December 18, 2025

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RE: Rexton Lagoon Capacity Assessment and Upgrade Options

Introduction

The Rexton Wastewater Treatment Plant (WWTP), located off Rue Main, was originally constructed in 1975. It consists of a single-cell, 10-acre facultative lagoon and currently serves approximately 910 residents. Wastewater is collected within the community of Rexton by gravity and forcemains. The wastewater enters the lagoon and naturally circulates, the effluent discharges into a stream that eventually flows into the Richibucto River.

The operators have concerns about the treatment process, related to effluent quality, short circuiting, and berm stability. The community of Rexton has retained CBCL Limited (CBCL) to assess the current condition and capacity of the WWTP as well as upgrade options to ensure reliable operation of the WWTP.

Background

The existing treatment lagoon was constructed on a site of approximately 10 hectares. The lagoon does not have a liner, suggesting native materials were sufficiently impermeable for berm construction. The lagoon interior berm slopes are 4 to 1 and the exterior slopes are 3 to 1. The lagoon operates with a liquid depth of 1.2 meters with 0.9 meters freeboard. The lagoon has a surface area of 40,470 m^2 and a corresponding operating volume of approximately 46,000 m^3. A system of stop logs allows the operators to adjust the lagoon depth and freeboard.

The collection system is made up of gravity lines and forcemains. The collection system for the lagoon includes seven lift stations, all of which were upgraded in 2023 along with a portion of the forcemain.

Within their Approval to Operate (A.T.O) it is not required for the Rexton Lagoon to disinfect the effluent before being discharged. Previously there was chlorine disinfection which is no

longer used as it is not a requirement. The disinfection building is currently still on the property but has been abandoned since the chlorine treatment stopped. ‘

Existing Conditions

A site visit to the WWTP was carried out on May 14, 2025, with Joshua Gallant from Rexton Public Works and Sarah Ensslin, P. Eng., Brennan Thorne, P.Eng., Manuela Chavarro, C.E.T, and Cailyn Sheehan from CBCL. The purpose of the site visit was to assess the condition of the WWTP. The following sections describe the general configuration and concerns of the WWTP.

Equipment Configuration

The existing WWTP is a single cell facultative lagoon with a total of seven lift stations within the collection system. Raw sewage is conveyed to the treatment plant from the lift station closest to the WWTP located just off Rue Main, through a 200 mm diameter forcemain. Flow from the forcemain enters the lagoon through a 350 mm diameter influent pipe that runs beneath the lagoon and discharges into the lagoon approximately in the middle. The lagoon has no mechanical equipment as it is a facultative lagoon. The influent naturally circulates in the treatment process. The treated effluent is discharged through a 350 mm diameter outlet pipe. The treated effluent still passes through the abandoned disinfection building before discharging into the adjacent stream eventually flowing into the Richibucto River.

Concerns with Existing WWTP

During the site visit operations staff have communicated concerns about the condition of the lagoon as it is experiencing erosion and vegetation around the outer edge of the lagoon, and the pipe that discharges the influent into the lagoon has a leak midway. There were significant concerns with the influent manhole located beside the lagoon, because it had deteriorated resulting in influent bypassing the intended entry point and entering the lagoon near the outlet, though this has now been repaired. Operations staff have reported ongoing challenges in meeting effluent regulatory requirements which are likely linked to those concerns.

Wastewater Characteristics

Serviced Population

The lagoon services the community of Rexton. According to Statistics Canada census data, the community of Rexton experienced a slight increase in population from 2011 to 2016, followed by a larger increase in population from 2016 to 2021. The latest census data is presented below in Table 1.

Table 1: Statistics Canada Census Data

Year	Population	% Change	% Change/Year	No. People/Year
2001	810	—	—	—
2006	862	6.40 %	1.25 %	11
2011	818	-5.10 %	-1.04 %	-9
2016	830	1.50 %	0.29 %	3
2021	874	5.30 %	1.04 %	10

Presented below in Figure 1 is the historical population trends from census data and the results of possible future growth rate assumptions.

