Appendix B

EA Addendum Studies and Reports

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September 29, 2022

Technical Memorandum No. 1: Updated Growth Evaluation Report

Municipality of Brighton Wastewater Treatment System Class EA Addendum

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Appendix A Brighton Wastewater Treatment System: 20-Year Committed Capacity for Growth (2021-2041)

1.0 INTRODUCTION

1.1 Background

The Municipality includes the former Town and Township of Brighton and is the most eastern municipality within the County of Northumberland. The Municipality is bounded by the City of Quinte West to the east and the Township of Cramahe to the west, with the shoreline of Lake Ontario to the south. Highway 401 provides the main east-west corridor through the Municipality, which tends to be a regional focus for hamlets in the surrounding areas. Refer to Figure 1 for an overview of the Municipality and study location.

The communal sewage system generally consists of the Brighton Wastewater Treatment Lagoon system (currently rated for 4,600 m^3/day), the Harbour Street Sewage Pumping Station (SPS) and forcemain, a small sub-area sewage pumping station and forcemain servicing Presqu'ile Provincial Park, and several kilometers of gravity collection sewer. Approximately half of the sewage generated in the collection system is directed to the Harbour Street SPS and pumped via an 0.82 km long, 300 mm forcemain to the Lagoon and the other half flows by gravity to the Lagoon. Refer to Figure 2 for an overview of the Brighton communal sewage system.

The Harbour Street SPS receives sewage from a significant portion of the collection system, including pumped flow from Presqu'ile Provincial Park. The Harbour Street SPS is currently being upgraded and expanded. The SPS generally consists of a wet well/dry well configuration and is equipped with three dry pit centrifugal type raw sewage pumps (lead/lag/standby operation) complete with inlet and outlet piping, a standby diesel generator, a wet well emergency overflow to Butter Creek, and related instrumentation and controls for the station.

The wastewater treatment system consists of a 0.68 ha single cell aerated lagoon, a single cell 5.44 ha waste stabilization pond with baffle partition curtains, and a 2-cell constructed wetland with a total surface area of 6.2 ha. There is also a chemical storage/feed system used to facilitate continuous phosphorus removal. Chemical is introduced after the aerated lagoon and upstream of the waste stabilization pond. Treated effluent from the waste stabilization pond is discharged continuously to the constructed wetland and from the constructed wetland it continuously discharges to a natural wetland and ultimately to Presqu'ile Bay, which is located off the northeast shore of Lake Ontario.

1.1.1 2017 Schedule 'B' Class Environmental Assessment for Brighton Wastewater Treatment System prepared by J.L. Richards & Associates Limited

The Municipality of Brighton (the Municipality) initiated a Class Environmental Assessment (Class EA) of their wastewater treatment system in August 2016 to address various problems experienced with treatment at their treatment lagoon (e.g., elevated ammonia concentrations in the treated effluent), and also to ensure that increased influent flows from future growth can be effectively accommodated. J.L. Richards & Associates Limited (JLR) was retained by the Municipality to define the problems and identify a preferred solution to address these issues. The Class EA was completed in 2017. The preferred solution included the following:

- Installation of a specialized treatment system (such as a complete mix activated sludge process or a fixed film biological process)
- Upgrading baffles in the stabilization pond
- Optimizing alum dosing
- Refurbishing the constructed wetland
- Diverting high waste streams
- Desludging program

1.1.2 2020 Brighton Wastewater Treatment System Design by GHD

Additional efforts have been undertaken by the Municipality since the completion of the 2017 Schedule 'B' Class EA to address treatment deficiencies. A moving bed biofilm reactor (MBBR) system was selected as the preferred treatment technology. The Brighton Wastewater Treatment System upgrades were then designed and tendered in 2020. However, due to budgetary constraints, the project was cancelled.

1.1.3 2021 Brighton Wastewater Treatment System Aeration Conceptual Design by GSS

With an effort to address the effluent quality issues in June 2021, the Municipality retained GSS Engineering, who acted as the Municipality's Engineer, to develop conceptual level design for aeration upgrades in the aerated lagoon cell. In addition, GSS recommended implementing a secondary clarifier after the aerated cell and adding screening and grit removal processes. For sludge management, GSS suggested the alternatives to either discharge waste sludge to a drying bed, Geotubes®, or discharge waste sludge to the stabilization lagoon and remove annually.

1.1.4 2022 Brighton Wastewater Treatment System Technical Review by R.V. Anderson Associates Limited

Further to that, the Municipality retained R.V. Anderson Associates Limited (RVA) to undertake a technical feasibility review of GSS's design. RVA proposed the following changes to the GSS's design which include the following:

- Implementing a new headworks facility upstream of the aerated lagoon cell
- Confirming proposed aeration rate to provide adequate mixing
- Upsizing proposed clarifier
- Removing accumulated sludge from aerated cell and stabilization pond
- Evaluating options for sludge storage and dewatering in a later study

1.1.5 2022 Brighton Wastewater Treatment System Schedule 'B' Class EA Addendum

In 2022, the Municipality retained JLR to complete a Class EA Addendum to capture the changes that have occurred since the completion of the previous Schedule 'B' Class EA for the Brighton Wastewater Treatment System. These changes include updated growth projections and design basis, the proposed liquid and solids treatment by GSS and RVA, and sludge management options.

Figure 1: Municipality and Study Location

Figure 2: Municipality of Brighton Wastewater System

1.2 Class Environmental Assessment Process

The Ontario Environmental Assessment Act (the Act) sets out a planning and decision-making process so that potential environmental effects are considered before a project begins. The purpose of the Act is to provide for the protection and conservation of the natural environment (R.S.O. 1990, c.E.18, s.2).

The Municipal Class EA process is followed for common types of projects to streamline the review process while ensuring that the project meets the requirements of the Act. It involves detailed site-specific information gathering and studies, as well as consultation with the public and stakeholder agencies. In 1987 the first Class EA prepared by the Municipal Engineers Association (MEA) on behalf of Ontario Municipalities was approved under the Act. Updates and amendments were subsequently made in 1993, 2000, 2007, 2011, and 2015.

This Class EA was initiated as a Schedule B project under the Class EA process. Projects categorized as Schedule B undertakings have the potential for significant environmental effects, and are required to follow Phase 1 and Phase 2 specified under the Municipal Class EA. This includes consultation with all parties that may potentially be affected by the project, and the preparation of a Class EA project file that documents the Class EA process for the project. At the end of Phase 2, the project Schedule is reviewed to determine if the project is complete under a Schedule B Schedule or if the project needs to proceed as a Schedule C undertaking, in which case Phases 3 and 4 of the Class EA process are completed.

The Class EA framework defines the process for each type of project. For Schedule B projects, the completion of the following Phases of the Class EA process are required:

- Phase 1 – Identify the Problem and/or Opportunity
- Phase 2 – Identify Alternative Solutions to the Problem and/or Opportunity

The Project File shall be made available for public and agency review at the completion of Phase 2 of the Class EA process for a mandatory 30-day period. If there are no requests to the Minister of the Environment, Conservation and Parks (MECP) for a 'Part II Order' within this 30-day review period, then the project may proceed to implementation (Phase 5).

A Class EA Addendum is prepared when there is any significant modification to the project or change in the environmental conditions of the project. For this project, the Project Team has planned to undertake public consultation at three project milestones, including the Notice of Study Commencement for EA Addendum, the Notice of Public Information Centre (PIC), and the Notice of Filing of Addendum. The Notices will be sent to those who were notified during the preparation of the original Class EA, with the addition of any new members of the public or review agencies that are potentially affected with the proposed changes. Like the original Class EA process, the Addendum will be made available for public review for a mandatory 30-day period. During this review period, only the Addendum (the changes to the project) shall be open for review or considered in a request for a Part II Order.

1.3 Objectives of the Class EA Addendum

The purpose of the Class EA Addendum is to describe the proposed modification to the original Class EA, describing the circumstances necessitating the change, including any potential environmental impacts and proposed mitigation measures.

Technical memoranda (TM) and reports are to be prepared to summarize various elements of the overall project. Technical Memoranda and reports will form part of the Class EA Addendum Project File, which is anticipated to be the key deliverable for this project.

Three (3) Technical Memoranda are anticipated and will cover the following topics:
- TM 1 - Updated Growth Evaluation Report
- TM 2 - Headworks Evaluation Report
- TM 3 - Solids Treatment and Sludge Management Report

The Class EA Addendum is proceeding in accordance with the Schedule B requirements of the Ontario Municipal Class EA, October 2000, as amended in 2015, but the Schedule will be reconfirmed at the completion of the Updated Growth Evaluation Report.

1.4 Objectives of this Technical Memorandum

The main objective of this TM is to provide an update to TM – Growth Evaluation Document completed in December 2016, as part of the Schedule 'B' Class EA. This Technical Memorandum will summarize the anticipated growth in the Brighton Wastewater Treatment System Servicing Area over a 20-year planning period with consideration of the ongoing Northumberland County Official Plan Updates, and the 2020 Brighton Official Plan, such that the projected future flows to the lagoon can be revised and updated. This information is important when considering potential solutions to the problems.

2.0 PLANNING POLICIES

2.1 Provincial Policy Statement

The 2020 Provincial Policy Statement (PPS) provides general policy guidance on matters of provincial interest related to land use planning and development. The 2020 PPS provides policy direction for appropriate development while protecting resources of provincial interest, public health and safety as well as the quality of the natural environment. All local planning matters must be consistent with the 2020 PPS, which is issued under Section 3 of the *Planning Act*. The *Planning Act* requires that decisions of Council be consistent with the Statement. Policies related to infrastructure, servicing (sewer and water), climate change, natural heritage wetlands and water, and aboriginal interests may have implications at the Class EA level. The changes that have occurred since the 2014 PPS are not anticipated to impact the selection of the preferred alternative. However, in subsequent phases of this Class EA, alternatives will be reviewed to ensure conformance with the 2020 PPS.

2.2 The Municipality of Brighton Official Plan (2020)

In 2001, the Municipality of Brighton was established through the combination of the former Town of Brighton and Brighton Township. Prior to this amalgamation, land use and development were dictated by each of the former municipality's Official Plans and Zoning By-Laws. The purpose of the new Official Plan, developed in 2020, is to guide land use and development within the rural and urban areas of the Municipality, so as to protect and enhance the established settlement areas, natural heritage, agricultural, mineral and aggregate resources, cultural and archaeological resources, and recreational value for the next 20 years.

2.3 Northumberland County Official Plan (2016)

The 2016 Northumberland County Official Plan (County Official Plan) provides direction and a policy framework to manage decisions regarding growth and land use in the County to 2034. The intention of the County Official Plan is to conform to the Provincial Policy Statement and other Provincial plans. All local Official Plans and zoning by-laws shall conform to this County Official Plan. The Official Plan sets areas of growth and population projections for the local municipalities and provides guidance regarding developments crossing municipality boundaries.

2.3.1 Northumberland County Official Plan Review and Draft Official Plan Growth Forecast (Ongoing)

The Northumberland County is in the process of updating their 2016 Official Plan. In 2021, Watson & Associates Economists Ltd. reviewed the 2016 County Official Plan and prepared an updated growth forecast for the development of the updated Northumberland County Official Plan. Public consultation is currently underway for the Growth Management aspect of the Official Plan Update. Updated growth allocations were presented by municipalities within the County and provided population, housing, and employment forecasts to 2051. The new County Official Plan has yet to be finalized, but the Municipality provided the information presented by Watson & Associates for use in the growth projections in this Technical Memorandum

2.4 A Place to Grow, Growth Plan for the Greater Golden Horseshoe (2020)

The Growth Plan for the Greater Golden Horseshoe was consolidated by the Ontario Government in 2020 to provide a framework for the development of regional growth plans and guidelines for short and long-term planning policies. The Plan is to be read in conjunction with the Provincial Policy Statement. According to the Growth Plan, the majority of growth is to be allocated to existing delineated settlement areas, with the goal of intensification and providing a mixed range of housing options.

3.0 POTENTIAL GROWTH

3.1 Forecast of Population Distribution

As per Section 2.2.1 Traditional Growth Projections, of the Brighton Official Plan, in 2016 was 11,844 consisting of a delineated urban settlement area and rural properties beyond the urban boundary. Factors contributing to the Municipality's growth are its proximity to urban centers along Lake Ontario, as well as growth occurring in the City of Quinte West associated with the multi-million-dollar expansions of the Canadian Forces Base at Trenton (Official Plan, 2020). The Municipality is assuming that the majority of future growth will occur within the urban settlement boundary, serviced by the communal sewage system.

3.2 Forecast of Population Growth

With their ongoing work of the Northumberland County Official Plan Updates, Watson & Associates Economists Ltd. forecasted the Municipality of Brighton's total population and urban settlement population. As shown in Table 1, the percentage of the total growth in Brighton from the urban population is approximately 86% from 2016 to 2041 and 100% from 2041 to 2051.

Table 1: Summary of Brighton Population Forecast (Watson and Associates Ltd.)

<table>
<tr><th>Year</th><th>Total Population</th><th>Urban Settlement Population</th><th>Percent of Total Growth from Urban Population</th></tr>
<tr><td>2016</td><td>12,100</td><td>6,800</td><td>-</td></tr>
<tr><td>Growth (2016-2041)</td><td>+2,900</td><td>+2,500</td><td rowspan="2">86%</td></tr>
<tr><td>2041</td><td>15,000</td><td>9,300</td></tr>
<tr><td>Growth (2041-2051)</td><td>+1,900</td><td>+1,900</td><td rowspan="2">100%</td></tr>
<tr><td>2051</td><td>16,900</td><td>11,200</td></tr>
</table>

Watson & Associates Economists Ltd. also determined an historical average housing growth rate for 2011 to 2019 of 69 homes (159 persons) per year for the Municipality of Brighton, refer to Figure 3. It shall be noted that this growth rate is greater than the urban settlement population forecast from the Draft County Official Plan (approximately 100 persons per year). The Municipality has indicated that the future housing growth will occur within the Brighton Wastewater Treatment System Servicing Area. The Municipality has elected to use the forecasted annual average housing growth rate as a more conservative basis for the population growth projections in this EA Addendum.

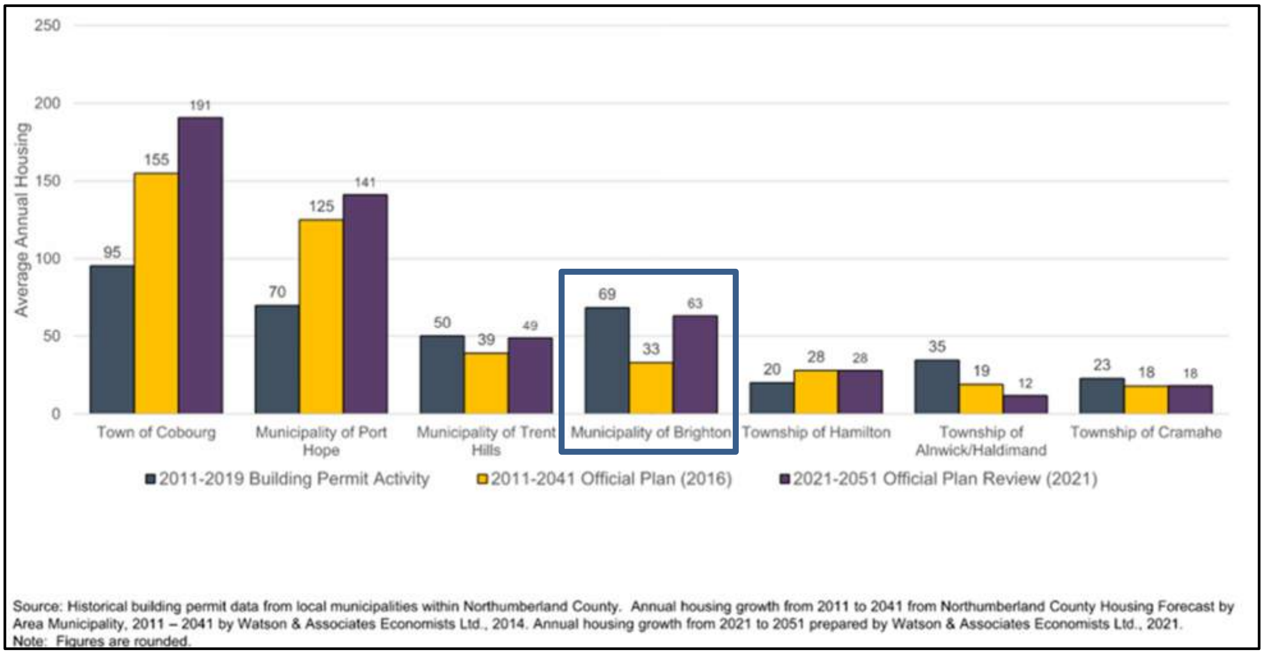

Figure 3: Northumberland County Tracking Average Annual Housing Growth by Area Municipality (Watson & Associates, 2021)

For the population projections in this Environmental Assessment the historical housing growth rate (69 houses per year) will be used, assuming the urban population growth is 86% of the total population growth. Therefore, the housing forecast for the urban settlement area is approximately 59.3 houses per year.

3.3 Forecast of Industrial/Commercial/Institutional (ICI) Growth

The Official Plan notes that the Municipality of Brighton has become an area people go to retire and this will have an impact on the demands for recreation, health services, schools, long-term care, etc. (Brighton Official Plan, 2020). Based on discussions with the Municipality it has been assumed that ICI growth will be proportional to the urban population growth. The Municipality also anticipates approximately 28-37 m^2 (300-400 ft^2) of light industrial developments per year.

3.4 Presqu'ile Provincial Park

In the past, Presqu'ile Provincial Park was a large focus of the Municipality's development as it provided opportunities for both commercial and recreational fisheries. It continues to provide a recreational focus for this area since it is commonly known as the gateway to Presqu'ile Provincial Park which attracts over 200,000 visitors each year (OMNR, 2003). It is assumed that the sewage flow generated by Presqu'ile Provincial Park will remain the same in the future.

4.0 POPULATION FOR INFLUENT FLOW PROJECTIONS

The population projections shown in Table 2 will be used to develop 20-year influent flow projections, utilizing the 59.3 homes (approx. 136 persons) per year growth rate described in Section 3.2. The projections will be based on the 2016 as the starting year, using the available Census data for the urban settlement population of 6,800.

