ADDRESS:
CITY/TOWN: / PROV.:
POSTAL CODE:

PAYMENT PARTICULARS
☒ INVOICE NEEDED / CLIENT'S P.O. NO.
☐ INTERAC
☐ CASH Subtotal $
☐ CHEQUE G.S.T. $
☐ VISA / MASTERCARD Total $
* OUR POLICY IS NOT TO ACCEPT SAMPLES FROM THE PRIVATE CITIZEN WITHOUT PREPAYMENT

ENTERED IN LIMS BY:

SAMPLING INSTRUCTIONS ON REVERSE SIDE

Manitoba Technology Centre Ltd.
Part of the **ALS Laboratory Group**
12 - 1329 Niakwa Rd. E., Winnipeg, MB Canada R2J 3T4
Phone: +1 204 255 9720 Fax: +1 204 255 9721 **www.alsglobal.com**
A Campbell Brothers Limited Company

SUBMITTER COPY

Town of Beausejour
ATTN: JEFF MATYCHAK
Box 1028
Beausejour MB R0E 0C0

Date Received: 23-MAY-12
Report Date: 06-JUN-12 12:26 (MT)
Version: FINAL

Client Phone: 204-268-7561

Certificate of Analysis

Lab Work Order #: L1151150

Project P.O. #: NOT SUBMITTED
Job Reference: BEAUSEJOUR LAGOON EXPANSION TESTING - JRCC
C of C Numbers:
Legal Site Desc:

GARRETT RONCERAY
Biology Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1151150-1 CELL #1A							
Sampled By: CLIENT on 23-MAY-12 @ 12:00							
Matrix: WASTEWATER							
Miscellaneous Parameters							
Nitrate and Nitrite as N	0.127		0.050	mg/L		04-JUN-12	R2376192
Phosphorus (P)-Total	3.48		0.010	mg/L		25-MAY-12	R2370956
pH	8.41		0.10	pH units		24-MAY-12	R2370909
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	11.3	DLA	0.50	mg/L		01-JUN-12	R2375034
Temperature supplied by Client							
Temperature, Client Provided	18.0		0.1	Degree C		24-MAY-12	R2370638
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	0.916		0.010	mg/L		01-JUN-12	
pH supplied by Client							
pH, Client Supplied	8.41		0.10	pH		24-MAY-12	R2370638
Note: The lab pH was used to calculate un-ionized ammonia.							
L1151150-2 CELL #1B							
Sampled By: CLIENT on 23-MAY-12 @ 12:00							
Matrix: WASTEWATER							
Miscellaneous Parameters							
Nitrate and Nitrite as N	0.124		0.050	mg/L		04-JUN-12	R2376192
Phosphorus (P)-Total	3.53		0.010	mg/L		25-MAY-12	R2370956
pH	8.41		0.10	pH units		24-MAY-12	R2370909
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	12.3	DLA	0.50	mg/L		01-JUN-12	R2375034
Temperature supplied by Client							
Temperature, Client Provided	18.0		0.1	Degree C		24-MAY-12	R2370638
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	0.994		0.010	mg/L		01-JUN-12	
pH supplied by Client							
pH, Client Supplied	8.41		0.10	pH		24-MAY-12	R2370638
Note: The lab pH was used to calculate un-ionized ammonia.							
L1151150-3 CELL #4A							
Sampled By: CLIENT on 23-MAY-12 @ 12:00							
Matrix: WASTEWATER							
Miscellaneous Parameters							
Nitrate and Nitrite as N	1.42		0.050	mg/L		04-JUN-12	R2376192
Phosphorus (P)-Total	1.60		0.010	mg/L		25-MAY-12	R2370956
pH	9.37		0.10	pH units		24-MAY-12	R2370909
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	2.44	DLA	0.50	mg/L		01-JUN-12	R2375034
Temperature supplied by Client							
Temperature, Client Provided	18.0		0.1	Degree C		24-MAY-12	R2370638
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	1.09		0.010	mg/L		01-JUN-12	
pH supplied by Client							
pH, Client Supplied	9.37		0.10	pH		24-MAY-12	R2370638
Note: The lab pH was used to calculate un-ionized ammonia.							