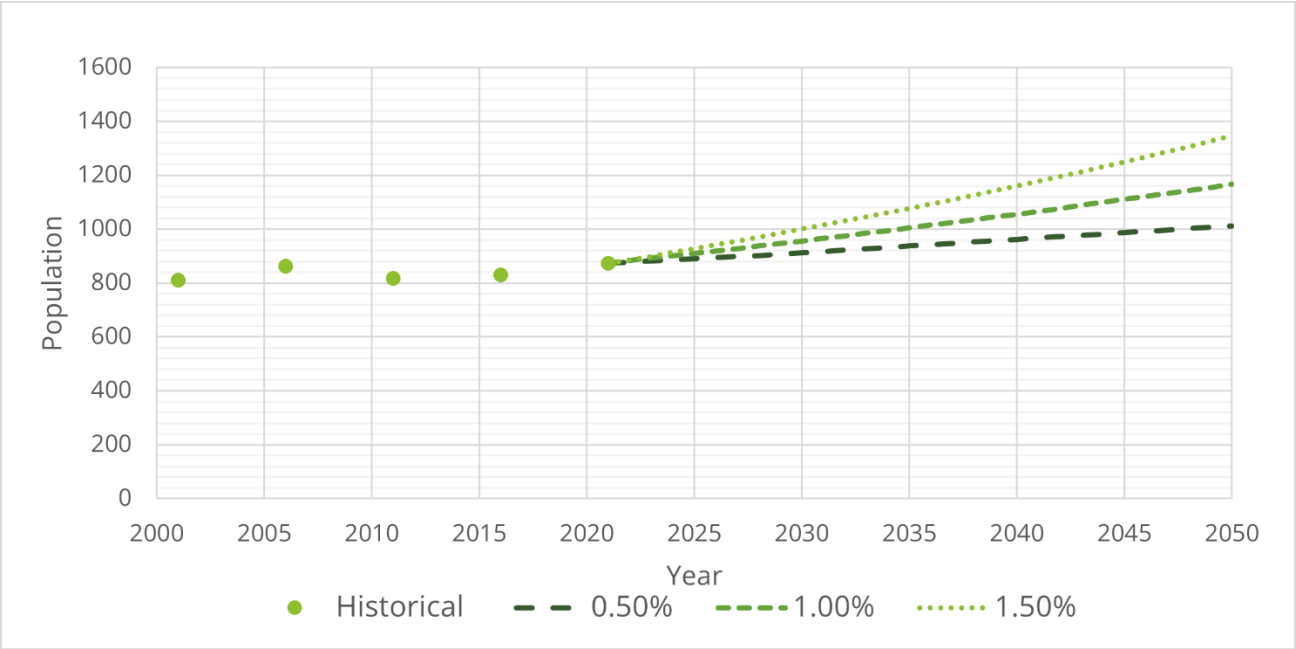

Figure 1: Population Data for Rexton Comparing Historical and Possible Future Growth Rates

Population Projections

Projections of future hydraulic and organic wastewater loading typically involves a review of current per capita loading rates and future serviced population. Assuming a 25-year design horizon and a population of 874 in 2021 possible future growth rates were calculated and presented below in Table 2. Discussion with the operators indicated that there is planned development in the area, including three apartments, consisting of two duplexes and a 12-unit apartment. Based on the historical data, 1.00% population growth (Medium Growth) is a reasonable estimate given that over the past 5 years the community has experienced a population growth rate of 1.04% per year.

Table 2: Projected Population Growth

Year	Low Growth (0.5% per year)	Medium Growth (1.0% per year)	High Growth (1.5% per year)
2025	890	910	928
2030	912	955	1000
2050	1012	1166	1346

Wastewater Flows & Loads

Flow data for the Rexton lagoon were provided from April 2025 to August 2025. The Average Daily Flow (ADF) was 687 m^3/d. Daily flows and population projections were used to determine the influent parameters of the facultative lagoon. The WWTP does not have any influent sampling therefore theoretical influent loading rates were applied to determine the Carbonaceous Biochemical Oxygen Demand (CBOD), Total Suspended Solids (TSS), and Total Kjeldahl Nitrogen (TKN). Figure 2 presented below shows the Rexton flow data and the ADF.