Table 2: Brighton Urban Settlement Population Forecast

Year	Population
2016	6,800
2041	10,212

5.0 WASTEWATER INFLUENT FLOW PROJECTIONS

Table 3 shows the wastewater treatment influent flow projections for the next 20 years. Appendix A shows a breakdown of the calculations for the residential and ICI growth rate and flow generations discussed in earlier sections.

Table 3: 20-Year Brighton Wastewater Influent Flow Projection

5-year (2017-2021) Average Day Flow (ADF)	3,290 m^3/day
Residential Unit Projected Flow (2021-2041)	1,201 m^3/day
ICI Projected Flow (2021-2041)	6 m^3/day
Projected ADF (2041)	4,497 m^3/day
Percentage of Treatment System Rated Capacity (4,600 m^3/day)	98%

Figure 4 shows the projected growth of wastewater flows in Brighton against the Wastewater Treatment System rated capacity (4,600 m^3/day). As shown in the figure, the projected growth would reach 80% and 100% rated capacity by 2028 and 2043, respectively.

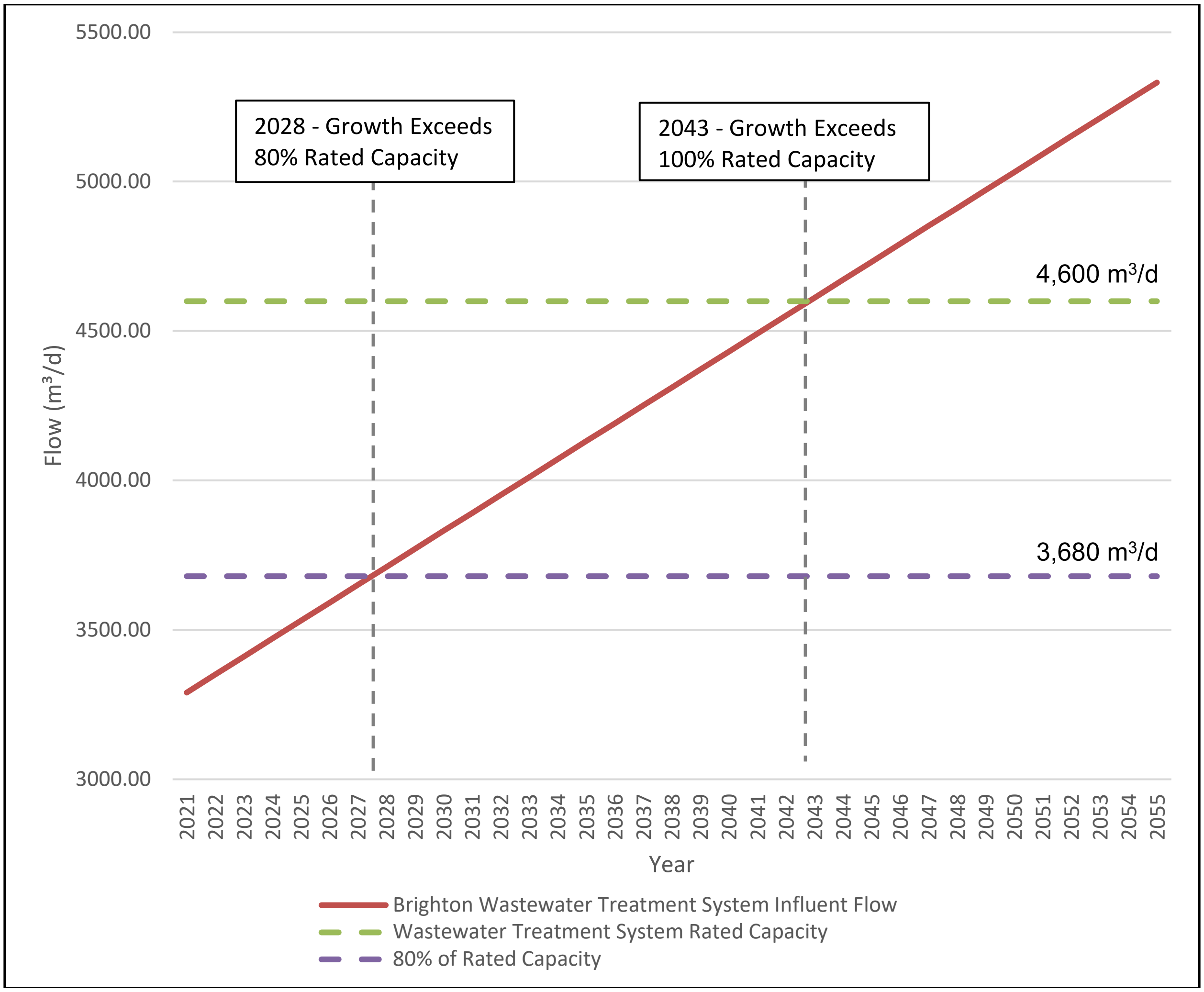

Figure 4: Brighton Wastewater Flow Growth Forecast

6.0 CONFIRMING CLASS EA SCHEDULE

Since the 20-year flow projections are within the Brighton Wastewater Treatment System's rated capacity, the Municipality has decided to continue with the Schedule B EA Addendum process. The conceptual design for the Schedule B EA Addendum will be based on the existing rated capacity of the treatment system at 4,600 m^3/d, and review provisions to facilitate future expansion. The Municipality will continue to monitor Brighton's growth and initiate further studies when 80% rated capacity is reached, depending on the Municipal Class EA requirements at that time. Generally, the MECP expect for municipalities to start planning for a capacity increase once 80% of its rated capacity is reached. There is substantial time between the identification of the need to expand and the implementation of the expansion. The plan would include allowing further growth beyond 80% of its rated capacity but would have to include timing of a Municipal Class EA, design and construction that would see a capacity increase prior to reaching the rated capacity.

7.0 REFERENCES

- Northumberland County Official Plan, as approved by the Ontario Municipal Board on November 2016.
- Provincial Policy Statement, prepared by the Ontario Ministry of Municipal Affairs and Housing, May 2020.
- A Place to Grow: Growth Plan for the Greater Golden Horseshoe, Office Consolidation, prepared by the Ontario Ministry of Municipal Affairs and Housing, August 2020.
- Municipality of Brighton Official Plan, as approved by the County of Northumberland September 2020.
- Northumberland County Official Plan Review and Draft Official Plan Growth Forecast, prepared by Watson & Associates Economists Ltd. March 2021.

This report has been prepared by J.L. Richards & Associates Limited for the Municipality of Brighton's exclusive use. Its discussions and conclusions are summary in nature and cannot properly be used, interpreted or extended to other purposes without a detailed understanding and discussions with the client as to its mandated purpose, scope and limitations. This report is based on information, drawings, data, or reports provided by the named client, its agents, and certain other suppliers or third parties, as applicable, and relies upon the accuracy and completeness of such information. Any inaccuracy or omissions in information provided, or changes to applications, designs, or materials may have a significant impact on the accuracy, reliability, findings, or conclusions of this report.

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J.L. RICHARDS & ASSOCIATES LIMITED

Prepared by:	Reviewed by:
Matthew Marcuccio, P.Eng. Civil Engineer	Susan Shi, M.Eng., P.Eng. Associate Senior Environmental Engineer

Appendix A

Brighton Wastewater Treatment System: 20-Year Committed Capacity for Growth (2021-2041)

Brighton Wastewater Treatment System
Class EA Addendum

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APPENDED TABLE D - WASTEWATER TREATMENT PLANT D-5-1 (COMMITTED)

20-Year Committed Capacity for Growth (2021-2041)

Current Capacity		Units	Notes / Assumptions
Current 5-Yr Average Day Flow (ADF)	3,290	m3/d	Wastewater Annual Reports (2017-2021)
ECA Design ADF	4,600	m3/d	ECA
Residential Growth Requirements		**Units**	**Notes / Assumptions**
Existing Serviced Population (2021)	7,482	persons	Urban Population Forecast Summary - Brighton
Current ADF per person	440	L/person/d	(ADF) / (Existing Serviced Population)
Committed Annual Residential Dwellings	59.3	Dwellings/year	Historical average growth of 69 Houses per year (2016-2019), assuming 86% urban growth (Source: Northumberland County Official Plan Review, Watson & Associates, 2021)
Total Number of Committed Dwelling Units	1,187	Dwellings	Annual Growth for 20 years.
Population Density	2.30	Persons/Dwelling	2021 Census Profile for Brighton, ON
Committed Residential Growth	2,730	Persons	(# of Committed Dwelling Units) x (Population Density)
Committed Residential Capacity	1,201	m3/d	
Commercial Growth Requirements		**Units**	**Notes / Assumptions**
Commited Commercial Growth	N/A	ha	Assumed All Growth is Light Industrial
Committed Institutional Growth	N/A	ha	Assumed All Growth is Light Industrial
Total Committed C&I Area	0	ha	
Unit Flow (per MOECC)	28	m3/d	MOECC Design Guidelines for Sewage Works 2008
Committed C&I Capacity	0	m3/d	
Industrial Growth Requirements		**Units**	**Notes / Assumptions**
Committed Industrial Growth (Gross Area)	0.16	ha	- Light industrial growth of 400ft² floor area per year for 20 years - Assuming building area is 50% gross area
Unit Flow (per MOECC)	35	m3/ha/d	- MOECC Design Guidelines for Water Works, Light Industry water demand - Assumed sewage demand equals water demand
Committed I Capacity	6	m3/d	
Total Committed Flows		**Units**	**Notes / Assumptions**
Future Total Flow (2041)	**4,497**	**m3/d**	(5-Year Avg ADF) + (Residential) + (ICI)
Percent of Rated Capacity	98%		
Uncommitted Reserve Capacity		**Units**	**Notes / Assumptions**
Hydraulic Reserve Capacity, Cr	1,310	m3/d	
Committed Residential Capacity	1,201	m3/d	
Committed I&C Capacity	0	m3/d	
Committed I Capacity	6	m3/d	
Uncommitted Reserve Capacity	**103**	**m3/d**	
Residential Units Available	102	units	

Urban Population Forecast Summary - Brighton

Year	Population	Notes
2016	6,800	2016 Census
2021	7,482	
2031	8,847	
2041	10,212	
2046	10,894	

Notes:
- Net Census undercount estimated at approximately 2.4%. Numbers have been rounded.
- Growth Rate used: 59.3 Dwellings / Year
- Population Density used: 2.3 Persons / Dwelling

Sources:
- Historical population derived from Statistics Canada Demography Division by Watson & Associates Economists Ltd., 2021.
- Forecast Annual Growth Rate from Northumberland County Official Plan Review, prepared by Watson & Associates Economists Ltd., 2021.

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www.jlrichards.ca

Ottawa

343 Preston Street
Tower II, Suite 1000
Ottawa ON Canada
K1S 1N4
Tel: 613 728-3571
ottawa@jlrichards.ca

Kingston

203-863 Princess Street
Kingston ON Canada
K7L 5N4
Tel: 613 544-1424

kingston@jlrichards.ca

Sudbury

314 Countryside Drive
Sudbury ON Canada
P3E 6G2
Tel: 705 522-8174

sudbury@jlrichards.ca

Timmins

834 Mountjoy Street S
Timmins ON Canada
P4N 7C5
Tel: 705 360-1899

timmins@jlrichards.ca

North Bay

501-555 Oak Street E
North Bay ON Canada
P1B 8E3
Tel: 705 495-7597

northbay@jlrichards.ca

Hawkesbury

326 Bertha Street
Hawkesbury ON Canada
K6A 2A8
Tel: 613 632-0287

hawkesbury@jlrichards.ca

Guelph

107-450 Speedvale Ave. West
Guelph ON Canada
N1H 7Y6
Tel: 519 763-0713

guelph@jlrichards.ca

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

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Technical Memorandum No. 2: Headworks Evaluation Report

Municipality of Brighton Wastewater System Class EA Addendum

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Appendix A Supplier Information for Headworks Options

1.0 Introduction

1.1 Background

The Municipality includes the former Town and Township of Brighton and is the most eastern municipality within the County of Northumberland. The Municipality is bounded by the City of Quinte West to the east and the Township of Cramahe to the west, with the shoreline of Lake Ontario to the south. Highway 401 provides the main east-west corridor through the Municipality, which tends to be a regional focus for hamlets in the surrounding areas. Refer to Figure 1 for an overview of the Municipality and study location.

The communal sewage system generally consists of the Brighton Wastewater Treatment Lagoon system (currently rated for 4,600 m^3/day), the Harbour Street Sewage Pumping Station (SPS) and forcemain, a small sub-area sewage pumping station and forcemain servicing Presqu'ile Provincial Park, and several kilometers of gravity collection sewer. Approximately half of the sewage generated in the collection system is directed to the Harbour Street SPS and pumped via a 0.82 km long, 300mm forcemain to the Lagoon and the other half flows by gravity to the Lagoon. Refer to Figure 2 for an overview of the Brighton communal sewage system.

The Harbour Street SPS receives sewage from a significant portion of the collection system, including pumped flow from Presqu'ile Provincial Park. The Harbour Street SPS is currently being upgraded and expanded. The SPS generally consists of a wet well/dry well configuration and is equipped with three dry pit centrifugal type raw sewage pumps (lead/lag/standby operation) complete with inlet and outlet piping, a standby diesel generator, a wet well emergency overflow to Butter Creek, and related instrumentation and controls for the station.

The wastewater treatment system consists of a 0.68 ha single cell aerated lagoon, a single cell 5.44 ha waste stabilization pond with baffle partition curtains, and a 2-cell constructed wetland with a total surface area of 6.2 ha. There is also a chemical storage/feed system used to facilitate continuous phosphorus removal. Chemical is introduced after the aerated lagoon and upstream of the waste stabilization pond. Treated effluent from the waste stabilization pond is discharged continuously to the constructed wetland and from the constructed wetland it continuously discharges to a natural wetland and ultimately to Presqu'ile Bay, which is located off the northeast shore of Lake Ontario.

1.1.1 2017 Schedule 'B' Class Environmental Assessment for Brighton Wastewater Treatment System by J.L. Richards & Associates Limited

The Municipality of Brighton (the Municipality) initiated a Class Environmental Assessment (Class EA) of their wastewater treatment system in August 2016 to address various problems experienced with treatment at their treatment lagoon (e.g., elevated ammonia concentrations in the treated effluent), and also to ensure that increased influent flows from future growth can be effectively accommodated. J.L. Richards & Associates Limited (JLR) was retained by the Municipality to define the problems and identify a preferred solution to address these issues. The Class EA was completed in 2017. The preferred solution included the following:

- Installation of a specialized treatment system (such as a complete mix activated sludge process or a fixed film biological process)
- Upgrading baffles in the stabilization pond
- Optimizing alum dosing
- Refurbishing the constructed wetland
- Diverting high waste streams
- Desludging program

1.1.2 2020 Brighton Wastewater Treatment System Design by GHD

Additional efforts have been undertaken by the Municipality since the completion of the 2017 Schedule 'B' Class EA to address treatment deficiencies. A moving bed biofilm reactor (MBBR) system was selected as the preferred treatment technology. The Brighton Wastewater Treatment System upgrades were then designed and tendered in 2020. However, due to budgetary constraints, the project was cancelled.

1.1.3 2021 Brighton Wastewater Treatment System Aeration Conceptual Design by GSS

With an effort to address the effluent quality issues, in June 2021, the Municipality retained GSS Engineering, who acted as the Municipality's Engineer, to develop conceptual level design for aeration upgrades in the aerated lagoon cell. In addition, GSS recommended implementing a secondary clarifier after the aerated cell and adding screening and grit removal processes. For sludge management, GSS suggested the alternatives to either discharge waste sludge to a drying bed or Geotubes®, or discharge waste sludge to the stabilization lagoon and remove annually.

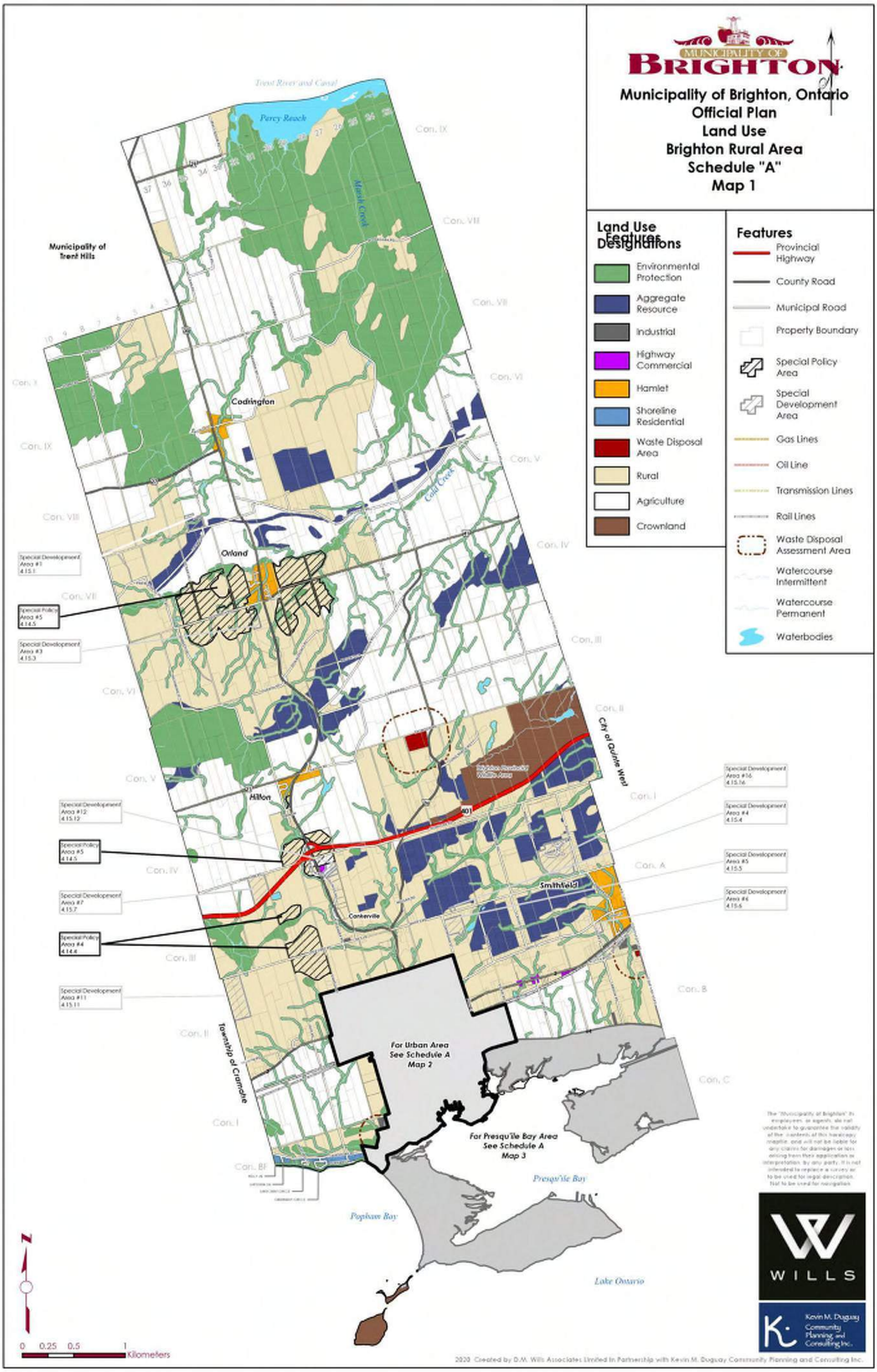
1.1.4 2022 Brighton Wastewater Treatment System Technical Review by R.V. Anderson Associates Limited

Further to that, the Municipality retained R.V. Anderson Associates Limited (RVA) to undertake a technical feasibility review of GSS's design. RVA proposed the following changes to the GSS's design which include the following:

- Implementing a new headworks facility upstream of the aerated lagoon cell
- Confirming proposed aeration rate to provide adequate mixing
- Upsizing proposed clarifier
- Removing accumulated sludge from aerated cell and stabilization pond
- Evaluating options for sludge storage and dewatering in a later study

1.1.5 2022 Brighton Wastewater Treatment System Schedule 'B' Class EA Addendum

In 2022, the Municipality retained JLR to complete a Class EA Addendum to capture the changes that have occurred since the completion of the previous Schedule 'B' Class EA for the Brighton Wastewater Treatment System. These changes include updated growth projections and design basis, the proposed liquid and solids treatment by GSS and RVA, and sludge management options.