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1151150-4 CELL #4B							
Sampled By: CLIENT on 23-MAY-12 @ 12:00							
Matrix: WASTEWATER							
Miscellaneous Parameters							
Nitrate and Nitrite as N	1.40		0.050	mg/L		04-JUN-12	R2376192
Phosphorus (P)-Total	1.55		0.010	mg/L		25-MAY-12	R2370956
pH	9.35		0.10	pH units		24-MAY-12	R2370909
Un-ionized ammonia							
Ammonia by colour							
Ammonia, Total (as N)	2.42	DLA	0.050	mg/L		01-JUN-12	R2375034
Temperature supplied by Client							
Temperature, Client Provided	18.5		0.1	Degree C		24-MAY-12	R2370638
Un-ionized ammonia							
Ammonia, Un-ionized (as N)	1.07		0.010	mg/L		01-JUN-12	
pH supplied by Client							
pH, Client Supplied	9.35		0.10	pH		24-MAY-12	R2370638
Note: The lab pH was used to calculate un-ionized ammonia.							

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

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
N2N3-COL-WP	Water	Nitrate + Nitrite	APHA4500;2005/LACHAT;1997,1999
The sample is passed through a column containing cadmium granules coated with copper sulphate, reducing nitrate to nitrite. The resulting nitrites plus those originally present in the sample are reacted with sulfanilamide (an organic amine) to form the diazonium salt which is coupled in an acidic solution with N-(1-naphthyl)-ethylenediamine dihydrochloride, to form azo dye. The azo dye intensity is measured by a colorimeter at 520 nm, The Omnion software compares the sample peak areas to a calibration curve and reports the concentration of nitrate-nitrite in the sample as nitrogen.			
Reference: APHA, AWWA, WPCF, Standard Methods for the Examination of Water and Wastewaters, 20th Edition, Washington, 1998. Method 4500-NO3-I			
NH3-COL-WP	Water	Ammonia by colour	APHA 4500 NH3 F
Ammonia in water samples forms indophenol when reacted with hypochlorite and phenol. The intensity is amplified by the addition of sodium nitroprusside and measured colourmetrically.			
NH3-UNION-CALC-WP	Water	Un-ionized ammonia	Calculation
P-T-COL-WP	Water	Phosphorus, Total	APHA 4500 P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous is determined colourimetrically after persulphate digestion of the sample.			
PH-CLIENT-WP	Water	pH supplied by Client	Supplied by client
PH-WP	Water	pH	APHA 4500H
The pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.			
TEMP-CLIENT-WP	Water	Temperature supplied by Client	Result supplied by Client

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

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mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
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ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

ALS

L1151150-COFC

COC # 09-019420
C1151150
Page ___ of ___

Report To		Service Requested: (Rush subject to availability)
Company: Town of Beausejour	Standard: ___ Other (specify): ___	✓ Regular (Standard Turnaround Times))
Contact: Jeff Matychak	Select: PDF ✓ Excel ___ Digital ___ Fax ___	Priority, Date Req'd: ___ (Surcharges apply)
Address: Box 1028	Email 1: waterworks@townofbeausejour.com	Emergency (1 Business Day) - 100% Surcharge
	Email 2: matychak@townofbeausejour.com	For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone: 2042687554 Fax: 2042689294	11 3obmccormack@jrcl.ca	**Analysis Request**
Invoice To Same as Report ? (circle) Yes or No (if No, provide details)	**Client / Project Information**	(Indicate Filtered or Preserved, F/P)
Copy of Invoice with Report? (circle) Yes or No	Job #: Lagoon expansion testing JRC	
Company:	PO / AFE:	
Contact: W465	LSD:	
Address:		
Phone: Fax:	Quote #:	
Lab Work Order # (lab use only)	**ALS Contact:** **Sampler:**	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Dissolved Ammonia	Nitrate+Nitrite	Total Phosphorus	pH	Un-ionized Ammonia	Temp	Number of Containers
1	Cell #1A			Lagoon	✓	✓	✓	✓	✓	18	
2	Cell #1B			↓	↓	↓	↓	↓	↓	18	
3	Cell #4A			↓	↓	↓	↓	↓	↓	19	
4	Cell #4B			↓	↓	↓	↓	↓	↓	18.5	

Special Instructions / Regulations / Hazardous Details

Run All tests on All Samples
Use LAB PH Results for Un-ionized Ammonia Calculation

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date:	Time:	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
				23-May	14:55	17.2 °C				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY — GENF 18.01 Front

Appendix E

Plan L1: Proposed Lagoon Expansion Location with Setbacks to Nearest Residents

Plan L2: Proposed Lagoon Expansion Layout with Test Hole Locations

Plan L3: Lagoon Discharge Route

Plan L4: Perimeter Dike, Intercell Dike, Valve, Valve Marker, Rip Rap and Ditch Details