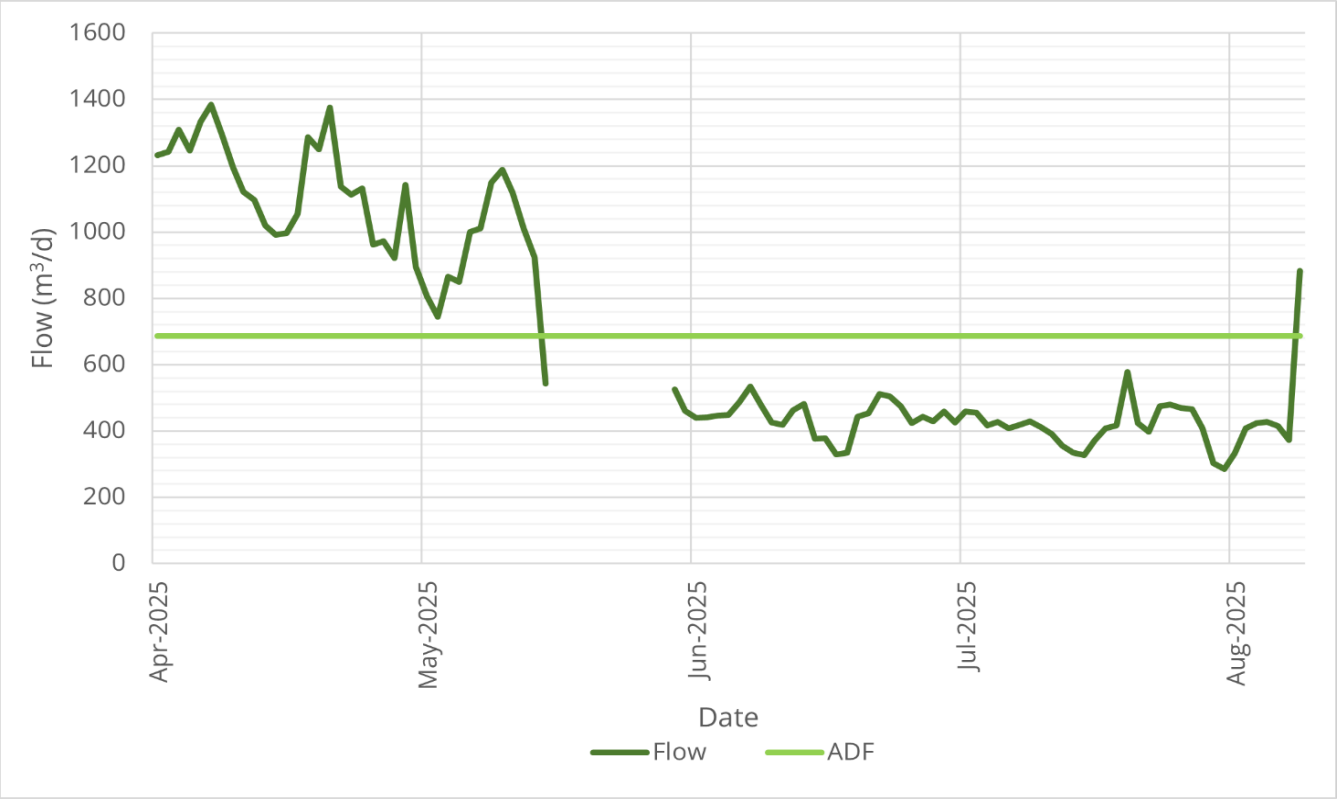

Figure 2: Flow Data and ADF from April 2025 to August 2025

Based on the current serviced population of 910 residents and an ADF of 687 m^3/day, the per capita wastewater generation rate is approximately 754 liters per person per day. The theoretical loading concentrations are based on established design guidelines. Typical CBOD,

TSS, and TKN values from the *Metcalf and Eddy Wastewater Treatment Resource and Recovery* were applied. The CBOD loading is 0.08 kg/cap/day, TSS loading is 0.09 kg/cap/day and TKN is 0.013 kg/cap/d. Using the flows provided and these theoretical parameters the influent CBOD, TSS, and TKN loadings were calculated and are presented below in Table 3.