PROJECT:
BRIGHTON WASTEWATER TREATMENT SYSTEM CLASS EA ADDENDUM
MUNICIPALITY OF BRIGHTON, ONTARIO

DRAWING:
Urban Area Location Plan

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS
www.jlrichards.ca

DESIGN: MM	JLR NO: 31795
DRAWN: KTK	DRAWING NO.:
CHECKED: SJS	FIGURE 1

File Location: P:\31000\31795-000 - Brighton Lagoon EA Addendum\5-Production\1-Civil\Attach Civil\11x17v.mxd

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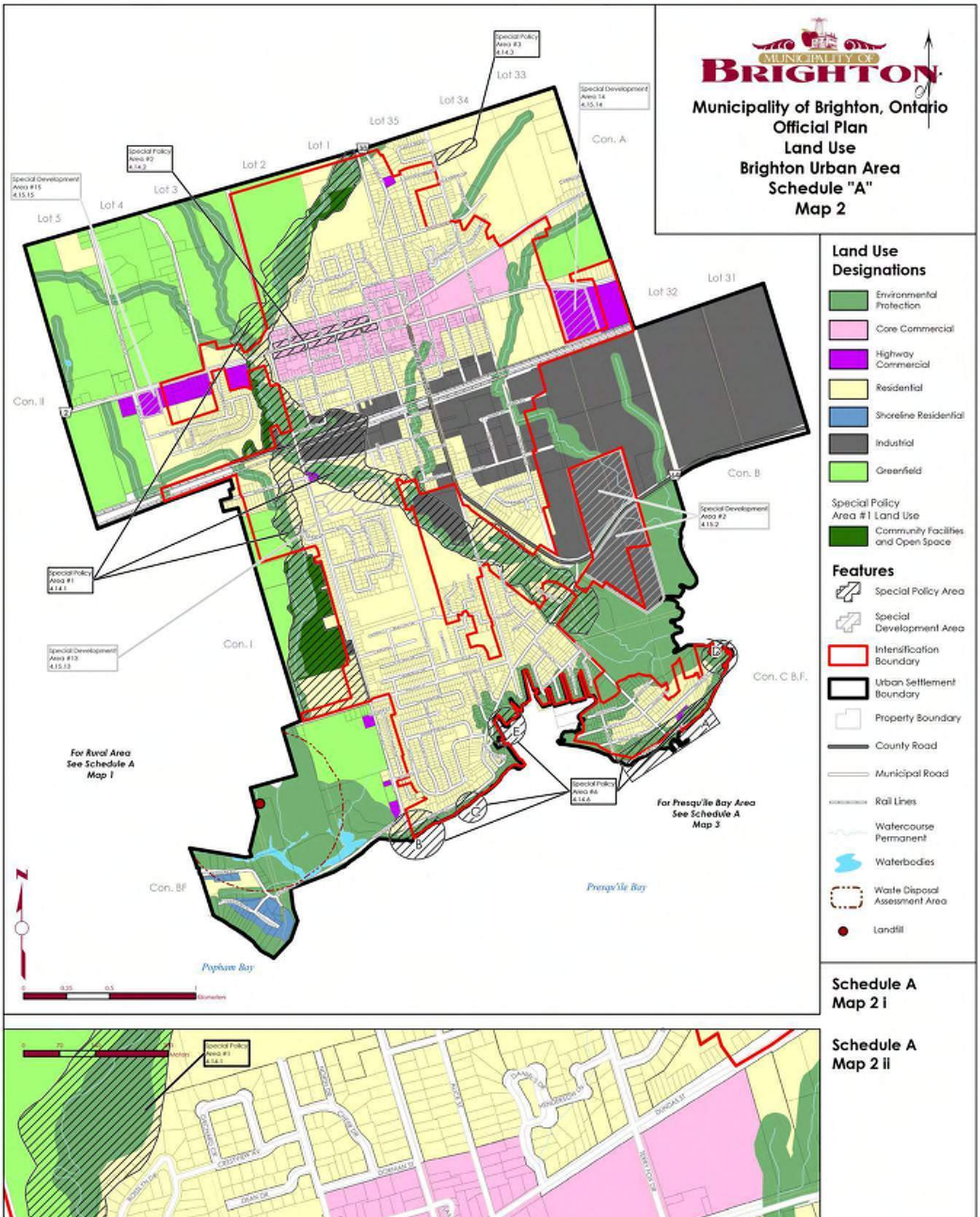

PROJECT:
BRIGHTON WASTEWATER TREATMENT SYSTEM CLASS EA ADDENDUM
MUNICIPALITY OF BRIGHTON, ONTARIO

DRAWING:
Urban Settlement Area

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS
www.jlrichards.ca

DESIGN:	MM	JLR NO:	31795
DRAWN:	KTK	DRAWING NO.:	FIGURE 2
CHECKED:	SJS		

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1.2 Class Environmental Assessment Process

The Ontario Environmental Assessment Act (the Act) sets out a planning and decision-making process so that potential environmental effects are considered before a project begins. The purpose of the Act is to provide for the protection and conservation of the natural environment (R.S.O. 1990, c.E.18, s.2).

The Municipal Class EA process is followed for common types of projects to streamline the review process while ensuring that the project meets the requirements of the Act. It involves detailed site-specific information gathering and studies, as well as consultation with the public and stakeholder agencies. In 1987 the first Class EA prepared by the Municipal Engineers Association (MEA) on behalf of Ontario Municipalities was approved under the Act. Updates and amendments were subsequently made in 1993, 2000, 2007, 2011, and 2015.

This Class EA was initiated as a Schedule B project under the Class EA process. Projects categorized as Schedule B undertakings have the potential for significant environmental effects, and are required to follow Phase 1 and Phase 2 specified under the Municipal Class EA. This includes consultation with all parties that may potentially be affected by the project, and the preparation of a Class EA project file that documents the Class EA process for the project. At the end of Phase 2, the project Schedule is reviewed to determine if the project is complete under a Schedule B Schedule or if the project needs to proceed as a Schedule C undertaking, in which case Phases 3 and 4 of the Class EA process are completed.

The Class EA framework defines the process for each type of project. For Schedule B projects, the completion of the following Phases of the Class EA process are required:

Phase 1 – Identify the Problem and/or Opportunity
Phase 2 – Identify Alternative Solutions to the Problem and/or Opportunity

The Project File shall be made available for public and agency review at the completion of Phase 2 of the Class EA process for a mandatory 30-day period. If there are no requests to the Minister of the Environment, Conservation and Parks (MECP) for a 'Part II Order' within this 30-day review period, then the project may proceed to implementation (Phase 5).

A Class EA Addendum is prepared when there is any significant modification to the project or change in the environmental conditions of the project. For this project, the Project Team has planned to undertake public consultation at three project milestones, including the Notice of Study Commencement for EA Addendum, the Notice of Public Information Centre (PIC), and the Notice of Filing of Addendum. The Notices will be sent to those who were notified during the preparation of the original Class EA, with the addition of any new members of the public or review agencies that are potentially affected with the proposed changes. Like the original Class EA process, the Addendum will be made available for public review for a mandatory 30-day period. During this review period, only the Addendum (the changes to the project) shall be open for review or considered in a request for a Part II Order.

1.3 Objectives of this Class EA Addendum

The purpose of the Class EA Addendum is to describe the proposed modification to the original Class EA, describing the circumstances necessitating the change, including any potential environmental impacts and proposed mitigation measures.

Technical memoranda (TM) and reports are to be prepared to summarize various elements of the overall project. Technical Memoranda and reports will form part of the Class EA Addendum Project File, which is anticipated to be the key deliverable for this project.

Three Technical Memoranda are anticipated and will cover the following topics:

- TM 1 - Updated Growth Evaluation Report
- TM 2 - Headworks Evaluation Report
- TM 3 - Solids Treatment and Sludge Management Report

The Class EA Addendum is proceeding in accordance with the Schedule B requirements of the Ontario Municipal Class EA, October 2000, as amended in 2015. Per the updated growth evaluation in TM 1, the EA Addendum was re-confirmed to follow a Schedule B Class EA Process.

1.4 Objectives of this Technical Memorandum

The Brighton Wastewater Treatment System is currently experiencing issues with ammonia exceedances in the effluent wastewater. Based on previous studies, the probable causes of elevated ammonia concentration in the effluent include seasonal water temperature changes turning over and reactivating of sludge from bottom of the aerated cell, which in turn is likely caused by improper mixing and aeration in the aerated lagoon pond. Proposed solutions include upgrading the aeration system and separating the liquid stream and the waste solids stream, such that the quality of the treated effluent can be improved.

As part of the upgrades to the Wastewater Treatment System, the Municipality has adopted the concept to install a secondary clarifier downstream of the aerated lagoon cell, to remove the suspended solids from the treated wastewater effluent and to promote nitrification through return sludge. In addition, based on the feedbacks from operators, there are screening materials (e.g., rags, plastics) in the aerated lagoon that are being removed on a regular basis. As such, a headworks facility would be beneficial to remove debris and sediment from influent wastewater flows. This would protect downstream equipment and treatment process, particularly sludge pumps and sludge collectors, from getting blocked or damaged and reduce the maintenance costs to clean out future aeration equipment, tanks and channels.

The main objective of this TM is to evaluate and select the technologies for the new headworks system. Due to the nature of substantial head loss from headworks equipment, plant hydraulics upstream of the aerated lagoon will also be reviewed to determine if an influent pumping station is required.

2.0 Design Basis

2.1 Design Flows

As outlined in TM No. 1 - Updated Growth Evaluation Report, the wastewater treatment system will maintain its current rated capacity (4,600 m^3/d) over the next 20 years.

For the purposes of the EA Addendum, peak flows were estimated based on the future Harbour Street Pumping Station rated capacity and the flow split of 40% to 60% between gravity and pumped flow, since the current flow meter only records daily flows, not peak hourly flow or peak instantaneous flow. It is recommended for the Municipality to install flow metering that collects peak instantaneous flows, or to conduct a flow monitoring program prior to detailed design, to assess the actual peak flows in the wastewater system.

Table 1 summarizes the design flows for the wastewater treatment system.

Table 1: Summary of Design Flows and Peaking Factors

Design Flow	Peaking Factor	Flow (m^3/d)
Average Day Flow (ADF)	n/a	4,600
Peak Day Flow (PDF)	2.89(1)	13,294
Peak Hourly Flow (PHF)	3.87(2)	17,813
Peak Instantaneous Flow (PIF)	4.70	21,600(3)

Notes:
(1) Historical PDF factor (RVA 2022)
(2) WEF guidelines for peaking factor, based on Population (RVA 2022)
(3) Estimation based on design PIF of pumped flow from Harbour St. Pumping Station (150 L/s), with the assumption that pumped flows are approximately 60% of total flows (based on feedback provided by Municipality Operators).

The design basis for sizing unit processes is outlined in the Design Guidelines for Sewage Works (MECP 2008). The screening unit is to be sized based on the PIF, while the grit removal unit is to be sized based on the PHF.

The majority of influent flows (approximately 60% based on feedback by operators) are pumped from the Harbour Street Pumping Station. At the station, the flow is passed through a grinder before being pumped to the Lagoon. The rest of the influent flow is from the gravity sewer system on the eastern area of Brighton. There is no pre-processing for this portion of flows. The new headworks system would need to capture both smaller, ground debris and larger debris/rags.

3.0 Headworks Locations

The 2021 GSS design has recommended installing the headworks facility downstream of the aerated lagoon and upstream of the secondary clarifier. The 2022 RVA report has recommended the headworks facility be provided upstream of the aerated lagoon.

This section is intended to review the different headworks location options and provide a recommendation.

3.1 Option 1: Do Nothing

This option involves the maintenance of the “status quo” in the wastewater treatment system where no alternatives are implemented (i.e., no headworks installed). This option is not necessarily an alternative to be selected during the evaluation, but instead would serve as a basis for comparison with the other options.

3.2 Option 2: Upstream of Aerated Lagoon

This option involves the installation of the headworks system upstream of the aerated lagoon cell. Screening and degritting of the influent flows would protect the equipment in the aeration lagoon cell in addition to the clarifier, and would mitigate the accumulation of debris.

The headworks facility is typically located at the head of the plant to treat raw wastewater and to protect all downstream equipment, including aeration equipment, pumps, pipes, sludge collectors, etc.

3.3 Option 3: Downstream of Aerated Lagoon

This option involves the installation of the headworks system downstream of the aerated lagoon cell. This option was proposed in the GSS conceptual design, where screening would be installed between the aerated lagoon and the clarifier, in order to protect the clarifier from debris and ragging. Based on conversation with operators, it appears that rags and plastics are constantly being found in the aerated lagoon and that it is a labor-intensive undertaking to remove rags and plastics to allow the existing mechanical aerators to function properly. As such, there is a need to remove screening materials before wastewater enters the aerated lagoon.

4.0 Headworks Technologies

This section summarizes the various headworks technologies that will be evaluated in this Technical Memorandum.

4.1 Screening Technologies

4.1.1 Option 1: Multi-Rake Mechanical Bar Screen

Example: Duperon FlexRake®, Huber RakeMax®

The multi-rake mechanical bar screen typically consists of a chain-driven scraper, which provides continuous cleaning for an inclined mechanical bar screen. The scraper system lifts screenings into a discharge chute. The unit is typically installed with a washer/compactor unit, which automatically and simultaneously washes organics, dewaters, and compacts collected screenings for disposal. A building is typically required to house the channel, the screens and the washer/compactor systems.

(Duperon FlexRake®)

4.1.2 Option 2: Perforated Plate Screen

Example: John Meunier Escalator® Fine Screen, Claro Fine Step Screen

The perforated plate screen typically consists of a continuous chain of segmented screen panels, a rotating cleaning brush, a sparge system and discharge chute. The sparge system dislodges solids from the screen panels, and the rotating brush sweeps screenings into the discharge chute. The unit is typically installed with a washer/compactor unit, which automatically and simultaneously washes organics, dewaters, and compacts collected screenings for disposal. A building is typically required to house the channel, the screens and the washer/compactor systems.

(John Meunier Escalator®)

4.1.3 Option 3: Inclined Cylindrical Screen

Example: JWC Environmental Inc. Auger Monster®

The inclined auger screen system typically consists of a perforated screen, transport and discharge segments. The perforated screen segment consists of a combination of a perforated steel screen, an auger with wiper/brush affixed to the outer edge to provide cleaning and screenings transport, and a spray wash system to separate organics from the captured shredded inorganic material. The transport segment lifts and dewaters the washed inorganic material. The discharge segment compacts the washed and dewatered inorganic material for disposal. A bagger system is available for screening materials to discharge into. The Auger Monster® system also includes a two parallel drum grinder, equipped with individual intermeshing cutters and spacers that macerate inorganic material in the raw sewage stream. This type of screen can be installed outdoors when proper weather protection is provided (e.g., heat tracing). Indoor installation can also be implemented.

(JWC Environmental Inc. Auger Monster®)

4.1.4 Option 4: Manual Bar Screen

Manual Bar Screens are static bar screens with minimal or no moving parts. The bars will need to be cleaned manually. The manual bar screen can be implemented as its own system, installed upstream of the other types of screens, or in the bypass channel.

4.2 Grit Removal Technologies

Grit Removal Technologies consist of the following:

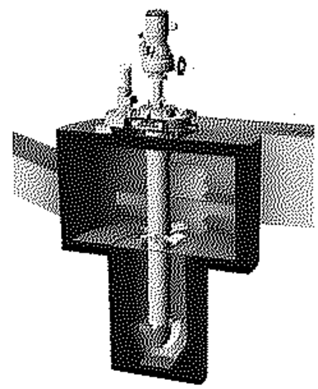
4.2.1 Option 1: Horizontal-Flow Grit Channel

Horizontal-flow grit channels are rectangular gravity settling basins, sometimes with baffles or weirs, designed to maintain a control velocity which allows for the grit to settle as the steam flows through the channel. Grit is typically collected manually from the bottom of the channels for the plant of Brighton's size. For larger plants, chain and flight collectors or augers are typically used to scrape the grit out of the channel for dewatering and disposal.