Plan L5: Gate, Fence, Lock, Site Marker, Silt Fence and Access Road Details

Plan L6: Cross Section from Existing Lagoon to Proposed Building

TOWN OF BEAUSEJOUR

WASTEWATER TREATMENT LAGOON EXPANSION

ENVIRONMENT ACT PROPOSAL

PRELIMINARY
NOT FOR CONSTRUCTION

REDUCED DRAWING
50% SCALE

J. R. Cousin Consultants Ltd.
Consulting Engineers and Project Managers

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PLAN INDEX

LAGOON

RESIDENCE
RESIDENCE
R460.000
R460.000
NW1/4 12-13-07-E
NE1/4 12-13-07-E
EXISTING LAGOON DISCHARGE PITCH
MTS FIBRE OPTIC CABLE
FENCE
OJ PACKERS PACKING PLANT
PROPOSED STORAGE CELL #9
PROPOSED STORAGE CELL #8
EXISTING STORAGE CELL #6
FENCE
FENCE
SW1/4 12-13-07-E
SE1/4 12-13-07-E
PROPOSED STORAGE CELL #7
RESIDENCE
BROKENHEAD RIVER
UPGRADED PUMP STATION/ CHEMICAL FEED BUILDING
P.T.H. 12/44
P.T.H. 12/44
#3
#4
EXISTING PRIMARY CELLS
#2
#1
EXISTING STORAGE CELL #5
FIRST STREET
P.T.H. 12/44
N

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: 13/06/21

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J.R. COUSIN
13/06/21
REGISTERED PROFESSIONAL ENGINEER

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CODE:	B-353.05
DESIGNED BY:	JC
DRAWN BY:	BM
REVIEWED BY:	JC

PROJECT: TOWN OF BEAUSEJOUR
ENVIRONMENT ACT PROPOSAL

TITLE: PROPOSED LAGOON EXPANSION LOCATION WITH SETBACKS TO NEAREST RESIDENTS

SCALE:	DATE:	PLAN:	SHEET:
1:7500	13/06/05	L1	1 of 6

Jun 21, 2013 - 1:42pm P:\JOBS\353 Beausejour\L353.05 Lagoon Study and Environmental Submission\04 Drawings\Autocad\EAP\L1.dwg

NW1/4 13-12-7-E

NE1/4 13-12-7-E

SW1/4 13-12-7-E

SE1/4 13-12-7-E

MTS FIBRE OPTIC CABLE

EXISTING LAGOON DISCHARGE DITCH

MTS FIBRE OPTIC CABLE

BJ PACKERS PACKING PLANT

R460.000

PROPOSED DISCHARGE VALVE

PERIMETER FENCE

PERIMETER DITCH

SLOPE = 4:1

PROPOSED DISCHARGE VALVE

EXISTING DISCHARGE VALVE

TH14

157.534

215.756

TH16

10.000

3.000

VARIES

310.000

135.000

EXISTING STORAGE CELL #6

PROPOSED STORAGE CELL #8

PROPOSED STORAGE CELL #9

275.862

312.800

TH15

TH17

TH13

454.980

PROPOSED INTERCELL VALVE

PROPOSED INTERCELL VALVE

PROPOSED DISCHARGE VALVE

EXISTING ACCESS ROAD

215.624

10.000

3.000

10.000

TOWN LAND BOUNDARY

38.1m SETBACK FROM P.T.H. 12

PTH 12

236.501

TH12

PROPOSED INTERCELL VALVE

RESIDENCE

TH18

PERIMETER FENCE

PERIMETER DITCH

PROPOSED STORAGE CELL #7

312.571

R460.000

EXISTING LAGOON DISCHARGE DITCH

EXISTING FORCEMAIN TO CELL #8

PROPOSED PIPE INLET

NEW VALVES AND PIPING TO BE INSTALLED AND CONNECTED TO EXISTING FORCEMAIN

R460.000

TH11

TH19

76.2 m SETBACK FROM PTH 44

RESIDENCE

NEW ROAD TO MEET EXISTING SERVICE ROAD

EXISTING SERVICE ROAD

SLOPE = 4:1

PERIMETER DITCH

SITE MARKER

NEW ACCESS ROAD

EXISTING FORCEMAIN

PTH 12/44

ACCESS ROAD AND TRUCK TURNAROUND AREA

GRAVITY PIPE TO BUILDING

PUMP STATION AND CHEMICAL FEED BUILDING

EXISTING LIFT STATION TO BE DECOMMISSIONED

EXISTING PRIAMRY CELLS #1-4

EXISTING STORAGE CELL #5

PRELIMINARY
NOT FOR CONSTRUCTION

SCALE BAR
(IN METRES)
50 0 25 50 100 150 200 250
1:2500

No.	REVISIONS	DATE	INITIALS
			B.M. EL.