Table 3: Projected Flows and Load Summary

Parameter	Current (2025)	Short Term (2030)	Long Term (2050)
Serviced Population	910	955	1166
Litres Per Capita (L/Cap/d)	754	754	754
ADF (m^3/d)	687	720	880
PDF (m^3/d)	1385	1460	1780
Peaking Factor (PDF: ADF)	2.02	2.02	2.02
Average CBOD Concentration (mg/L)	106	106	106
Average TSS Concentration (mg/L)	119	119	119
Average TKN Concentration (mg/L)	17	17	17

The concentrations calculated in Table 3 are lower than typical design values, which is consistent with the higher per capita flow observed in Rexton. Currently the per capita flow is approximately 754 L/cap/day, compared to the guideline value of 380 L/cap/day from the *Atlantic Canada Wastewater System Guidelines* (*ACWSG*). If the Municipality undertakes more sewer separation and implements additional measures to reduce inflow and infiltration the concentration will rise into a more typical range.

Effluent Requirements

The Approval to Operate (A.T.O) limits for the WWTP are presented below in Table 4. These are typical and we assume they will continue to apply for the foreseeable future.

Table 4: A.T.O Effluent Limits for Rexton Lagoon

Parameter	Current (2025)
CBOD (mg/L)	25
TSS (mg/L)	25
Un-ionized Ammonia (mg/L)	1.25
Total Residual Chlorine (mg/L)	0.02

Current Performance

The municipality sends samples of effluent to be analyzed at an accredited lab quarterly. Based on the effluent results from the lagoon it has typically been operating within the regulatory requirements except for in 2024 and 2025. The annual average CBOD exceeded the regulatory limit in 2025 at 32.3 mg/L and the annual average TSS exceeded the regulatory limit in 2024 at 27.7 mg/L and again in 2025 at 50.7 mg/L. Presented below in Figure 3 is the annual average CBOD and TSS effluent concentrations for the Rexton lagoon.

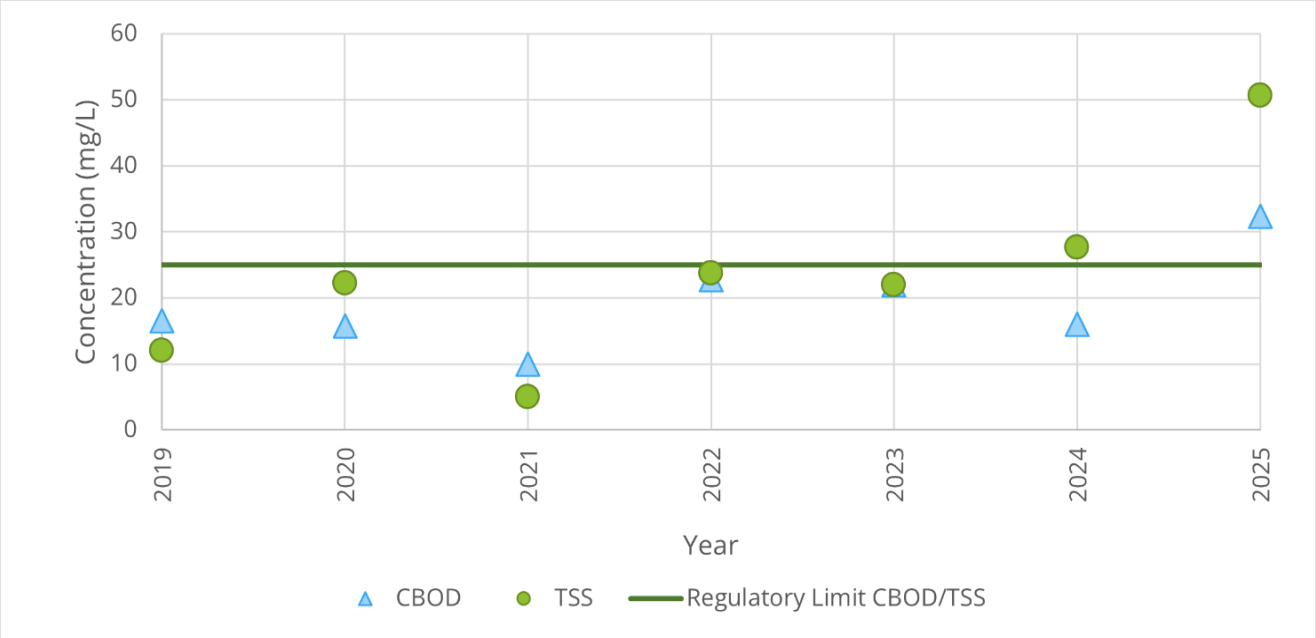

Figure 3: Annual Average CBOD and TSS Effluent Data

Assessment of WWTP

Design Loading Capacity

Lagoons are typically designed for 250 people per acre of surface area, according to *ACWSG*. This would result in the maximum capacity of the lagoon occurring at a service population of 1012. Currently the WWTP is operating within its designed capacity at approximately 910 people. Using the assumed projected population growth of 1.00% per year this population would be surpassed in 2036, indicating that the lagoon would require upgrades prior to 2036 to improve treatment performance.