4.2.2 Option 2: Aerated Grit Removal

Aerated grit removal systems consist of rectangular basins that have air introduced at the base of one side of the tank, to induce a spiral flow pattern that is perpendicular to the flow pattern through the tank. The spiral flow pattern removes entrained grit by centrifugal force. Influent flow is pre-treated with a polymer to facilitate grit settlement. Tanks are benched so as to optimize the spiral flow pattern, and provide hoppers at the bottom for the collection of settled grit. Submersible pumps along with an auger or chain and flight collectors are typically used to transfer settled grit to a grit classifier. Based on JLR's experience, this option is typically used in larger facilities, and is designed to retrofit existing non-aerated grit tanks. Polymers are typically dosed to improve grit settling. The O&M cost with this option is higher comparing to Option 1. Similar treatment efficiency is expected as compared to Option 3.

4.2.3 Option 3: Vortex Grit Removal


Vortex Grit Tank

Vortex grit tanks are proprietary grit removal systems that consist of two (2) types; turbine and tangential flow. Wastewater enters the turbine type tangentially and a rotating turbine maintains a constant flow velocity in the tank. The pitch of the blades is adjustable, to customize separation of grit and organics. The turbine induces a spiral flow pattern that is perpendicular on the vertical axis to the flow pattern through the tank. The spiral flow pattern removes entrained grit by centrifugal force. The upper section of the tanks is circular and benched so as to optimize the spiral flow pattern. Smaller diameter tank sections below the grit removal zones separate the vortex action from the wastewater, allowing separated grit to settle by gravity into the grit storage hoppers. Submersible or self-priming centrifugal pumps are typically used to lift settled grit from the hoppers to a grit classifier. The tangential flow type is similar to the turbine type, except the spiral flow pattern is induced by the kinetic energy of the sewage flow. The unit is typically installed with a dewatering screw/grit classifier, which automatically and simultaneously washes organics, dewaters, and compacts collected grit for disposal.

4.3 Hydraulic Analysis

An important consideration for headworks equipment is the hydraulic analysis. Depending on the plant hydraulics, the head loss of the headworks equipment can drive the decision on technology selection. The head losses of the headworks options at peak flows were reviewed based on the proposal received from suppliers and are shown in the Table below. This table demonstrates a large variation of head losses between the different types of screening and grit removal options.

Table 2: Headworks Options Head Loss Summary

	Head Loss at Peak Flow (mm)
Screening	
Option 1: Multi-Rake Mechanical Bar Screen	
Duperon FlexRake®	58
Huber RakeMax®	179
Option 2: Perforated Plate Step Screen	
John Meunier Escalator® Fine Screen	199

	Head Loss at Peak Flow (mm)
Claro Fine Step Screen	242
Option 3: Inclined Auger Screen	
JWC Environmental Inc. Auger Monster®	742
Grit Removal	
Option 3: Vortex Grit Removal	
Mabarex Vistex Grit Removal	25
Claro VortiClar™ Vortex Unit	25
John Meunier MECTAN® Vortex Grit Removal System	66
Headworks Head Loss Summary (Screen + Grit Removal)	
Minimum Head Loss Option	83 (Duperon Screen + Mabarex/Claro Vortex)
'Mid-Range' Head Loss Option	308 (Claro Screen + J.M MECTAN
Maximum Head Loss Option	808 (Auger Monster + J.M MECTAN)

The available head between inlet MHs 130/131 and aeration tank is insufficient to account for the existing gravity sewers and a full headworks facility. The limitation is the elevation of the existing gravity influent flow. Therefore, an influent pumping station will be required. The size of the pump will be dependent on the following:

- Elevation/grade of the headworks building.
- Pumping for combined pumped/gravity influent flow or just the gravity sewer flow.
- Operating water level in aeration tank.

5.0 Evaluation and Selection of the Preferred Headworks Solution

5.1 Evaluation and Selection Methodology

In order to facilitate the evaluation and selection of the preferred solutions, a transparent and logical four-part assessment process was established. This process included:

- Initial identification and screening of various aspect of headworks facility (including headworks locations, screening technologies and grit removal technologies);
- Establishment of feasible headworks solutions based on short-listed options;
- Detailed evaluation of headworks solutions; and
- Selection of a preferred headworks solution.

The first evaluation stage considers the overall feasibility of the potential headworks solutions. This step ensures that unrealistic alternatives are not carried forward to a more detailed evaluation stage.

Based on the initial screening, a list of feasible headworks solutions is established, and a detailed assessment of the headworks solutions is conducted. Evaluation criteria were developed based on a review of the background information, experience on similar assessments and in consultation with Municipality staff. The evaluation was conducted using criterion in the following four major criteria categories:

Table 3: Summary of Evaluation Criteria

Criteria	Description
Natural Environment Considerations	Natural features, natural heritage areas, Areas of Natural and Significant Interest, designated natural areas, watercourses and aquatic habitat
Social and Cultural Environment Considerations	Proximity of facilities to residential, commercial and institutions, archeological and cultural features, designated heritage features, wellhead protection areas, land-use and planning designations
Technical Feasibility	Constructability, maintaining or enhancing water quality, reliability and security of wastewater collection system, ease of connection to existing infrastructure and operation and maintenance requirements, addresses aging infrastructure, expandability
Financial Considerations	Capital costs, Operation and Maintenance costs

Each criterion was assigned a colour to reflect its level of impact relative to other criteria. The relative level of impact for each criterion for each potential solution was then assessed based on the colour weighting system summarized in Table 4. The option that has the least negative impact or has the strongest positive impact was recommended as the preferred solution and presented to stakeholders to solicit input before finalizing. The evaluation criteria were assigned equal weights as they were considered to have equal importance in this evaluation at the EA stage.

Table 4: Detailed Evaluation Impact Level and Colouring System

Impact Level	Colour	Relative Impact
Strong Positive Impact	Green	Preferred
Minor Impact	Yellow	Less Preferred
Strong Negative Impact	Red	Least Preferred

The OPC for each servicing solution were based on a Class ‘D’ estimate, generally defined as follows:

- Work Definition: A description of the intended solutions with such supporting documentation as is available.

- Intended Purpose: To aid in the screening of various servicing solutions prior to recommending a preferred solution (not intended to establish or confirm budgets).
- Opinion of Probable Cost: Completed using 2022 dollar value. An OPC with a Class 'D' (Indicative Estimate) level of accuracy was developed for each alternative solution and includes allowances for design elements that have not fully been developed. Class 'D' OPCs developed for this assignment are expected to be within +/- 30%. The OPCs were developed based on past experience on similar projects, professional judgment, and equipment costs provided by suppliers. Design completed as part of this Class EA is conceptual in nature for the purpose of obtaining Class 'D' cost estimates. All design parameters should be confirmed during detailed design. Any provided estimate of costs or budget is an OPC that is based on historic construction data and does not include labour, material, equipment, manufacturing, supply, transportation or any other cost impacts in relation to COVID-19. JLR shall not be responsible for any variation in the estimate caused by the foregoing factors but will notify the Municipality of any conditions which JLR believes may cause such variation upon delivery of the estimate.

5.2 Initial Screening of Alternatives

An initial screening of the headworks location, screening technologies and grit removal technologies were undertaken to eliminate unfeasible options, such that the evaluation of the headworks alternative can be focused.

The following tables provide rationale for the short-listed options to be carried forward into the detailed evaluation.

Table 5: Headworks Location Initial Screening

Option 1: Do Nothing	Review: This option does not address the problem, but will be carried forward as a baseline option for comparison. Recommendation: Carry Forward, as baseline only.
Option 2: Upstream of Aerated Lagoon	Review: This option will provide adequate protection for downstream processes. Recommendation: Carry Forward
Option 3: Downstream of Aerated Lagoon	Review: This option increases the risk of ragging and fouling in the aeration lagoon. Not typical in municipal wastewater treatment plants. Recommendation: Do not carry forward

Table 6: Screening Technology Initial Screening

Option 1: Multi-Rake Mechanical Bar Screen	Review: This technology is considered a reliable and effective form of screening, widely used in many treatment plants in Ontario. Recommendation: Carry Forward
Option 2: Perforated Plate Step Screen	Review: This technology is considered a reliable and effective form of screening, widely used in many treatment plants in Ontario. Recommendation: Carry Forward
Option 3: Inclined Auger Screen	Review: This technology is considered a reliable and effective form of screening, commonly used in many treatment plants in Ontario. Recommendation: Carry Forward
Option 4: Manual Bar Screen	Review: Manual bar screens are cost effective but are inefficient at capturing fine debris and are prone to blinding with rags. Additional operational costs and labour are required for the frequent manual cleaning and disposal of screened debris by operators. Recommendation: Do not carry forward as a standalone option. Can be combined with other screening options to improve treatment. This can also be used in bypass channel.

Table 7: Grit Removal Technology Initial Screening

Option 1: Horizontal-Flow Grit Channel	Review: This technology is considered an effective form of grit removal for smaller WWTPs. However, the performance of the technology is dependent on the consistency of influent flow rates. Recommendation: Carry Forward
Option 2: Aerated Grit Removal	Review: This technology can be considered a reliable and effective form of grit removal. However, the capital costs, and associated operation costs are high compared to other options, and the process requires polymer dosing to operate effectively. This technology is more suitable for larger treatment plants, or as a retrofit/upgrade to an existing horizontal flow grit channel. Recommendation: Do not carry forward

Option 3: Vortex Grit Tank	Review: The vortex grit chambers are considered a reliable and effective form of grit removal, widely used in many treatment plants in Ontario. Recommendation: Carry Forward

5.3 Detailed Evaluation of Headworks Alternatives

5.3.1 Headworks Location

Table 8 summarizes the detailed evaluation of the headworks location.

Table 8: Detailed Evaluation of Headworks Location

	Option No. 1 – Do Nothing	Option No. 2 – Upstream of Aerated Lagoon
Natural Environment	• Increased maintenance of equipment due to ragging or damage by debris which may increase plant bypasses.	• New Construction • Improved headworks treatment reduces risk of equipment breakdowns which reduces plant bypasses • Improves water quality into wetland
Evaluation	**Least Preferred**	**Preferred**
Social and Cultural Environment	• No effect to Social/Cultural Environment	• No effect to Social/Cultural Environment
Evaluation	**Preferred**	**Preferred**
Technical Feasibility	• Lack of grit removal would increase risk of fouling in the aeration cell and downstream processes	• Screening and grit removal is beneficial for the O&M of downstream systems.
Evaluation	**Least Preferred**	**Preferred**
Financial Considerations	• No additional costs for new installation • Additional costs to maintain aeration cell to clean fouling from grit accumulation	• Additional Costs for construction of headworks system • Additional Costs to maintain and operate new headworks system
Evaluation	**Preferred**	**Least Preferred**
Overall Evaluation	**Least Preferred**	**Preferred**

5.3.2 Screening Technologies

The Table below summarized the Opinion of Probable Costs (OPC) of various screening options. Note that the costs include new headworks buildings to house screening equipment.

Table 9: Cost Estimate Summary of Screening Technologies

Screening Technology	OPC(1) (excl. HST)	Annual Operating Cost(2)
Option 1: Multi-Rake Mechanical Bar Screen		
a) Duperon FlexRake®	$ 2,800,000	$ 12,000
b) Huber RakeMax®	$ 3,000,000	$ 15,000
Option 2: Perforated Plate Step Screen		
a) John Meunier Escalator® Fine Screen	$ 2,700,000	$ 17,000
b) Claro Fine Step Screen	$ 2,500,000	$ 12,500
Option 3: Inclined Auger Screen		
a) JWC Environmental Inc. Auger Monster®	$2,600,000 (3)	$10,000

Notes:
1) OPC includes costs for installation, channel and building construction, Contractor markup (20%), contingency (25%), and engineering costs (15%).
2) Operating costs include electrical, water consumption and average annual spare parts replacement over 20 years. Costs do not include operator hours and building operation.
3) The $2.6M represents the cost for an indoor installation. Outdoor installation for auger screen is $1.8 M.

Table 10 summarizes the detailed evaluation of the screening technologies.

Table 10: Detailed Evaluation of Screening Technologies

	Option 1: Multi-Rake Mechanical Bar Screen	Option 2: Perforated Plate Step Screen	Option 3: Inclined Auger Screen
Natural Environment	• Larger construction footprint (space for screen and washer/compactor units) • Improved headworks treatment reduces risk of equipment breakdowns which reduces plant bypasses • Improves water quality into wetland	• Larger construction footprint (space for screen and washer/compactor units) • Improved headworks treatment reduces risk of equipment breakdowns which reduces plant bypasses • Improves water quality into wetland	• Smallest construction footprint (washer/compactor is built into unit) • Improved headworks treatment reduces risk of equipment breakdowns which reduces plant bypasses • Improves water quality into wetland
Evaluation	**Preferred**	**Preferred**	**Preferred**
Social and Cultural Environment	• No effect to Social/Cultural Environment	• No effect to Social/Cultural Environment	• No effect to Social/Cultural Environment
Evaluation	**Preferred**	**Preferred**	**Preferred**
Technical Feasibility	• Highly effective screening technology; offers good screening capture • Self-cleaning • Long vertical gaps can allow thin objects to pass – this may not work well with Harbour Street PS grinder • Indoor installation only	• Highly effective screening technology • Self-cleaning • More effective than bar screen at capturing screenings • Higher Head losses • Indoor installation only	• Highly effective screening technology • Self-cleaning • More effective than bar screen at capturing screenings • Highest head losses • More pumping required compared to Option 1 and 2
Evaluation	**Preferred**	**Preferred**	**Preferred**
Financial Considerations	• Most Expensive • Higher operation costs	• Less Expensive • Higher operation costs	• Less Expensive • Lowest operation costs
Evaluation	**Least Preferred**	**Less Preferred**	**Preferred**
Overall Evaluation	**Less Preferred**	**Less Preferred**	**Preferred**

5.3.3 Grit Removal Technologies

The Table below summarized the costs of various grit removal options. Note that both grit removal options will be outdoor installations. The grit classifier for Option 3 will be housed inside the new headworks building.

Table 11: Cost Estimate Summary of Grit Removal Technologies

Grit Removal Technology	OPC(1) (excl. HST)	Annual Operating Cost OPC(2)
Option 1: Horizontal Flow Grit Channel (Incl. Concrete tanks, manual grit removal)	$400,000	$ 0
Option 3: Vortex Grit Removal		
Mabarex Vistex Grit Removal	$ 1,000,000	$ 5,200
Claro VortiClar™ Vortex Unit	$ 900,000	$ 7,600
John Meunier MECTAN® Vortex Grit Removal System	$ 900,000	$ 5,000

Notes:
1) OPC includes costs for installation, channel and building construction, Contractor markup (20%), contingency (25%), and engineering costs (15%).
2) Operating costs include electrical, water consumption and average annual spare parts replacement over 20 years. Costs do not include operator hours and building operation.

Table 12 summarizes the detailed evaluation of the grit removal technologies:

Table 12: Detailed Evaluation of Grit Removal Technologies

	Option 1: Horizontal-Flow Grit Channel	Option 3: Vortex Grit Removal
Natural Environment	• Large construction footprint, but shallow excavation • Improved headworks treatment reduces risk of equipment breakdowns which reduces plant bypasses • Improves water quality into wetland	• Small construction footprint, but deeper excavation • Improved headworks treatment reduces risk of equipment breakdowns which reduces plant bypasses • Improves water quality into wetland
Evaluation	**Preferred**	**Preferred**
Social and Cultural Environment	• No effect to Social/Cultural Environment	• No effect to Social/Cultural Environment
Evaluation	**Preferred**	**Preferred**
Technical Feasibility	• Simple construction • Commonly used in smaller treatment plants • Performance is dependent on the consistency of influent flow rates • Higher head losses	• Most commonly used technology in new build • Effective and consistent removal of grit over a wide range of flows • Minimal head loss • Energy efficient • Unit is tall, requires additional excavation as compared to Option 1.
Evaluation	**Less Preferred**	**Less Preferred**
Financial Considerations	• Lower capital costs • More operator hours required to clean channels • No replacement parts required	• Higher capital cost • Less operator hours for operation (automated system) • Requires maintenance and parts replacement
Evaluation	**Preferred**	**Less Preferred**
Overall Evaluation	**Preferred**	**Less Preferred**

5.4 Summary of Evaluation

The evaluation of headworks technologies is summarized below:

- Preferred Headworks Location:
  - Upstream of Aerated Lagoon (Option 2)

- Preferred Screening Technology:
  - Inclined Auger Screen (Option 3)

- Preferred Grit Removal:
  - Horizontal Flow Grit Channel (Option 1)

5.5 Preferred Headworks Facility Solutions

The preferred solutions for headworks facility are to install:

- Inclined Auger Screen with Horizontal Grit Channel, Upstream of Aerated Lagoon

6.0 Conceptual Design

6.1 Description

The headworks upgrades will consist of the following:

- One headworks building to house the screens, screening bins, electrical equipment, instrumentation and control equipment and odour control.
- Influent Pumping, comprising of a wet well, with submersible pumps.
- One inclined auger screen. A second channel with manual bar screen for bypass and for a future auger screen will also be provided.
- Grit Removal System (two grit channels). The grit channels will be installed outdoors and cleaned manually.

6.2 OPC

The following table is a summary of the conceptual OPC of the preferred options.

Table 13: OPC Summary of Preferred Headworks Facility Solutions

Item	Inclined Auger Screen with Grit Channel (1)
Headworks Building	$ 2,150,000
Influent Pumping	$ 830,000
Screening (Inclined Auger Screen)	$ 480,000
Grit Removal	$ 240,000
Subtotal (2)	$ 3,700,000
Contingency (~25%)	$ 930,000
Subtotal	$4,630,000
Engineering (~15%)	$ 700,000
Total (Incl. Engineering, Contingency, Contractor Fees, Excl. HST)	**$ 5,300,000**
Notes: 1) All OPCs exclude HST. 2) Capital OPCs include costs for installation, contractor markup (~20%).	