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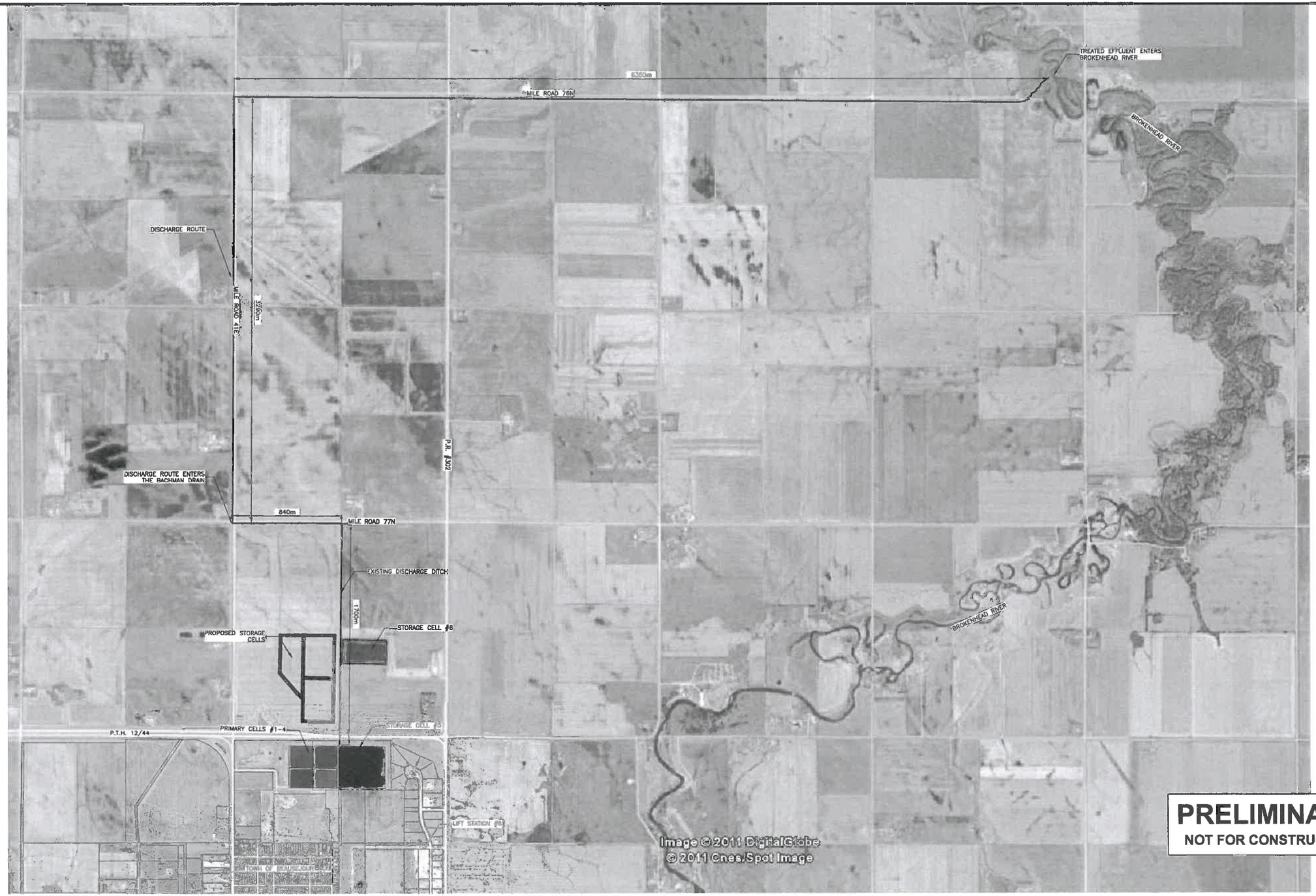
DESIGNED BY:	JC
DRAWN BY:	BM
REVIEWED BY:	JC

PROJECT: TOWN OF BEAUSEJOUR
ENVIRONMENT ACT PROPOSAL

TITLE: PROPOSED LAGOON EXPANSION LAYOUT WITH TEST HOLE LOCATIONS

SCALE:	DATE:	PLAN:	SHEET:
1:2500	13/06/05	L2	2 of 6

Jan 21, 2013 - 2:14pm P:\300\353 Beausejour\353.05 Lagoon Study and Environmental Submission\04 Drawings\Layout\EXPA\L2.dwg



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PRELIMINARY
NOT FOR CONSTRUCTION

SCALE BAR
(IN METRES)

300 0 150 300 600 900 1200 1500

1:15000

No.	REVISIONS	DATE	INITIALS
			B.M. EL.