Short Circuiting

During the site visit we observed a large quantity of influent leaking out of an eroded manhole and short circuiting the treatment process. Short circuiting is when wastewater takes a short cut through the lagoon, passing through the inlet to the outlet without circulating through the treatment process. Detention time for a facultative lagoon is key to the treatment process. If wastewater does not have enough contact with digesting microorganisms, it will not be treated adequately, resulting in high CBOD and moderately high TSS in the treated effluent. Influent that is short circuiting the treatment process can have a large impact on effluent quality even if it is only a small portion of the total influent. Presented below in Figures 4 and 5 are photos taken during the site visit in May 2025 which show the influent short circuiting and bypassing the treatment process to the outlet

Figure 4 & 5 − Short Circuiting of Influent into Lagoon Near Outlet

Figure 6: Replaced Influent Manhole

The influent manhole which experienced significant short circuiting was replaced in late October 2025. Presented above in Figure 6 is a photo of the manhole being replaced.

Further discussion with the operators confirmed that short circuiting is occurring in the lagoon due to a leak in the influent pipe which passes under the lagoon. The leak, located midway along the pipe, was verified through a dye test conducted by the Municipality.

Vegetation on Banks

During the site visit we observed excessive vegetation growth along the lagoon perimeter. Vegetation growth on lagoon banks provides a habitat for insects, traps grease and organics, and allows scum and floating solids to collect in the lagoon. This is likely not causing performance challenges but should be addressed as tree roots can make holes in the berm. Figure 7 shows vegetation and trees in the lagoon.

Figure 7: Vegetation and Trees in the Lagoon

Disinfection Building

In the A.T.O the Rexton lagoon does not require effluent disinfection prior discharge. The existing chlorine building on site has been abandoned and now poses a safety hazard for operators. If disinfection is reinstated in the future, Ultraviolet (UV) disinfection is the preferred option. Its effectiveness, lower chemical handling risk, and elimination of the two-step chlorination and de-chlorination process makes it the better option for disinfection. Presented below in Figure 8 is the abandoned chlorine building.

Figure 8: Abandoned Chlorine Building

Sludge Management

Facultative lagoons are intended to accumulate sludge since part of the treatment process involves the biological decay of the settled material. Sludge removal from facultative lagoons is required infrequently. It is suggested that after a significant duration of operating time allowing for sludge to accumulate, the sludge should be removed. To the Municipality's knowledge the lagoon has not been dredged since commissioning in 1975, resulting in 50 years' of accumulation in the lagoon cell.

The build up of sludge over 50 years was estimated using theoretical TSS loading rate which gave a sludge depth of about one foot, assuming a 7% solids concentration. Detention time is the theoretical amount of time the influent flow spends in the lagoon before it is discharged. Facultative lagoons are designed for a detention time of 30 to 180 days which is from the *ACWSG*. The detention time of the lagoon at one foot of sludge depth was determined to be approximately 67 days. A detention time of 67 days can theoretically produce an effluent CBOD of 25 mg/L. This is a reasonable estimate as effluent CBOD results for the lagoon have been near the 25 mg/L over the past few years.

The actual sludge depth will vary across the lagoon. An evaluation to quantify and characterize the sludge should be undertaken prior to tendering a dredging contract. Sludge can be measured using depth samplers, ultrasonic or optical sludge blanket detectors, or transits. Additionally, collecting sludge samples for analysis to confirm sludge consistency is recommended to calculate a more accurate estimate of sludge mass.

Options

The following section includes options to address the issues identified above. These options are shown on a sketch (PSK01) in Attachment A.

Short Circuiting

An option to remediate the influent pipe leak causing short circuiting would be installing a new influent pipe around the lagoon. Installing a new influent pipe that discharges at the opposite end of the current effluent point would maximize hydraulic retention times and minimize short circuiting, which is critical for facultative lagoon performance. This solution addresses the leak as well as overall treatment efficiency.