6.2.1 Design Considerations

The following are considerations to be explored during the detailed design of the headworks facility:

- Due to the elevations of the incoming flows, an influent pumping station will be required to lift the wastewater into the headworks facility and then into the aerated lagoon
- There may be opportunity to optimize the Harbour St. Pumping Station to increase the head of the pumped flow, in order reduce the size of the new influent pumping station. This should be reviewed during detailed design.
- There may be opportunity of value engineering to reduce or eliminate the influent pumping station, such as lowering the floor of the aeration lagoon to drop the hydraulic grade line, lowering the operating water level of the aeration lagoon, etc. This value engineering exercise can be conducted during detailed design.
- It is recommended for the Municipality to conduct a flow monitoring program, or to provide a new influent flow meter, to confirm the actual peak flows in the wastewater system. This will better define the peak instantaneous and peak hourly flow design basis for the detailed design of headworks equipment.
- The headworks system design will need to consider the future expansion of the wastewater treatment system beyond the 20-year growth forecasts (e.g., provide additional channel for future screen and allow space for future grit channel)

- The channels should be equipped with means to isolate equipment and sections of the channel (e.g., gate valves or similar) to facilitate maintenance of the screening and grit removal units while maintaining plant operation.
- The headworks channels should consider incorporating bypasses around screening and grit removal units, to maintain plant operation while the units are out of service for maintenance or replacement. The bypass channel around the screening unit should be equipped with a manual bar screen, to capture larger debris while the main screening unit is out of service.
- The existing treatment system will need to maintain operation during the construction of the new headworks facility. Location of the new headworks facility will need to be reviewed and established. Site planning should also account for solids treatment train.
- The designer should consider odour control for the headworks unit if installed indoors.
- There may be opportunity in the detailed design phase for value engineering to evaluate the costs for outdoor installation of the headworks screens.

7.0 References

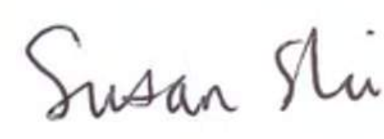
- R.V. Anderson Associates Ltd., Brighton WPCP Proposed Upgrade Technical Review, 2022.
- Water Environment Federation, Design of Water Resource Recovery Facilities, Manual of Practice No. 8, Sixth Edition, 2017.
- Ministry of the Environment, Conservation and Parks, MOE Design Guidelines for Sewage Works, 2008.
- Metcalf & Eddy Inc., Wastewater Engineering Treatment and Reuse, Fourth Edition, 2003.
- United States Environmental Protection Agency, Wastewater Technology Fact Sheet, Screening and Grit Removal, 2003.

J.L. RICHARDS & ASSOCIATES LIMITED

Prepared by:

Matthew Marcuccio, P.Eng.
Civil Engineer

Reviewed by:



Susan Jingmiao Shi, P.Eng., M.Eng.
Senior Environmental Engineer

The contents of this Appendix was removed as it contained proprietary information from equipment suppliers. This information can be provided upon request with permission from the Suppliers.

Appendix A

Supplier Information for Headworks Options

BEST MANAGED COMPANIES
CANADA
Platinum member

www.jlrichards.ca

Ottawa

343 Preston Street
Tower II, Suite 1000
Ottawa ON Canada
K1S 1N4
Tel: 613 728-3571
ottawa@jlrichards.ca

Kingston

203-863 Princess Street
Kingston ON Canada
K7L 5N4
Tel: 613 544-1424

kingston@jlrichards.ca

Sudbury

314 Countryside Drive
Sudbury ON Canada
P3E 6G2
Tel: 705 522-8174

sudbury@jlrichards.ca

Timmins

834 Mountjoy Street S
Timmins ON Canada
P4N 7C5
Tel: 705 360-1899

timmins@jlrichards.ca

North Bay

501-555 Oak Street E
North Bay ON Canada
P1B 8E3
Tel: 705 495-7597

northbay@jlrichards.ca

Hawkesbury

326 Bertha Street
Hawkesbury ON Canada
K6A 2A8
Tel: 613 632-0287

hawkesbury@jlrichards.ca

Guelph

107-450 Speedvale Ave. West
Guelph ON Canada
N1H 7Y6
Tel: 519 763-0713

guelph@jlrichards.ca

J.L.Richards
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JLR No.: 31795-000
Revision: FINAL

November 14, 2022

Technical Memorandum No. 3: Sludge Treatment and Solids Management Evaluation Report

Municipality of Brighton Wastewater System Class EA Addendum

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

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Brighton WPCP Proposed Upgrade Technical Review (RVA, 2022)
Appendix B Sludge Management Workshop Presentation and Minutes, August 18, 2022

1.0 Introduction

1.1 Background

The Municipality includes the former Town and Township of Brighton and is the most eastern municipality within the County of Northumberland. The Municipality is bounded by the City of Quinte West to the east and the Township of Cramahe to the west, with the shoreline of Lake Ontario to the south. Highway 401 provides the main east-west corridor through the Municipality, which tends to be a regional focus for hamlets in the surrounding areas. Refer to Figure 1 for an overview of the Municipality and study location.

The communal sewage system generally consists of the Brighton Wastewater Treatment Lagoon system (currently rated for 4,600 m^3/day), the Harbour Street Sewage Pumping Station (SPS) and forcemain, a small sub-area sewage pumping station and forcemain servicing Presqu'ile Provincial Park, and several kilometers of gravity collection sewer. Approximately half of the sewage generated in the collection system is directed to the Harbour Street SPS and pumped via a 0.82 km long, 300mm forcemain to the Lagoon and the other half flows by gravity to the Lagoon. Refer to Figure 2 for an overview of the Brighton communal sewage system.

The Harbour Street SPS receives sewage from a significant portion of the collection system, including pumped flow from Presqu'ile Provincial Park. The Harbour Street SPS is currently being upgraded and expanded. The SPS generally consists of a wet well/dry well configuration and is equipped with three dry pit centrifugal type raw sewage pumps (lead/lag/standby operation) complete with inlet and outlet piping, a standby diesel generator, a wet well emergency overflow to Butter Creek, and related instrumentation and controls for the station.

The wastewater treatment system consists of a 0.68 ha single cell aerated lagoon, a single cell 5.44 ha waste stabilization pond with baffle partition curtains, and a 2-cell constructed wetland with a total surface area of 6.2 ha. There is also a chemical storage/feed system used to facilitate continuous phosphorus removal. Chemical is introduced after the aerated lagoon and upstream of the waste stabilization pond. Treated effluent from the waste stabilization pond is discharged continuously to the constructed wetland and from the constructed wetland it continuously discharges to a natural wetland and ultimately to Presqu'ile Bay, which is located off the northeast shore of Lake Ontario.

1.1.1 2017 Schedule 'B' Class Environmental Assessment for Brighton Wastewater Treatment System by J.L. Richards & Associates Limited

The Municipality of Brighton (the Municipality) initiated a Class Environmental Assessment (Class EA) of their wastewater treatment system in August 2016 to address various problems experienced with treatment at their treatment lagoon (e.g., elevated ammonia concentrations in the treated effluent), and also to ensure that increased influent flows from future growth can be effectively accommodated. J.L. Richards & Associates Limited (JLR) was retained by the Municipality to define the problems and identify a preferred solution to address these issues. The Class EA was completed in 2017. The preferred solution included the following:

- Installation of a specialized treatment system (such as a complete mix activated sludge process or a fixed film biological process)
- Upgrading baffles in the stabilization pond
- Optimizing alum dosing
- Refurbishing the constructed wetland
- Diverting high waste streams
- Desludging program

1.1.2 2020 Brighton Wastewater Treatment System Design by GHD

Additional efforts have been undertaken by the Municipality since the completion of the 2017 Schedule 'B' Class EA to address treatment deficiencies. A moving bed biofilm reactor (MBBR) system was selected as the preferred treatment technology. The Brighton Wastewater Treatment System upgrades were then designed and tendered in 2020. However, due to budgetary constraints, the project was cancelled.

1.1.3 2021 Brighton Wastewater Treatment System Aeration Conceptual Design by GSS

With an effort to address the effluent quality issues, in June 2021, the Municipality retained GSS Engineering, who acted as the Municipality's Engineer, to develop conceptual level design for aeration upgrades in the aerated lagoon cell. In addition, GSS recommended implementing a secondary clarifier after the aerated cell and adding screening and grit removal processes. For sludge management, GSS suggested the alternatives to either discharge waste sludge to a drying bed or Geotubes®, or discharge waste sludge to the stabilization lagoon and remove annually.

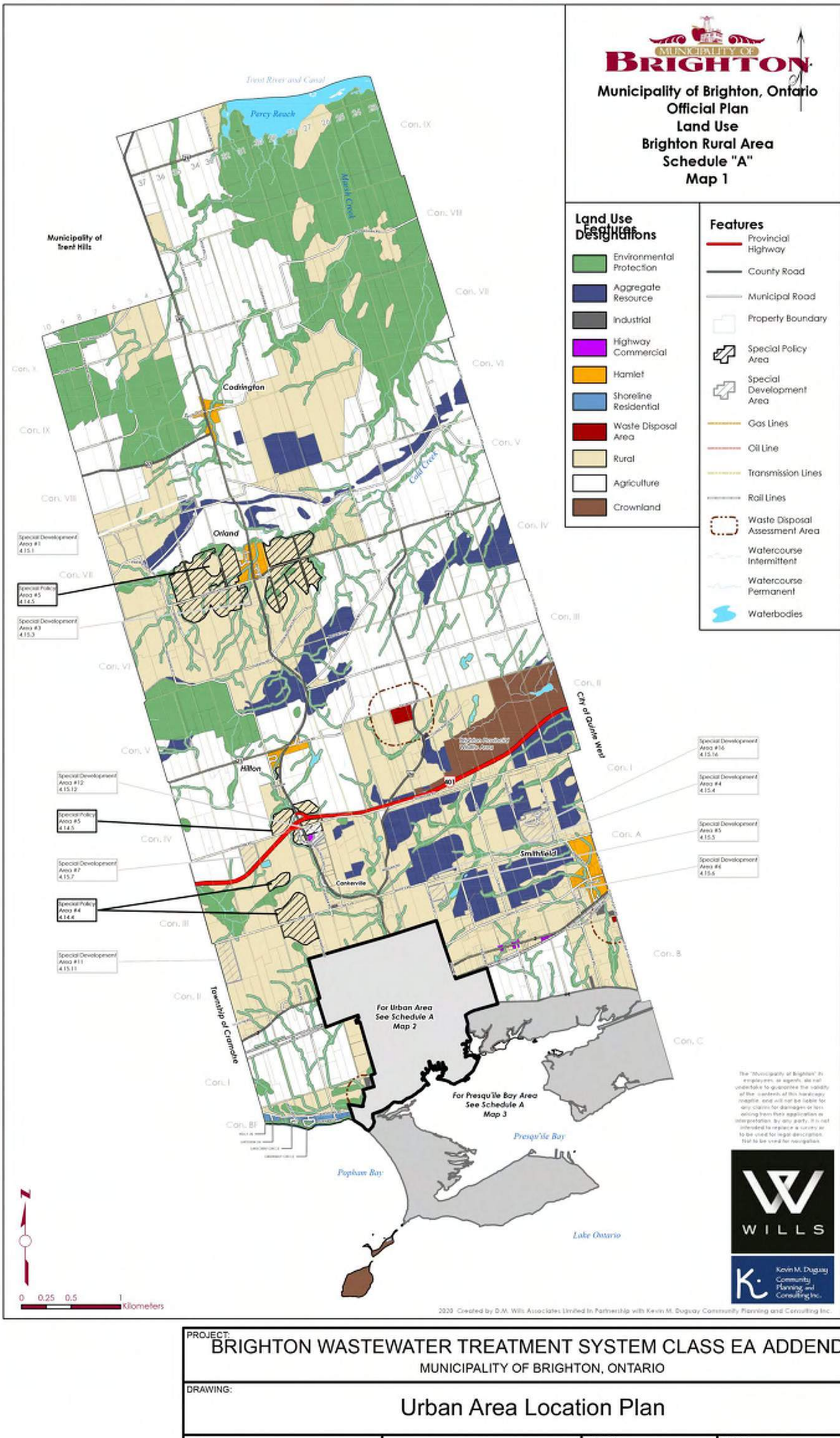
1.1.4 2022 Brighton Wastewater Treatment System Technical Review by R.V. Anderson Associates Limited

Further to that, the Municipality retained R.V. Anderson Associates Limited (RVA) to undertake a technical feasibility review of GSS's design. RVA proposed the following changes to the GSS's design which include the following:

- Implementing a new headworks facility upstream of the aerated lagoon cell
- Confirming proposed aeration rate to provide adequate mixing
- Upsizing proposed clarifier
- Removing accumulated sludge from aerated cell and stabilization pond
- Evaluating options for sludge storage and dewatering in a later study

1.1.5 2022 Brighton Wastewater Treatment System Schedule 'B' Class EA Addendum

In 2022, the Municipality retained JLR to complete a Class EA Addendum to capture the changes that have occurred since the completion of the previous Schedule 'B' Class EA for the Brighton Wastewater Treatment System. These changes include updated growth projections and design basis, the proposed liquid and solids treatment by GSS and RVA, and sludge management options.



PROJECT:
BRIGHTON WASTEWATER TREATMENT SYSTEM CLASS EA ADDENDUM
MUNICIPALITY OF BRIGHTON, ONTARIO

DRAWING:
Urban Area Location Plan

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DESIGN:	MM	JLR NO:	31795
DRAWN:	KTK	DRAWING NO.:	
CHECKED:	SJS		FIGURE 1

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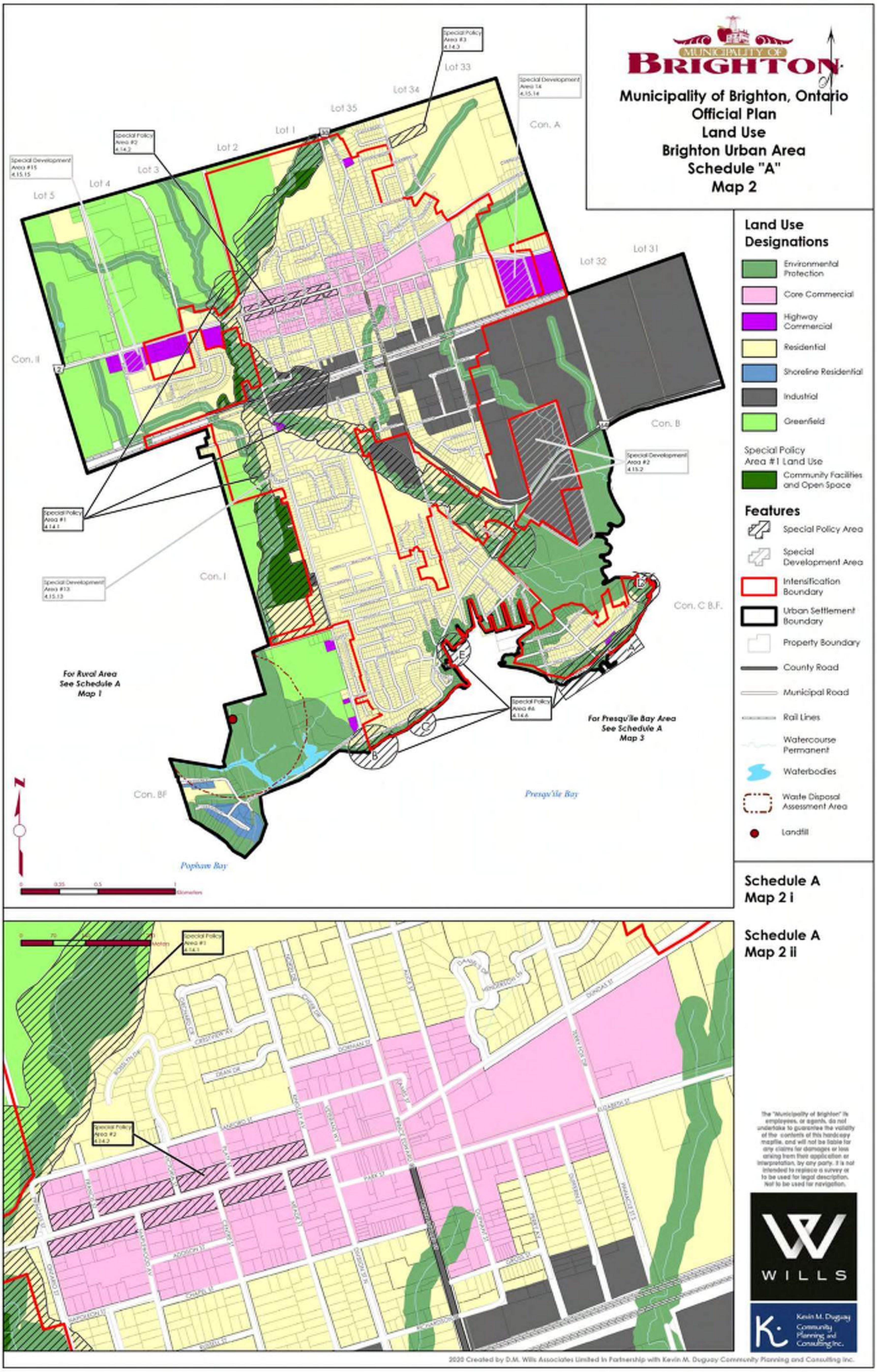

PROJECT:
BRIGHTON WASTEWATER TREATMENT SYSTEM CLASS EA ADDENDUM
MUNICIPALITY OF BRIGHTON, ONTARIO

DRAWING:
Urban Settlement Area

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DESIGN:	MM	JLR NO:	31795
DRAWN:	KTK	DRAWING NO.:	FIGURE 2
CHECKED:	SJS		

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1.2 Class Environmental Assessment Process

The Ontario Environmental Assessment Act (the Act) sets out a planning and decision-making process so that potential environmental effects are considered before a project begins. The purpose of the Act is to provide for the protection and conservation of the natural environment (R.S.O. 1990, c.E.18, s.2).

The Municipal Class EA process is followed for common types of projects to streamline the review process while ensuring that the project meets the requirements of the Act. It involves detailed site-specific information gathering and studies, as well as consultation with the public and stakeholder agencies. In 1987, the first Class EA prepared by the Municipal Engineers Association (MEA) on behalf of Ontario Municipalities was approved under the Act. Updates and amendments were subsequently made in 1993, 2000, 2007, 2011, and 2015.

This Class EA was initiated as a Schedule B project under the Class EA process. Projects categorized as Schedule B undertakings have the potential for significant environmental effects, and are required to follow Phase 1 and Phase 2 specified under the Municipal Class EA. This includes consultation with all parties that may potentially be affected by the project, and the preparation of a Class EA project file that documents the Class EA process for the project. At the end of Phase 2, the project Schedule is reviewed to determine if the project is complete under a Schedule B Schedule or if the project needs to proceed as a Schedule C undertaking, in which case Phases 3 and 4 of the Class EA process are completed.

The Class EA framework defines the process for each type of project. For Schedule B projects, the completion of the following Phases of the Class EA process are required:

Phase 1 – Identify the Problem and/or Opportunity
Phase 2 – Identify Alternative Solutions to the Problem and/or Opportunity

The Project File shall be made available for public and agency review at the completion of Phase 2 of the Class EA process for a mandatory 30-day period. If there are no requests to the Minister of the Environment, Conservation and Parks (MECP) for a 'Part II Order' within this 30-day review period, then the project may proceed to implementation (Phase 5).