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DRAWN BY:	BM
REVIEWED BY:	JC

PROJECT: TOWN OF BEAUSEJOUR
ENVIRONMENT ACT PROPOSAL

TITLE: LAGOON DISCHARGE ROUTE

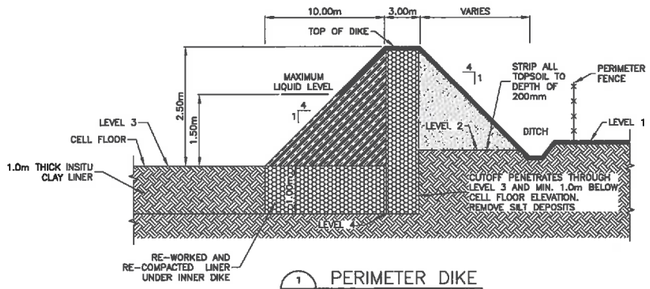
SCALE:	DATE:	PLAN:	SHEET:
1:15,000	13/06/05	L3	3 of 6

Jun 21, 2013 - 2:14pm J:\JOBS\353 Beausejour\353.05 Lagoon Study and Environmental Submission\04 Drawings\Acad\Plan\EAP-L3.dwg

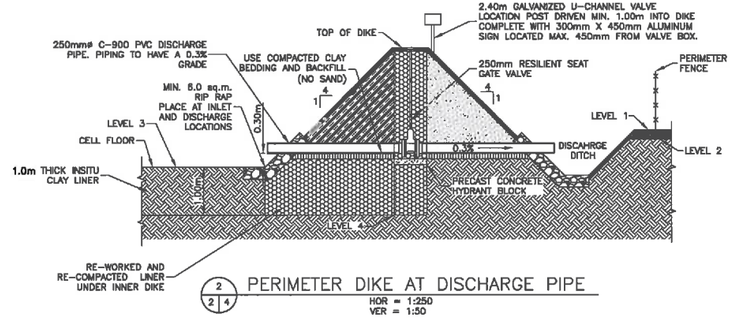
LEGEND:

- EXCAVATED AND COMPACTED MEDIUM PLASTIC CLAY TYPE SOIL
- EXCAVATED AND COMPACTED MIXTURE OF SOILS
- INSITU MEDIUM PLASTIC CLAY TYPE SOIL
- RIP RAP
- TOPSOIL
- EXCAVATED AND COMPACTED MEDIUM PLASTIC CLAY TYPE SOIL

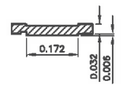
LEVEL 1 – PRE-CONSTRUCTION EXISTING GROUND ELEVATION
LEVEL 2 – ELEVATION FOLLOWING TOPSOIL REMOVAL
LEVEL 3 – FINISHED CELL BOTTOM ELEVATION
LEVEL 4 – BOTTOM OF HORIZONTAL LINER AND CUTOFF WALL



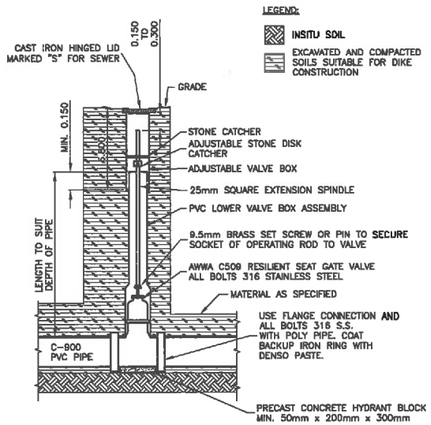
1/2/4 PERIMETER DIKE
HOR = 1:250
VER = 1:50