Vegetation

The lagoon requires maintenance, specifically removing vegetation and especially trees along the perimeter of the lagoon. Removing the vegetation will prevent damage to the berm and can improve overall lagoon performance.

Disinfection Building

The existing chlorine building should be demolished. The structure has been abandoned and poses a safety hazard for operators due to its deteriorated condition. Demolition will eliminate these hazards and free up spaces for future improvements.

Sludge Management

Dredging the lagoon is an option to reclaim capacity. It will eventually be necessary as sludge continues to accumulate. Over time, sludge buildup reduces the lagoons hydraulic capacity and treatment efficiency, making it difficult to meet regulatory compliance. Measuring sludge depth will provide a more accurate assessment of hydraulic capacity and detention time. Removing sludge restores lagoon volume and improves settling performance, although desludging requires significant planning and coordination. Therefore, evaluating sludge depth and solids concentration is the start point for developing a long-term dredging strategy. This evaluation will help the Municipality determine how urgent it is to desludge the lagoon.

Aeration

When the lagoon reaches the design capacity which is estimated to be in 2036, the capacity of the facultative lagoon can be increased by adding aeration. This will also improve performance. Aerators increase the oxygen transfer into the wastewater compared to the natural aeration. Facultative lagoons struggle to consistently meet compliance below 25 mg/L

CBOD and TSS. The addition of aeration will make meeting permit requirements consistently attainable.

While adding aeration will enhance treatment performance, it introduces additional equipment to the process, which increases both operational and maintenance requirements. Currently, the lagoon operates as a facultative system with minimal operational costs, as the only mechanical components are the lift stations within the collection system. Incorporating aeration will require the installation of blowers to supply air to the lagoon, as well as a dedicated building to house this equipment. Furthermore, aeration will significantly increase power consumption, resulting in higher electrical costs for the WWTP.

Additionally, blowers require routine and preventative maintenance to ensure reliable operations and maximize their service life, as their longevity is highly dependant on the quality and frequency of maintenance performed.

Opinion of Probable Cost

An opinion of probable cost has been developed for the Rexton lagoon. The opinion of probable cost is based on CBCL's experience, qualifications and best judgement and are an order of magnitude estimate used for evaluation purposes. CBCL cannot warrant or guarantee that the actual cost will not vary from the opinion provided. The cost has been broken down into routine maintenance costs, capital costs associated with the recommended upgrades, and the cost to dredge the lagoon. The design development contingency is to allow for increases in quantity and material as the work is better defined, and the construction contingency is to allow for additional work, over and above the awarded contract price.

The cost of dredging and dewatering is based on similar projects nearby completed by CBCL. Sludge volumes of one and two feet deep have been used to create an indicative sludge removal cost. At one foot of sludge, it is estimated that the total volume of sludge in the lagoon is 11,000 m^3 and at two feet of sludge it is estimated that the total volume of sludge in the lagoon is 23,000 m^3. Both approximations were determined using 7% sludge concentrations. A sludge analysis to determine the actual concentration is essential as the concentration has a large impact on the mass of solids and subsequently the cost to remove the sludge. Table 5 presented below summarizes the estimated sludge removal costs at one foot.

Table 5: Opinion of Probable Cost for Dredging at 1 ft. of Sludge

Elements	Probable Cost
Mobilization	$ 88,000
Dredging and Dewatering	$1,264,000
Transportation and Disposal	$1,553,000
Trucking Demerge	$3,000
Design Development Contingency (30%)	$873,000
Subtotal	**$3,781,000**
Construction Contingency (10%)	$379,000
Total	**$4,160,000**

The same elements are included in the estimate for two feet of sludge. While the cost of mobilization remains unchanged, the cost for dredging and dewatering, transportation and disposal, trucking demerge, and both design development and construction contingencies increase. This results in an opinion of probable cost of $8,187,000 for removing two feet of sludge.

A conceptual opinion of probable cost has been developed to support decision making regarding the recommended upgrades to the Rexton Lagoon. This is based on the options identified on the sketch (PSK01) provided in Attachment A. The opinion of probable cost includes allowance for the general conditions for both the installation of the new influent pipe and demolition of the abandoned disinfection building. The general conditions include mobilization, insurance, bonds, and contractor overhead. The installation of the new influent pipe around lagoon and demolition of the disinfection building include material, equipment, and labour costs. Presented below in Table 6 and 7 summarizes the cost associated each of the upgrades.