A Class EA Addendum is prepared when there is any significant modification to the project or change in the environmental conditions of the project. For this project, the Project Team has planned to undertake public consultation at three project milestones, including the Notice of Study Commencement for EA Addendum, the Notice of Public Information Centre (PIC), and the Notice of Filing of Addendum. The Notices will be sent to those who were notified during the preparation of the original Class EA, with the addition of any new members of the public or review agencies that are potentially affected with the proposed changes. Like the original Class EA process, the Addendum will be made available for public review for a mandatory 30-day period. During this review period, only the Addendum (the changes to the project) shall be open for review or considered in a request for a Part II Order.

1.3 Objectives of this Class EA Addendum

The purpose of the Class EA Addendum is to describe the proposed modification to the original Class EA, describing the circumstances necessitating the change, including any potential environmental impacts and proposed mitigation measures.

Technical memoranda (TM) and reports are to be prepared to summarize various elements of the overall project. Technical Memoranda and reports will form part of the Class EA Addendum Project File, which is anticipated to be the key deliverable for this project.

Three Technical Memoranda are anticipated and will cover the following topics:

- TM 1 - Updated Growth Evaluation Report
- TM 2 - Headworks Evaluation Report
- TM 3 - Solids Treatment and Sludge Management Report

The Class EA Addendum is proceeding in accordance with the Schedule B requirements of the Ontario Municipal Class EA, October 2000, as amended in 2015. Per the updated growth evaluation in TM 1, the EA Addendum was re-confirmed to follow a Schedule B Class EA Process.

1.4 Objectives of this Technical Memorandum

The Brighton Wastewater Treatment System is currently experiencing issues with ammonia exceedances in the effluent wastewater. Based on previous studies, the probable causes of elevated ammonia concentration in the effluent include seasonal water temperature changes turning over and reactivating of sludge from bottom of the aerated cell, which in turn is likely caused by improper mixing and aeration in the aerated lagoon pond. Proposed solutions include upgrading the aeration system and separating the liquid stream and the waste solids stream, such that the quality of the treated effluent can be improved.

As part of the upgrades to the Wastewater Treatment System, the Municipality has adopted the concept to install a secondary clarifier downstream of the aerated lagoon cell, to remove the suspended solids from the treated wastewater effluent and to promote nitrification through return sludge. As a result, the treatment and/or management of the waste activated sludge must be addressed as part of the proposed upgrades.

The main objective of this TM is to evaluate and select the preferred strategy and technology for the new sludge treatment and solids management.

2.0 Design Basis

2.1 Proposed Upgrades

The block flow diagram for the proposed upgrades to the Wastewater Treatment System are as follows and shown in Figure 3:

- Liquid treatment process will generally consist of:
  - New headworks facility (Refer to Tech Memo No. 2 – Headworks Evaluation Report)
  - The existing aerated lagoon
  - A new secondary clarifier
  - Disinfection by effluent polishing in existing facultative lagoon or a separate disinfection process, pending the selection of the preferred sludge treatment and solids management strategy.

- New solids treatment process will generally consist of:
  - The return activated sludge (RAS) is sent to the aerated lagoon
  - The waste activated sludge (WAS) is sent to solids treatment and disposal which will be evaluated and selected in this Technical Memorandum

- New solids management process will generally consist of:
  - Disposal or reuse methods which will be evaluated and selected in this Technical Memorandum.

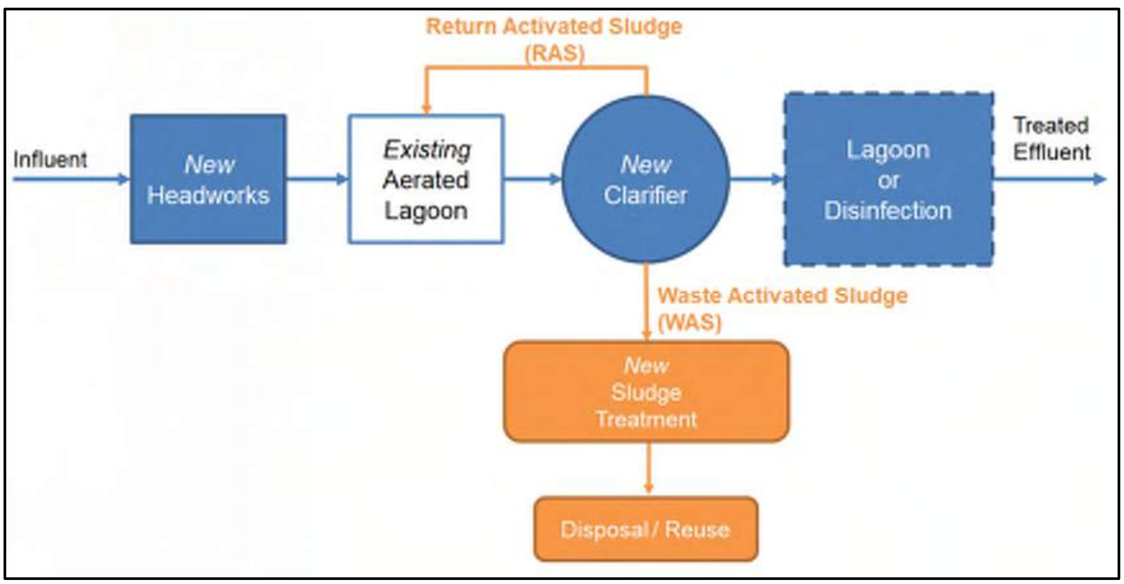


Figure 3: Block Flow Diagram of the Proposed Upgraded Wastewater Treatment Process

2.2 Design Flows

As outlined in TM No. 1 - Updated Growth Evaluation Report, the wastewater treatment system will maintain its current rated capacity (4,600 m^3/d) over the next 20 years.

For the purposes of the EA Addendum, peak flows were estimated based on the future Harbour Street Pumping Station rated capacity and the flow split of 40% to 60% between gravity and pumped flow, since the current flow meter only records daily flows, not peak hourly flow or peak instantaneous flow. It is recommended for the Municipality to install flow metering that collects peak instantaneous flows, or to conduct a flow monitoring program prior to detailed design, to assess the actual peak flows in the wastewater treatment system.

Table 1 summarizes the design flows for the wastewater treatment system:

Table 1: Summary of Design Flows and Peaking Factors

Design Flow	Peaking Factor	Flow (m^3/d)
Average Day Flow (ADF)	1	4,600
Peak Day Flow (PDF)	2.89(1)	13,294
Peak Hourly Flow (PHF)	3.87(2)	17,813
Peak Instantaneous Flow (PIF)	4.70	21,600(3)

Notes:
(1) Historical PDF factor, (RVA 2022)
(2) WEF guidelines for peaking factor, based on Population, (RVA 2022)
(3) Estimation based on design PIF of pumped flow from Harbour St. Pumping Station (150 L/s), with the assumption that pumped flows are approximately 60% of total flows (based on feedback provided by Municipality Operators).

The design basis for sizing unit processes is outlined in the MOE Guidelines for Sewage Works (MECP 2008). The sludge treatment system is to be sized based on the maximum monthly mass loading and flow rates.

2.3 Design WAS Generation Rates

In their technical review, RVA ran a BioWin model of the proposed clarifier upgrades at the current plant rated capacity. The model was prepared under the following assumptions:

- The lagoons have been emptied of previously accumulated sludge.
- Due to the significant difference between the current and proposed systems, a calibrated model of the existing system was not developed. The default BioWin operating parameters were therefore used.
- 20 days SRT (minimum 15 days in MECP guidelines).
- Influent characteristics higher than the average historic influent information was used.

At the current rated capacity (4,600 m^3/d), the WAS flow rate is estimated to be 236 m^3/d at a solids concentration of 0.3% (3 g/L). The corresponding solids generation rate is approximately 708 kg/d. Refer to Appendix A for further details.

3.0 Sludge Treatment and Solids Management Technologies

3.1 Typical Sludge Treatment and Solids Management Process

For the purposes of this EA, “sludge” refers to waste activated sludge (WAS), which is the solids collected at the bottom of the new secondary clarifier that are not returned to the aerated lagoon. “Biosolids” will refer to sludge that has undergone treatment and pathogen reduction to become suitable for beneficial reuse. In general, the sludge treatment process can include the following steps:

- WAS Thickening – increasing solids concentration and reducing sludge volume
- Sludge Stabilization – treating and stabilizing WAS
- Biosolids Management – removing water to thicken and reduce volume of biosolids, and to provide storage onsite

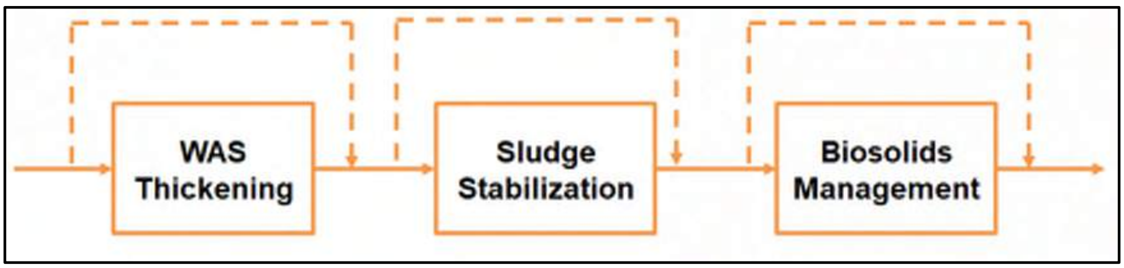


Figure 4: Block Flow Diagram - Typical Sludge Treatment Process

Some of the considerations for selecting a preferred solids treatment and sludge management solution include:

- End use / disposal options
- Requirements upstream/downstream of the technologies
- Plant size and economy-of-scale
- Land use; odour impact
- Energy requirements
- Sludge characteristics, etc.

3.2 Sludge/Biosolids Disposal Options

There are various receivers for WAS and biosolids, depending on the level of sludge treatment. The decision of the disposal and reuse is critical and will impact the decision of the sludge thickening, sludge stabilization and biosolids management options. Generally speaking, the stabilized sludge becomes suitable for reuse (i.e., land application). The untreated sludge will only be suitable for landfill or treatment at another wastewater treatment plant (WWTP).

The following table summarizes the various possible disposal options at each stage of the sludge treatment process that are feasible for Brighton.

Table 2: Disposal Options at Various Stages of WAS Treatment

Stage of WAS treatment	Disposal Options
Un-thickened, un-stabilized WAS	• Treatment at another WWTP
Thickened, un-stabilized WAS	• Landfill disposal • Treatment at another WWTP
Stabilized biosolids	• Land application • Landfill disposal
Stabilized and dewatered biosolids	• Land application • Landfill disposal

The various disposal options are described below:

3.2.1 Option 1: Landfill Disposal

This option involves hauling wasted sludge or biosolids to a landfill site for disposal. Transportation and handling of waste to landfills must comply with procedures and requirements laid out in *O.Reg.* 347, as amended. There may be additional requirements specific to the landfill site subject to the environmental compliance approval.

Some landfill sites may not accept liquid waste. Per the Design Guidelines for Sewage Works (MECP 2008), a slump test would generally be required, in accordance with *O.Reg.* 347, to determine if the waste suitable for disposal, typically requiring having slump greater than 150mm or minimum 18% total solids concentration. In this case, sludge would require thickening before disposal. Haulage costs would be significant considering the WAS volume being generated each day at Brighton Lagoon.

3.2.2 Option 2: Treatment at another Wastewater Treatment Plant (WWTP)

This option involves hauling WAS to another facility for further treatment.
This would require an agreement with the receiving facility, confirming there is sufficient capacity to receive and treat sludge.

The transportation and handling of hauled sewage would be subject to requirements in *O.Reg.* 347 as amended. The sludge could be thickened to reduce the volume needed to haul. Haulage costs would be significant considering the WAS volume being generated each day at Brighton Lagoon.

3.2.3 Option 3: Land Application

This option involves using treated biosolids as fertilizer or soil conditioning and is subject to *O.Reg.* 267/03 as amended. Per the regulations, biosolids from sewage are classified as Category 3 Non-Agriculture Source Material (NASM), and must comply with specific land application standards.

O.Reg. 267/03 provides limitations of where, when, how and how much NASM can be applied. Sampling procedures for both the NASM generator and receiving soils are also outlined.

NASM cannot be land applied if it exceeds specified concentration limits from regulated metals (CM1, CM2), pathogens (CP1, CP2), and odour detection thresholds (OC1, OC2, OC3), refer to Table 3. To be accepted as land-applicable NASM, the biosolids cannot exceed regulated metals over CM2 limits, pathogens over CP2 limits, and odour thresholds over OC3. However, if stricter limits are achieved (CM1, CP1, OC1/OC2), fewer application limitations can be imposed as detailed in the regulations.

Table 3: NASM Contaminant Concentration Limits (Sewage Biosolids)

Contaminant	Referenced Limits in *O.Reg.* 267/03
Regulated Metals	
CM1	Schedule 5, Table 1
CM2	Schedule 5, Table 2
Pathogens	
CP1	Schedule 6, Table 2
CP2	Schedule 6, Table 3
Odour Detection Threshold	
OC1	2012 NASM Odour Guide
OC2	
OC3	

Prior to commencing land application, a NASM management plan must be prepared, for approval by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA).

It should be noted that a third-party certified waste management company can be contracted to provide land application services.

3.2.4 Option 4: Soils Management

This option involves the temporary storage of sludge or biosolids by mixing with excess soils, complying with *O.Reg.* 406/19, as amended. The intent of this option is to provide soil management at the Brighton Lagoon site, considering there is space available. The regulations outline the standards for operating a soils management site, including storage, stockpiling, handling, reuse and management of runoff/leachate. An additional environmental compliance approval (ECA Waste) is required to use and operate the site as a soils management site. The site must also be managed and documented by a qualified person.

3.3 Waste Activated Sludge (WAS) Thickening

Sludge thickening involves removing water for sludge to increase the solids concentration and reduce the volume of the sludge. This will reduce the hydraulic loading and increase treatment efficiency of downstream treatment processes

3.3.1 Option 1: Do Nothing (No Thickening)

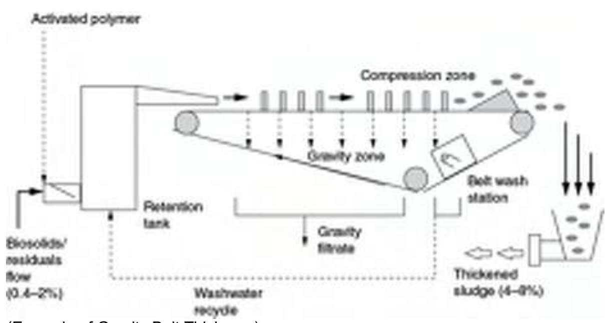
This alternative will evaluate the option of not thickening the WAS prior to downstream processes. Many treatment plants do not have the thickening process prior to sludge stabilization.

3.3.2 Option 2: Sludge Thickening

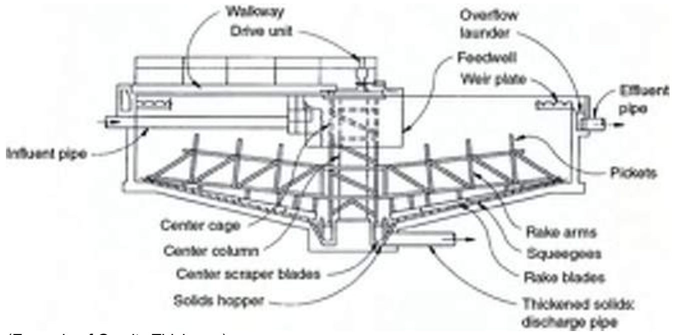
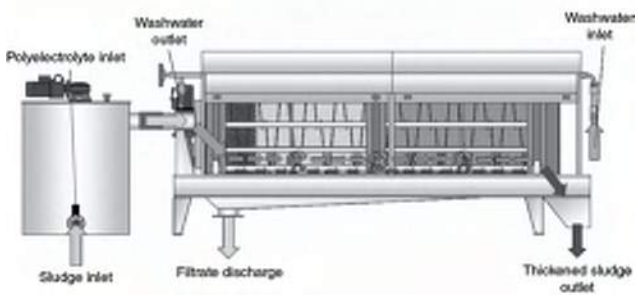
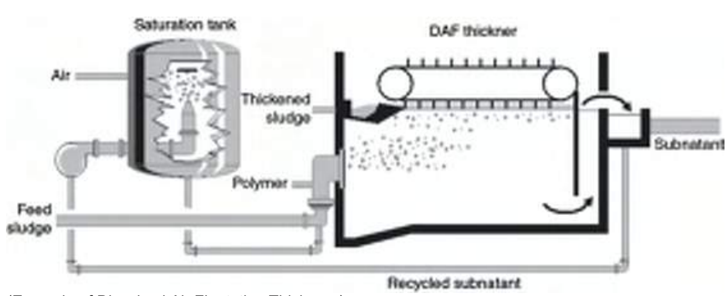
Typical sludge thickening technologies include the following table.

Table 4: Sludge Thickening Technologies

<table>
<tr><td>Gravity Belt Thickener</td><td>Polymer conditioned sludge is distributed evenly across the width of a moving fabric belt. Free water drains through the belt, while suspended solids are retained on the surface. Filtrate is collected and returned to the liquid treatment train. Typical performance produces sludge solids concentration of approx. 4-8% (MECP 2008).