2/2/4 PERIMETER DIKE AT DISCHARGE PIPE
HOR = 1:250
VER = 1:50



COVER DETAIL
SCALE = 1:10



3/4 TYPICAL VALVE DETAIL
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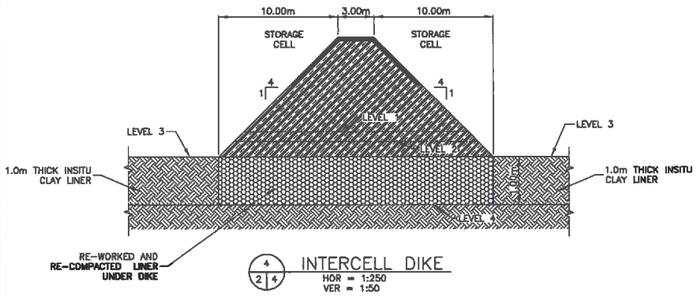

4/2/4 INTERCELL DIKE
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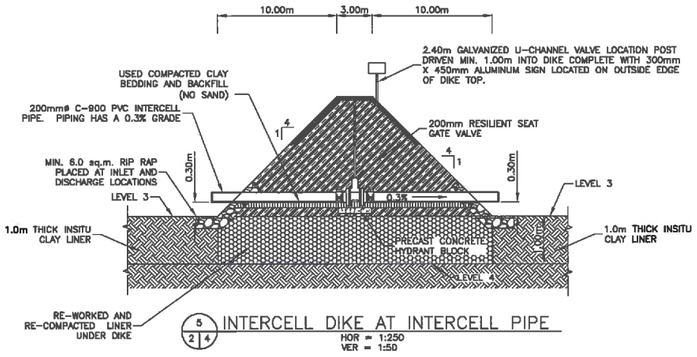
VER = 1:50



5/2/4 INTERCELL DIKE AT INTERCELL PIPE
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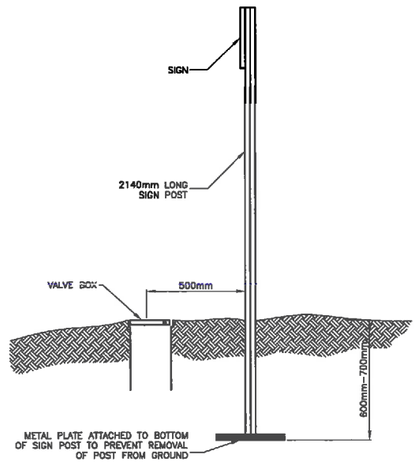
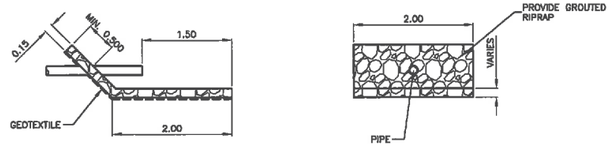
VER = 1:50



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

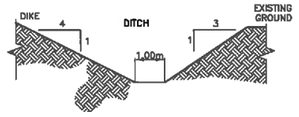
8/4 VALVE MARKER DETAIL
SCALE = 1:15



NOTE:

-RIPRAP MATERIAL SHALL BE WELL GRADED 125mm TO 150mm HARD, DENSE, ROUNDED & DURABLE FIELD STONE.

6/4 RIPRAP DETAIL
SCALE = 1:50



7/2/4 TYPICAL PERIMETER DITCH CROSS-SECTION
HORIZONTAL SCALE = 1:100
VERTICAL SCALE = 1:50

PRELIMINARY
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No.	REVISIONS	DATE	INITIALS

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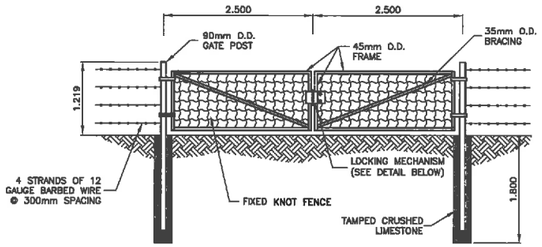
CODE:	B-353.05
DESIGNED BY:	JC
DRAWN BY:	BM
REVIEWED BY:	JC

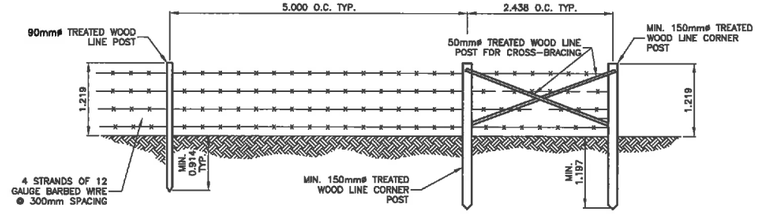
PROJECT: TOWN OF BEAUSEJOUR
ENVIRONMENT ACT PROPOSAL