Table 6: Opinion of Probable Cost for New Influent Pipe

Elements	Probable Cost
General Conditions	$33,000
Installing influent pipe around lagoon	$293,000
Design Development Contingency (30%)	$98,000
Subtotal	**$424,000**
Construction Contingency (10%)	$43,000
Total	**$467,000**

Table 7: Opinion of Probable Cost for Demolishing Disinfection Building

Elements	Probable Cost
General Conditions	$7,000
Demolition of Disinfection Building	$58,000
Design Development Contingency (30%)	$20,000
Subtotal	**$85,000**
Construction Contingency (10%)	$9,000
Total	**$94,000**

The opinion of probable maintenance cost for the Rexton lagoon is summarized in Table 8. As a facultative lagoon, the system requires minimal maintenance, with vegetation control along the perimeter being the primary activity.

Table 8: Opinion of Probable Cost for Maintenance

Elements	Probable Cost
Vegetation Removal	$25,000

Recommendations

The main concern was the eroded manhole that was causing short circuiting, which was likely contributing to the elevated CBOD and TSS results in March and May 2025. The manhole was repaired in late October 2025. It is recommended that the operators take samples of the effluent and send them to accredit laboratory to determined if the CBOD is within regulatory limits or if additional measures to control short circuiting need to be taken.

More frequent maintenance around and in the lagoon is recommended. This should include trimming vegetation and removing any trees that are in the lagoon or on the berm. Vegetation and trees can damage the berm as well as reduce lagoon performance; therefore, intentional and routine maintenance is advised.

Dredging the lagoon would provide improved settling and hydraulic capacity. Sludge removal can be a complicated and labour-intensive process and typically requires months of planning ahead of execution. It is recommended that the municipality starts planning the dredging process for the lagoon as the cost of the desludging event is significant and will need to be allowed for in the budget.

Closing

In terms of capacity and performance, the treatment system is currently operating in an acceptable manner and has historically been successful at meeting compliance requirements. However, as the system is expected to approach capacity, routine maintenance including vegetation removal and the evaluation of sludge depth and composition should be prioritized.

Joshua Gallant
December 18, 2025

To support housing development and growth in the municipality, more frequent and intentional maintenance of the lagoon will be necessary. The lagoon is designed to support a population of 1012 residents; however, the lagoon will only perform adequately if the maintenance recommendations outlined are implemented.

The timing of the upgrade option outlined will be related to the compliance. Effluent quality typically starts to deteriorate as a result of either overloading due to additional units being added to the system or due to excessive sludge accumulation. To date, the elevated effluent results in 2024 and 2025 appear to be associated with the eroded manhole, which has since been repaired. Effluent sampling should be carried out now that the eroded manhole has been repaired to confirm whether it was the primary cause of elevated effluent results.

The report also outlined more labour-intensive options to improve lagoon performance, including dredging the lagoon, installing a new influent pipe around the lagoon, decommissioning and demolishing the disinfection building, and adding aeration to the lagoon. These measures should be considered if effluent results remain elevated and as the lagoon approaches its projected capacity in 2036, assuming the current population growth rate of 1.00% per year continues. Regardless of sampling outcomes, initiating a sludge evaluation and dredging planning is essential to ensure long-term lagoon performance, and regulatory compliance, and to support budgeting.

Yours very truly,

CBCL Limited

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Attachment A

Rexton WWTP Site Plan Options

Date	Scale	Designed	Drawn	Checked	Approved	CBCL No.	Contract
DEC 2025	1:1500	CS	RH	SHE		253424.00	

CBCL

REXTON WWTP OPTIONS

SITE PLAN

Drawing

PSK01

DRAWING NAME: Y:\MONCTON\DATA\PROJECTS\2025\253424.00 FIVE RIVERS LAGOON REPAIR\44 CAD\06 PROCESS\253424.00 - PSK01_.DWG LAYOUT NAME: PSK01 PLOT DATE:Thursday, December 4, 2025 8:58:38 AM CAD OPERATOR: RHERNANDEZ