(Example of Gravity Belt Thickener)</td></tr>
<tr><td>Gravity Thickener</td><td>The system typically consists of a tank, sludge collection mechanism, and provisions for supernatant withdrawal, similar in design to conventional sedimentation tanks. Diluted sludge is fed to a center feed well and allowed to settle and compact. The sludge is gently stirred by the sludge collection mechanism, opening channels for water to escape. Supernatant is drawn off and returned to the liquid treatment train. Typical performance produces sludge solids concentration of approx. 2-3% (MECP 2008).</td></tr>
</table>

	 (Example of Gravity Thickener)
Rotating Drum Thickener	Polymer conditioned sludge is fed into a rotating drum screen. Flocculated sludge solids are retained on the inner surface, while free water drains through the screen. Filtrate is collected in a trough and is returned to the head of the plant. Captured solids are conveyed towards the outlet end of the drum by flights or an internal screw conveyor. Typical performance produces sludge solids concentration of approx. 4-8% (MECP 2008).  (Example of Rotating Drum Thickener)
Dissolved Air Flotation	A liquid stream saturated with air under high pressure is blended with sludge. The pressurized stream is fed into the flotation tank, where the resulting pressure drop causes the air to come out of solution and form microscopic bubbles. The bubbles attach to the suspended solids in the feed sludge which causes them to float to the surface of the tank. The thickened WAS is collected from the tank surface by a skimming mechanism and directed to a storage hopper. The underflow (subnatant) is collected in an effluent launder and returned to the liquid treatment train. Typical performance produces sludge solids concentration of approx. 4-6% (MECP 2008).  (Example of Dissolved Air Floatation Thickener)

3.4 Sludge Stabilization

The purpose of sludge stabilization includes reducing solids mass and volume, volatile solids reduction, pathogen reduction, odour reduction, and producing a useful product (i.e., land application). Primary forms of sludge stabilization feasible for Brighton Lagoon include the following:

3.4.1 Option 1: Lagoon Stabilization (with Supplemental Aeration)

This option consists of converting the existing facultative lagoon into a WAS stabilization pond. The lagoon would be disconnected from the aerated lagoon effluent and modified to accept WAS from the new secondary clarifier. The sludge will be stabilized and treated at the bottom of the lagoon. Sufficient water cover would need to be maintained over the sludge to minimize odours. The storage capacity of the WAS stabilization pond is dependent on how much of the existing lagoon is converted, ranging from a small portion sectioned off to the entire lagoon. For Brighton, it is anticipated that, with a 0.5 m water coverage and entire lagoon converted, the lagoon will have sufficient capacity to store and treat sludge for 15-20 years without desludging. Supernatant decanting mechanism should also be implemented to remove supernatant from lagoon to gain additional sludge storage.

There is a risk of freezing in the WAS stabilization pond due to the large lagoon surface area, intermittent WAS flow, and the shallow depth (lagoon depth is approximately 1.5m). Freezing will impact the pumping of WAS. Supplemental aeration can be implemented to prevent freezing around the inlet pipe. Supplemental aeration should also be installed throughout the lagoon to improve treatment efficiency and reduce odor impacts. The proposed supplemental aeration system allows the lagoon to be partially mixed. This still allows for anaerobic fermentation of the settled sludges at the bottom of the lagoon.

Upgrades will be required to convert the existing lagoon for WAS stabilization, including:

- Construct discharge piping from WAS pumping station to the lagoon.
- Disconnect from existing effluent chamber.
- If only a section of the lagoon is being converted, construct a berm to separate WAS pond from rest of the facultative lagoon.
- Implement supernatant collection, pumping or draining to liquid treatment process.
- Implement supplemental aeration

3.4.2 Option 2: Aerobic Digestion

In aerobic digestion, WAS is pumped into a tank or basin installed with aeration device to provide oxygen for microbial biomass to break down organic matter. By-products include water, carbon dioxide and more biomass. Aerobic digestion processes are typically designed to operate at an ambient temperature range. Aerobic digestion is common for WWTP the size of Brighton.

Upgrades required for aerobic digestion will typically include:

- Construct discharge piping from WAS pumping station to the lagoon
- Construction of new digester, complete with aeration, controls, and decanting mechanism.
- Optional construction of additional biosolids storage tank.

3.4.3 Option 3: Anaerobic Digestion

In anaerobic digestion, WAS is broken down by microorganisms in the absence of oxygen. The by-products include biomass, carbon dioxide and methane. The methane can be captured and used by on-site boilers for heating buildings or processes. Depending on the design of the process, anaerobic digestion would operate at temperatures ranging from 30°C to 60°C. Anaerobic digestion is common for larger wastewater treatment plants or where space is limited.

Upgrades required for anaerobic digestion will typically include.

- Construct discharge piping from WAS pumping station to the lagoon.
- Construction of new anaerobic digester, complete with controls, heat exchangers, mixing system, and biogas collection and treatment.
- Optional construction of additional biosolids storage tank.

3.4.4 Option 4: Lime Stabilization

This option consists of mixing lime, or other highly alkaline materials, with the sludge to reach and maintain a pH greater than 12. The mixture is constantly turned and held at this elevated pH until sludge is stabilized. Sometimes, quicklime is added to the mix, inducing a chemical reaction to raise the temperature of the sludge and further reduces pathogens. Due to the addition of material, Lime stabilization processes typically increase the volume of biosolids to be managed. This option is not typically used in Ontario municipal wastewater treatment plants for sludge stabilization.

3.5 Biosolids Management

3.5.1 Option 1: Haul Off-Site with No Onsite Storage

This option consists of removal of the treated biosolids from site without dewatering or any on-site storage. This option is sometimes coupled with aerobic or anaerobic digestion, where the tank is decanted once the sludge is stabilized.

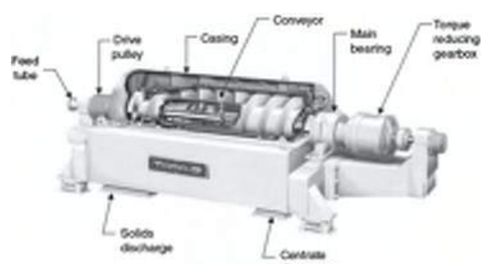
3.5.2 Option 2: Storage Lagoon

This option involves storage of biosolids in the existing facultative lagoon. The biosolids will naturally settle to the bottom of the lagoon and thicken. A solids concentration of 10% have been observed in stored sludge layer in similar facilities using lagoon to treat and store sludge. Once the lagoon fills to a certain level, the solids are dredged out and removed from site. Another Ontario WWTP with similar WAS storage lagoon (with a depth of 3m) undertake sludge dredging once every 20 years.

3.5.3 Option 3: Biosolids Dewatering

Dewatering biosolids removes water to reduce volume and thicken the biosolids. Solids concentrations of dewatered biosolids can range from 15% to over 40%, depending on the technology selected. Dewatering reduces the biosolids volume to transport off site. Typical technologies include the following:

Table 5: Biosolids Dewatering Technologies

Sludge Drying Bed	Lined concrete bed of sand and gravel. The biosolids are spread over the bed and allowed to dry. The liquid is either evaporated or seeps through the sand layer and collected in perforated underdrains. Typical performance produces a solids concentration of over 40%.	
Geotube® Dewatering	Engineered textile bags which are filled with the biosolids. The liquid (filtrate) seeps out through the textile, which is then collected and returned for treatment. The solids are kept in the bag until dry, and then hauled off-site. The used bag is disposed of and replaced with a new bag. Typical performance produces a solids concentration of over 40%. For all-season operation, a winterized enclosure would be required to prevent freezing while filling.	 (Example of Geotube® setup with winterization enclosure)
Mechanical Dewatering (Centrifuge)	Centrifuge dewatering typically consists of a bowl which is fed with sludge. The high centrifugal force caused by the rapid rotation of the bowl causes the solids to collect and thicken on the wall of the bowl. The thickened solids are directed towards the outlet by a conveyor screw. The liquid (centrate) overflows an outlet weir plate and is returned for treatment. Typical performance produces a solids concentration of 15-30%.	 (Example of Centrifuge)

3.6 Summary of Options

Figure 5 below is a summary of the identified sludge treatment and solids management options. The preferred alternative will be a combination from each group of options.

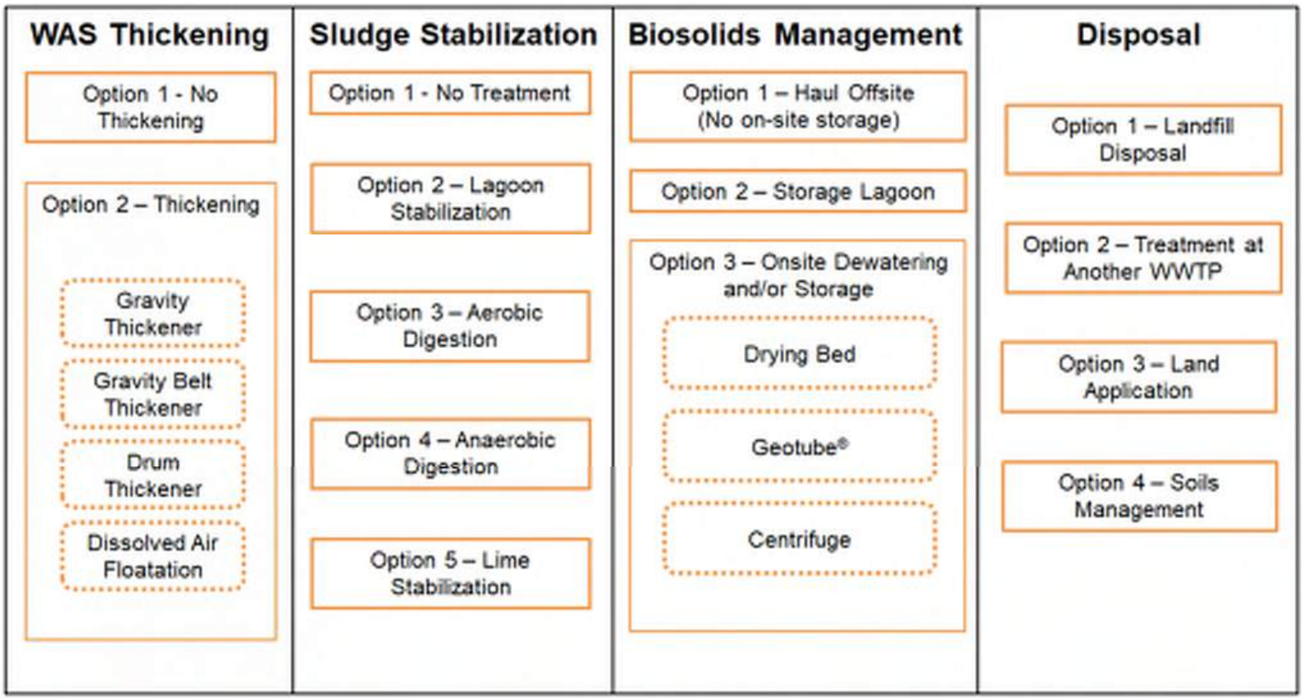


Figure 5: Summary of Sludge Treatment and Solids Management Options

4.0 Evaluation and Selection of the Preferred Sludge Treatment and Biosolids Management Alternatives

4.1 Evaluation and Selection Methodology

In order to facilitate the evaluation and selection of the preferred solutions, a transparent and logical five-part assessment process was established. This process included:

- Initial identification of options.
- Workshop hosted with Municipality to review and pre-screen options.
- Establishment of feasible sludge treatment and solids management alternative solutions based on short-listed options.
- Detailed evaluation of sludge treatment and solids management alternative solutions; and
- Selection of a preferred sludge treatment and solids management solution.

The first evaluation stage considers the overall feasibility of the potential options. This step ensures that unrealistic options are not carried forward to a more detailed evaluation stage.

Based on the initial screening, a detailed assessment of the short list of alternatives is conducted. Evaluation criteria were developed based on a review of the background information, experience on similar assessments and in consultation with Township staff. The evaluation was conducted using criterion in the following four major criteria categories:

Table 6: Summary of Evaluation Criteria

Criteria	Description
Natural Environment Considerations	Natural features, natural heritage areas, Areas of Natural and Significant Interest, designated natural areas, watercourses and aquatic habitat
Social and Cultural Environment Considerations	Proximity of facilities to residential, commercial and institutions, archeological and cultural features, designated heritage features, wellhead protection areas, land-use and planning designations
Technical Feasibility	Constructability, maintaining or enhancing water quality, reliability and security of wastewater collection system, ease of connection to existing infrastructure and operation and maintenance requirements, addresses aging infrastructure, expandability
Financial Considerations	Capital costs, Operation and Maintenance costs

Each criterion was assigned a colour to reflect its level of impact relative to other criteria. The relative level of impact for each criterion for each potential solution was then assessed based on the colour weighting system summarized in Table 7. The alternative solution that has the least negative impact or has the strongest positive impact is typically recommended as the preferred solution and presented to stakeholders to solicit input before finalizing. The evaluation criteria were assigned equal weights as they were considered to have equal importance in this evaluation at the EA stage.

Table 7: Detailed Evaluation Impact Level and Colouring System

Impact Level	Colour	Relative Impact
Strong Positive Impact	Green	Preferred
Minor Impact	Yellow	Less Preferred
Strong Negative Impact	Red	Least Preferred

The OPC for each alternative solution were based on a Class 'D' estimate, generally defined as follows:

- Work Definition: A description of the intended solutions with such supporting documentation as is available.
- Intended Purpose: To aid in the screening of various servicing solutions prior to recommending a preferred solution (not intended to establish or confirm budgets).
- Opinion of Probable Cost: Completed using 2022 dollar value. An OPC with a Class 'D' (Indicative Estimate) level of accuracy was developed for each alternative solution and includes allowances for design elements that have not fully been developed. Class 'D' OPCs developed for this assignment are expected to be within +/- 30%. The OPCs were developed based on past experience on similar projects, professional judgment, and equipment costs provided by suppliers. Design completed as part of this Class EA is conceptual in nature for the purpose of obtaining Class 'D' cost estimates. All design parameters should be confirmed during detailed design. Any provided estimate of costs or budget is an OPC that is based on historic construction data and does not include labour, material, equipment, manufacturing, supply, transportation or any other cost impacts in relation to COVID-19. JLR shall not be responsible for any variation in the estimate caused by the foregoing factors but will notify the Municipality of any conditions which JLR believes may cause such variation upon delivery of the estimate.

4.2 Review Workshop and Pre-Screening of Options

On August 18, 2022, a workshop with the Municipality and their operators was led by JLR for the review and initial screening of the sludge treatment and solids management options. The intent of the meeting was to engage the Municipality at the onset of this TM, to provide an overview of the available sludge treatment and solids management options, to walk through possible combinations of the options, and to eliminate unfeasible or undesirable options, such that the detailed evaluation of the alternatives can be focused. Refer to Appendix B for the presentation and meeting minutes.

The following tables provide rationales and the decisions made at the August 18 workshop for the short-listed options to be carried forward into the detailed evaluation.

Table 8: Sludge/Biosolids Disposal Initial Screening

Option 1: Landfill	Review: This option is a feasible method of disposal for sludge and biosolids. However, it is understood that the landfilling sewage treatment waste is generally discouraged by the MECP due to the limited space at existing sites and that the beneficial reuse is more desirable. The Municipality also expressed interest in the beneficial reuse of the sludge and biosolids. Recommendation: Do not carry forward
Option 2: Treatment at another WWTP	Review: This option is a feasible method of disposal for sludge and biosolids. The handling and transportation costs would be high, due to the frequency of haulage from site and the potential long travel distance to a large treatment facility with sufficient capacity to receive the additional sludge. The Municipality was not interested in this option. Recommendation: Do not carry forward
Option 3: Land Application	Review: This option is a feasible method of disposal for sludge and biosolids. The beneficial use for the wasted sludge is desirable for the Municipality. Recommendation: Carry Forward
Option 4: Soils Management	Review: Additional permitting and site upgrades are required for soil storage and stormwater/leachate management. Additional labour and equipment required to store, handle and mix soils. In addition, waste soils/biosolids may not be beneficial for reuse and must be transported to landfill for disposal. Recommendation: Do not carry forward

Table 9: WAS Thickening Initial Screening

Option 1: No Thickening	Review: This is a viable option, depending on the sludge treatment technology selected. Recommendation: Carry Forward
Option 2: Sludge Thickening	Review: Thickening is beneficial. Any of the technologies previously listed are considered effective and reliable options for sludge thickening. Recommendation: Carry Forward

Table 10: Sludge Stabilization Initial Screening

Option 1: Lagoon Stabilization	Review: This option is a commonly used technology, especially for facultative lagoons converting to a mechanical wastewater treatment plant. This option is highly effective at stabilizing sludge using the lagoon that is no longer needed. Recommendation: Carry Forward
Option 2: Aerobic Digestion	Review: This option is a commonly used technology and is highly effective at stabilizing sludge. This technology is also suitable for smaller sized treatment plants. Recommendation: Carry Forward
Option 3: Anaerobic Digestion	Review: This option is a commonly used technology and is highly effective at stabilizing sludge. However, this option is better suited for larger treatment facilities or treatment plants with limited expansion space. Anaerobic digestion also has a larger capital cost than aerobic digestion. Recommendation: Do not carry forward
Option 4: Lime Stabilization	Review: This option is not common practice in Ontario municipal wastewater treatment plants. While effective at stabilizing sludge, it typically produces a higher volume of biomass than digestion which must be managed. The option also releases off-gases such as ammonia, which must also be managed. Recommendation: Do not carry forward

Table 11: Biosolids Management Initial Screening

Option 1: Haul Offsite	Review: This option is a viable method to manage biosolids. Recommendation: Carry Forward
Option 2: Storage Lagoon	Review: This option is a common and effective method for storing biosolids, especially when an existing lagoon can be utilized. Recommendation: Carry Forward
Option 3a: Sludge Drying Bed	Review: This option is an effective and reliable technology for dewatering biosolids. However, sludge drying beds require a large footprint and are labour intensive to manage. Recommendation: Do not carry forward
Option 3b: Geotube® Dewatering	Review: This option is an effective and reliable technology for dewatering biosolids. Recommendation: Carry Forward
Option 3c: Centrifuge Dewatering with Storage	Review: This option is an effective and reliable technology for dewatering biosolids, however it has a high capital and operating cost, and is more suited for larger treatment plants. Recommendation: Do not carry forward

4.3 Identification of Combined Pre-screened Options for Evaluation

Individual screened options cannot be evaluated separately because they are influenced by the other. The sludge treatment and solids management alternative solutions for detailed evaluation are formed as combinations of the screened options. Factors to the selected alternative solutions include the following:

- Reuse of existing infrastructure
- Available site area
- Size of plant / economy of scale
- Feasibility in combination with the other options

Table 12 shows the selected alternative solutions for detailed evaluation.