TITLE: PERIMETER DIKE, INTERCELL DIKE, VALVE, VALVE MARKER, RIP RAP AND DITCH DETAILS

SCALE:	DATE:	PLAN:	SHEET:
AS NOTED	13/06/05	L4	4 of 6

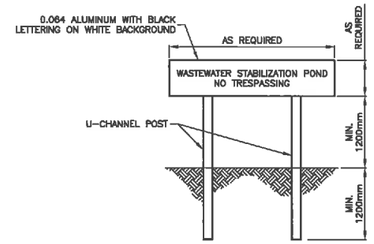


1/5 GATE DETAIL
Scale = 1:50

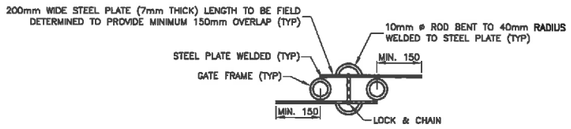


NOTE:
- PROVIDE CROSS BRACING AT CORNERS POSTS IN BOTH DIRECTIONS.
- SHOWN DIAMETER REFERS TO SMALLEST END OF POST.

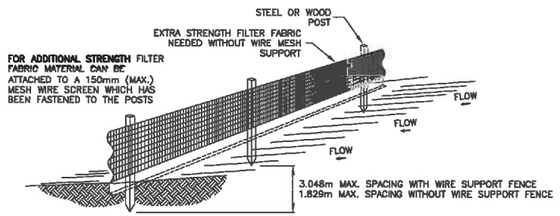
2/5 FENCE DETAIL
SCALE = 1:50



4/2 5 LAGOON SITE MARKER DETAIL
SCALE = 1:50



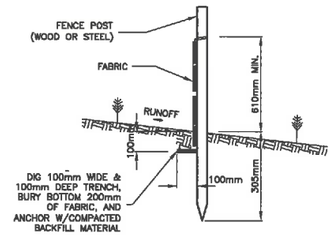
3/5 LOCK DETAIL
SCALE = 1:10



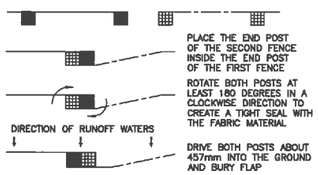
NOTES:

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

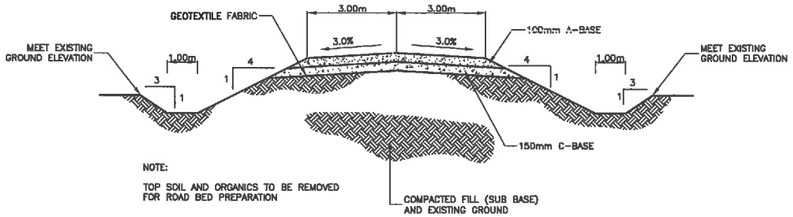
5/5 SILT FENCE DETAIL
SCALE = NTS



6/5 SILT FENCE SECTION
SCALE = NTS



7/5 ATTACHING TWO SILT FENCES
SCALE = NTS



8/2 5 TYPICAL ACCESS ROAD CROSS-SECTION
Horizontal Scale = 1:100
Vertical Scale = 1:50

PRELIMINARY
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No.	REVISIONS	DATE	INITIALS

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No. 234 Date: 13/06/21

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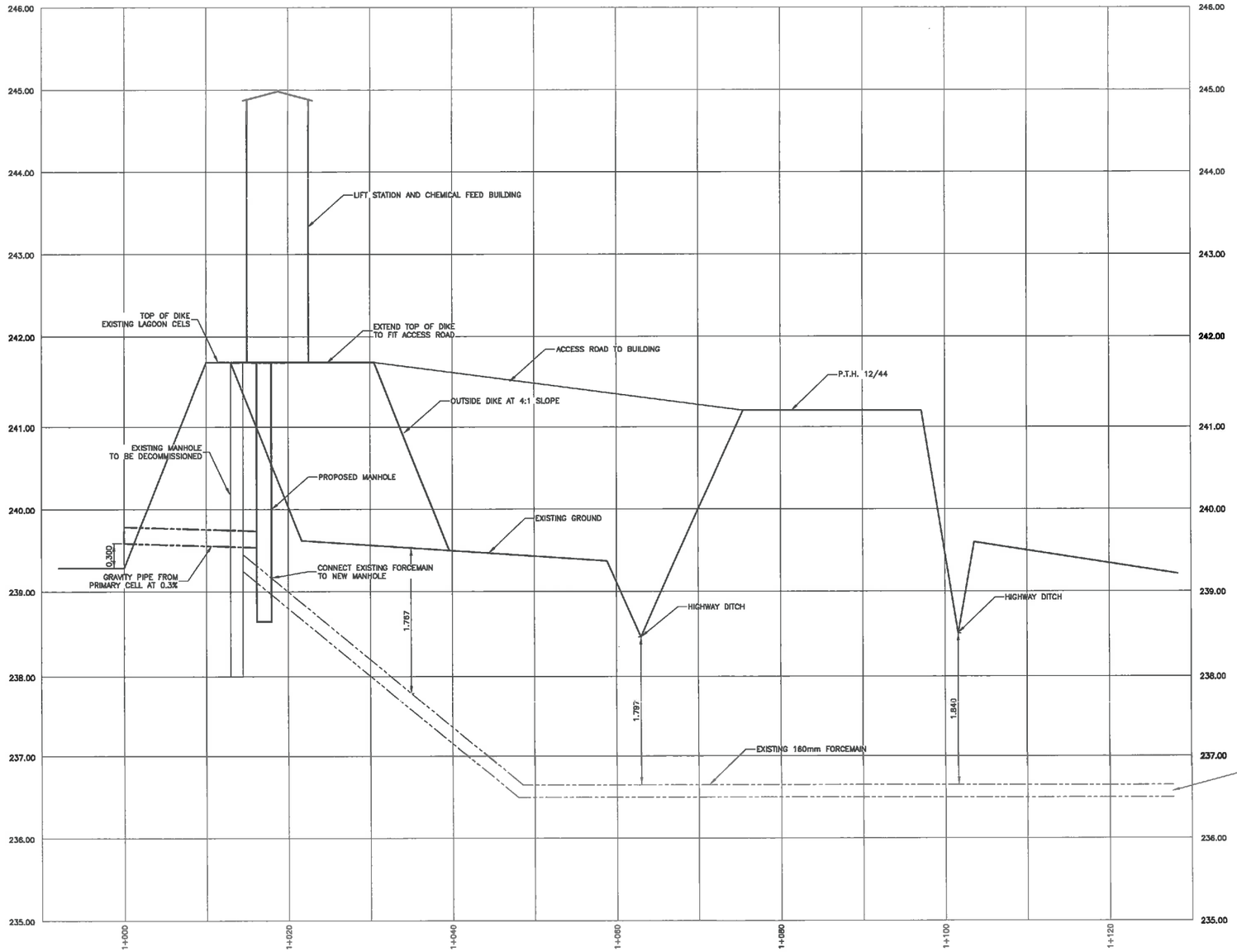
CODE:	B-353.05
DESIGNED BY:	JC
DRAWN BY:	BM
REVIEWED BY:	JC

PROJECT: TOWN OF BEAUSEJOUR
ENVIRONMENT ACT PROPOSAL

TITLE: GATE, FENCE, LOCK, SITE MARKER, SILT FENCE AND ACCESS ROAD DETAILS

SCALE:	DATE:	PLAN:	SHEET:
AS NOTED	13/06/05	L5	5 of 6

Jan 21, 2013 - 2:19pm P:\JOBS\353 Beausejour\353.05 Lagoon Study and Environmental Submission\04 Drawings\dwg\LOA\L5.dwg



1/2/6 SECTION FROM EXISTING LAGOON TO BUILDING

HOR = 1:300
VER = 1:30

PRELIMINARY
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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.

Certificate of Authorization
J.R. Cousin Consultants Ltd.
No. 234 Date: 13/06/21

ENGINEER'S SEAL
PROVINCE OF MANITOBA
J.C.R. COUSIN
13/06/21
REGISTERED PROFESSIONAL ENGINEER

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Engineering Excellence since 1981

CODE:	B-353.05
DESIGNED BY:	JC
DRAWN BY:	BM
REVIEWED BY:	JC

PROJECT: TOWN OF BEAUSEJOUR
ENVIRONMENT ACT PROPOSAL

TITLE: CROSS SECTION FROM EXISTING LAGOON TO PROPOSED BUILDING

SCALE:	DATE:	PLAN:	SHEET:
AS NOTED	13/06/05	L6	6 of 6

Jan 21, 2019 - 2:19pm N:\JOBS\353 Beausejour\353.05 Lagoon Study and Environmental Submission\04 Drawings\dwg\ENPL04.dwg