Table 12: Summary of Sludge Treatment and Biosolids Management Alternative Solutions

Alternative Solution No.	Screened Options Selected
1a: Lagoon Stabilization/Storage with Supplemental Aeration	• No thickening (WAS Thickening Option 1) • Lagoon Stabilization (Sludge Stabilization Option 2) • Lagoon Storage (Biosolids Management Option 2), with periodic clean-out. • Land Application (Disposal Option 3)
1b: Lagoon Stabilization with Supplemental Aeration and Periodic Geotube® Dewatering	• No thickening (WAS Thickening Option 1) • Lagoon Stabilization (Sludge Stabilization Option 2). • Geotube® Dewatering (Biosolids Management Option 3b) used for periodic lagoon cleanout to reduce hauled volume. A concrete pad with drainage is required for Geotube® placement. • Land Application (Disposal Option 3)
2a: Aerobic Digestion	• No thickening (WAS Thickening Option 1) • Aerobic Digestion (Sludge Stabilization Option 3) • Haul Biosolids Offsite (Biosolids Management Option 1) • Land Application (Disposal Option 3)
2b: Aerobic Digestion with Year-Round Geotube® Dewatering	• No thickening (WAS Thickening Option 1) • Aerobic Digestion (Sludge Stabilization Option 3) • Geotube® Dewatering (Biosolids Management Option 3b) for year-round operation to reduce hauled volume. A Geotube® enclosure building is necessary for winter operation • Land Application (Disposal Option 3)

WAS Thickening Option 2 did not form a part of the alternative solutions, as the stabilization technologies selected for this size of project do not require pre-thickening of sludge to operate effectively.

4.4 Detailed Evaluation of Sludge Treatment and Biosolids Management Alternatives

The Table below summarizes the capital and annual operating probable costs of the selected alternative solutions.

Table 13: Summary of Opinion of Probable Cost and Annual Operating Costs for Alternative Solutions

Alternative Solution No.	OPC (1) (2)	Estimated Annual Operating Cost (3)
1a: Lagoon Stabilization/Storage with Supplemental Aeration	$2,200,000	$130,000 (4)
1b: Lagoon Stabilization with Supplemental Aeration and Periodic Geotube® Dewatering	$2,500,000	$120,000 (5)
2: Aerobic Digestion	$8,700,000	$140,000 (6)
2a: Aerobic Digestion with Year-Round Geotube®	$11,400,000	$120,000 (7)

Notes:
1) All OPCs exclude HST.
2) Capital OPCs include costs for installation, contractor markup (20%), contingency (25%), and engineering costs (15%).
3) Estimated annual operation cost does not include operator hours spent onsite. It is assumed that an operator will always be stationed at the site. As such, there is no additional operating cost associated with operator salary.
4) Operating cost includes sludge dredging and removal (assume removal every 5 years), hydro cost to run supplemental aeration.
5) Operating cost includes sludge dredging and removal (assume removal every 5 years), hydro cost to run supplemental aeration, new Geotubes every 5 years.
6) Operating cost includes hydro cost to run blowers, biosolids hauling and disposal once every 2 months.
7) Operating cost includes hydro cost to run blowers, new Geotubes, polymer cost, building cost for winterized enclosure and biosolids disposal.

Table 14 summarizes the detailed evaluation of the sludge treatment alternatives.

Table 14: Detailed Evaluation of Sludge Treatment Alternative Solutions

	Solution 1a: Lagoon Stabilization/Storage with Supplemental Aeration	Solution 1b: Lagoon Stabilization with Supplemental Aeration and Periodic Geotube® Dewatering	Solution 2a: Aerobic Digestion	Solution 2b: Aerobic Digestion with Year-round Geotube® Dewatering
Natural Environment	• Utilizes existing lagoon with modifications • Requires least amount of construction	• Utilizes existing lagoon with modifications • Requires new construction footprint for Geotube pad	• Requires new construction footprint	• Requires largest construction footprint for digester and Geotube pads and winterized enclosure.
Evaluation	**Preferred**	**Less Preferred**	**Less Preferred**	**Least Preferred**
Social and Cultural Environment	• Less odours if water cover is maintained • Beneficial reuse of biosolids	• Less odours if water cover is maintained • Beneficial reuse of biosolids	• Less odours generated • Beneficial reuse of biosolids	• Less odours generated • Beneficial reuse of biosolids
Evaluation	**Preferred**	**Preferred**	**Preferred**	**Preferred**
Technical Feasibility	• Lagoon may be susceptible to freezing • Lagoon stabilization requires less involved operation and maintenance • Very high storage capacity, less frequent biosolids removal	• Lagoon may be susceptible to freezing • Lagoon Stabilization requires less involved operation and maintenance • Geotubes produce a drier and lower volume biosolids • Very high storage capacity, less frequent biosolids removal	• More controlled and faster stabilization • Additional storage required for biosolids. • Frequent hauling of biosolids from site • Aerobic Digestion typically requires more involved operation and maintenance	• More controlled and faster stabilization • Additional storage required for biosolids • Aerobic Digestion typically requires more involved operation and maintenance • Geotubes produce a drier and lower volume biosolids
Evaluation	**Less Preferred**	**Preferred**	**Least Preferred**	**Less Preferred**
Financial Considerations	• Least Capital Cost • Comparable operation costs • Slightly lower 20-year lifecycle cost as Solution 1b	• Slightly higher capital cost compared to Solution 1a • Comparable operation costs • Slightly higher 20-year lifecycle cost as Solution 1a	• High Capital Costs • Comparable operation costs	• Highest Capital Costs • Comparable operation costs
Evaluation	**Preferred**	**Preferred**	**Less Preferred**	**Least Preferred**
Overall Evaluation	**Preferred**	**Preferred**	**Less Preferred**	**Least Preferred**

4.5 Summary of Evaluation and Preferred Solution

The preferred sludge treatment and solids management solutions from the detailed evaluation are summarized below:

1a: Lagoon Stabilization/Storage with Supplemental Aeration	• No thickening. • Lagoon Stabilization. • Lagoon Storage with periodic clean-out. • Land Application.
1b: Lagoon Stabilization with Supplemental Aeration and Periodic Geotube® Dewatering	• No thickening. • Lagoon Stabilization. • Geotube® Dewatering used for periodic lagoon cleanout to reduce hauled volume. A concrete pad with drainage is required for Geotube® placement. • Land Application.

5.0 Conceptual Design

5.1 Description

The sludge treatment and solids management upgrades will consist of the following:

- Modification of existing facultative lagoon to a WAS stabilization/storage lagoon. Recommended modifications will include the following:
  - Disconnect existing facultative lagoon effluent chamber to disconnect the new WAS stabilization/storage lagoon from plant effluent.
  - New shoreline chamber for supernatant collection and return to liquid treatment process.
  - Installation of supplemental aeration in the WAS stabilization/storage lagoon to mitigate freezing risks and odor impacts.
- Monitoring of sludge level and progression of stabilization. The biosolids in the lagoon will be cleaned out for land application.

5.2 Opinion of Probable Costs

The following table is a summary of the conceptual OPC of the preferred options.

Table 15: OPC Summary of Preferred Sludge Treatment and Solids Management Solutions

Item	Solution 1a: Lagoon Stabilization/Storage with Supplemental Aeration (1)	Solution 1b: Lagoon Stabilization with Supplemental Aeration and Periodic Geotube® Dewatering (1)
Lagoon Modifications	$1,500,000	$1,500,000
Geotube® summer pad	n/a	$240,000
Subtotal (2)	1,500,000	$1,740,000
Contingency (~25%)	$ 400,000	$ 435,000
Subtotal	$1,900,000	$2,175,000
Engineering (~15%)	$ 300,000	$ 330,000
Total (Incl. Engineering, Contingency, Contractor Fees, Excl. HST)	**$2,200,000**	**$2,500,000**

Notes:
1) All OPCs exclude HST.
2) Capital OPCs include costs for installation, Contractor markup (~20%).

5.3 Design Considerations

The following considerations should be reviewed in detailed design:

- The size of the WAS stabilization/storage pond will depend on the Municipality's schedule for removal frequency. The recommendation is to have the entire lagoon available for WAS stabilization and storage.
- For Brighton, it is anticipated that, with a 0.5 m water coverage and entire lagoon converted, the lagoon will have sufficient capacity to store and treat sludge for 10-20 years without desludging. Supernatant decanting mechanism should be implemented to remove supernatant from lagoon to gain additional sludge storage. The extended sludge storage period will ensure proper digestion and stabilization of the WAS. In addition, the calculated storage period exceeds the minimum of 240 days storage requirements under *O.Reg.* 267/03 under the Nutrient Management Act.
- Location and type of the supplementary aeration system should be reviewed and designed accordingly. The primary intent of the supplementary aeration is to provide some aeration to the sludge to reduce odor and prevent freezing. Subsequently, aeration can speed up the digestion process and improve treatment.
- The supernatant draining structure will need to be located and reviewed with the location and hydraulics of the headworks facility. The supernatant decanting operation should occur periodically and the water level should be monitored to ensure sufficient water coverage over the sludge layer.

- Odour from the WAS stabilization lagoon should be monitored. It is not anticipated that the odour is an issue with the proposed supplemental aeration.

6.0 References

- R.V. Anderson Associates Ltd., Brighton WPCP Proposed Upgrade Technical Review, 2022.
- Water Environment Federation, Design of Water Resource Recovery Facilities, Manual of Practice No. 8, Sixth Edition, 2017.
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- Metcalf & Eddy Inc., Wastewater Engineering Treatment and Reuse, Fourth Edition, 2003.
- US EPA, Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers and Managers, 2011.

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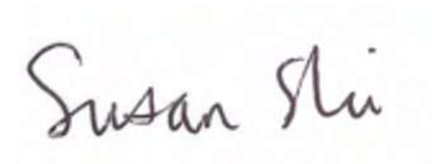
J.L. RICHARDS & ASSOCIATES LIMITED

Prepared by:

Matthew Marcuccio, P.Eng.
Civil Engineer

Reviewed by:



Susan Jingmiao Shi, P.Eng., M.Eng.
Senior Environmental Engineer

Appendix A

Brighton Lagoon Conceptual Design (GSS, 2021) and

Brighton WPCP Proposed Upgrade Technical Review (RVA, 2022)

June 15, 2021

Project # 15-017

Preston Parkinson
Municipality of Brighton
35 Alice Street, P.O. Box 189
Brighton, ON K0K 1H0

Re: Brighton WWTP
Aeration System Upgrades with Option to Expand Capacity

Dear Mr. Parkinson:

As required by MECP, an upgrade to the Brighton WWTP is required to improve treatment of ammonia. An aeration upgrade would also support additional growth in Brighton.

Our original submission of April 13, 2021 provided an outline of the Triplepoint proposal to upgrade aeration in the aerated cell component of the WWTP. This proposal would provide significantly more oxygen as well as full solids mixing in the aerated cell. The proposal includes the following:

1) Remove the existing catwalks, original mechanical mixers and the floating aerators in the aerated cell. The total existing horsepower of the existing mechanical and floating aerators is only 110 horsepower.

2) Installation of the new Triplepoint, shore based blowers (on the west side of the cell) would provide the air supply to the new, submerged aeration units. The aeration units would be distributed over the entire floor area of the aerated cell. Operating horsepower of the new blowers would be 300 hp.

3) Potential new secondary clarifier located at the south end of the aerated cell. The clarifier would separate the biological solids from the cell effluent flow and return the concentrated solids back to the inlet (north) end of the aerated cell.

This proposal does not require screening or grit removal of the raw sewage as the aeration units on the bottom of the aerated cell have no moving parts. As you are aware, we have received a preliminary sizing and design proposal from Triplepoint Environmental who specialize in sewage lagoon aeration projects including cold climate installations. Triplepoint is represented in Ontario by ACG Envirocan, who are a recognized supplier of wastewater treatment equipment in Ontario.

The Triplepoint proposal is included in **Appendix A**. Key features are summarized as follows:

i) Three, 150 hp blowers (2 operating and 1 standby). These blowers would be housed within acoustically treated, weatherproof enclosures. The blowers would be VFD controlled to provide operator flexibility. Total air flow with two blowers running at 100% speed would be approximately 5,050 cubic feet per minute (cfm) and provide approximately 3,900 kg of dissolved oxygen per day to the aerated cell.

ii) The air flow would be delivered evenly to 100 aeration units located on the bottom of the cell. Air flow per aeration unit would therefore be approximately 50.5 cfm per unit. Triplepoint has advised that each unit is designed to run efficiently over an airflow range of 25 to 75 cfm per aeration unit.

iii) The blower sizing has been oversized to provide sufficient mixing of the cell to maintain biological solids in suspension, compared to oxygen supply requirements (i.e. mixing dominates).

iv) At the current rated capacity of the WWTP (4,600 m^3/day), the raw sewage BOD load is estimated to be 900 kg/day and the raw sewage TKN load is estimated to be 275 kg/day.

v) The theoretical oxygen requirement for full removal of BOD and TKN is 1,350 kg/day for BOD removal and 1,270 kg/day for TKN removal. These values are based on 1.5 kg of oxygen per kg of BOD and 4.6 kg of oxygen per kg of TKN. Total oxygen required is therefore approximately 2,620 kg/day for the current, rated capacity of 4,600 m^3/day.

vi) As above, the air flow of 5,050 cfm provides a daily oxygen supply of 3,900 kg/day, or approximately 50% more oxygen than theoretically required for the current design flow of 4,600 m^3/day.

As you are aware, we have recently discussed possible, major residential developments in Brighton. Preliminary calculations of uncommitted, remaining treatment capacity would indicate that it is likely that a rated increase in sewage treatment capacity will be required at some point for Brighton.

Exactly when such an increase in rated capacity is required is difficult to predict. However, it would be reasonable to review the Triplepoint proposal to ensure that such an aeration upgrade (including provision of the secondary clarifier) is suitably sized for an increase in rated capacity.

While preliminary, we suggest the future, rated capacity of the WWTP be estimated as 6,000 m^3/day. This provides a 30% increase over the current rated capacity of 4,600 m^3/day. We note that current, average sewage flows are approximately 3,000 to 3,300 m^3/day. This 30% capacity increase (providing an additional 1,400 m^3/day treatment capacity) would allow connection of at least another 1,000 residential units.

Table 1 below provides a side by side comparison of the Triplepoint aeration system for the current capacity (4,600 m³/day) and the possible, future rated capacity (6,000 m³/day).

TABLE 1

Summary of Flow and Oxygen Demand
Current Rated Capacity and Potential, Future Rated Capacity

Operating Parameter	Current Capacity	Future Capacity
Design Flow Rate	4,600 m³/day	6,000 m³/day
Aeration Cell Volume	± 14,300 m³	± 14,300 m³/day
Air Flow Proposed (Triplepoint)	5,050 cfm	5,050 cfm
Oxygen Provided	3,900 kg/d	3,900 kg/d
BOD Load (at 195 mg/l)	± 900 kg/d	± 1,200 kg/d
BOD Oxygen demand (at 1.5 times BOD load)	± 1,350 kg/d	± 1,800 kg/d
TKN load (at 60 mg/l)	± 275 kg/d	± 360 kg/d
TKN Oxygen demand (at 4.6 times TKN load)	± 1,270 kg/d	± 1,660 kg/d
Total Oxygen demand	± 2,620 kg/d	±3,460 kg/d

As per **Table 1**, the Triplepoint aeration system appears to provide sufficient oxygen to satisfy the future BOD and TKN oxygen demands associated with a rated capacity of 6,000 m³/day. As per **Table 1**, the estimated, future oxygen demand is 3,460 kg/day. This compares with the Triplepoint oxygen supply estimate of 3,900 kg/day.

The surplus supply of oxygen is not surprising given total air flow from the blowers has been sized to provide a complete mix of solids in the aeration cell. This design approach therefore provides surplus oxygen supply for the current rated capacity and for the proposed, increased rated capacity of 6,000 m³/day.

We also provide a preliminary drawing set which details existing conditions, the proposed Triplepoint aeration system installation in the aerated cell, and installation of a secondary clarifier at the south end of the aerated cell.

The clarifier itself does not provide treatment of ammonia or any other pollutant. Rather, the sole function of the clarifier is to separate the biological solids from the effluent of the aerated cell and return these solids to the inlet of the aeration tankage. Maintaining high solids concentrations in the aeration cell is key to achieving ammonia removal.

In mechanical sewage plants, the secondary clarifiers also provide an important function to protect the quality of the secondary effluent. In those cases, the secondary clarifiers are designed to remove solids even at the maximum, peak flow rate. In the case of the Brighton WWTP, protection of secondary effluent quality is not nearly as critical as any biological solids (or other solids) escaping the secondary clarifier will settle out in the large, downstream stabilization lagoon.

The secondary clarifier is one option for removing the solids from the aerated cell. The other method would be to run the aerated cell similar to a Sequencing Batch Reactor system (SBR), which is now a commonly used activated sludge process that achieves aeration followed by quiescent settling, solids removal and decanting of secondary effluent all in a single tank. With the SBR approach, the decanting would be accomplished in Brighton manually (pulling stop logs from the outlet point of the aerated cell) or by way of an automatic decanter operating by PLC control. In either case, the blowers would first need to be turned off to allow the solids to settle before decanting occurs.

Particularly with the secondary clarifier option, rerouting of Arena Creek to the east and to the south east is required. With either option, however, relocation of the Arena Creek channel further east from the east side of the aerated cell is recommended to protect the east berm of the aerated cell from erosion during flood flows.

The secondary clarifier option also requires new inflow and effluent piping, sludge return pumping and piping, relocation of flow measurement facilities and a new location for addition of ferric chloride coagulant.

Process Objectives

The estimated oxygen requirement for effective treatment of BOD and ammonia in the aerated cell has been provided above in Table 1 for both the current rated capacity of 4,600 m^3/day and the proposed, potential rated capacity of 6,000 m^3/day.

Mixing of the aerated cell contents is considered more critical and dictates the size of the blowers. The volume of the aerated cell (included submerged side slope volumes) is approximately 14,300 m^3 at a normal water depth of 3 m. Total surface area of the cell is approximately 6,910 m^2 but the surface area of the cell overtop of the flat bottom area of the cell is approximately 3,600 m^2.

Total blower energy (two blowers running at 100% speed) is 300 hp (225 kW). Mixing energy is therefore 15.7 W per m^3 based on an aeration cell volume of 14,300 m^3 which essentially matches MECP design standards for even mixing of biological solids (MECP design parameters are 16 to 25 W per m^3 for mixing of biological solids).

The Triplepoint aeration unit design is a hybrid diffuser providing part coarse bubble and part fine bubble aeration.

The Triple Point air flow rate of 5,050 cfm (2,400 litres per second) represents an air flow rate of 0.17 l/s per m^3, which is less than the recommended coarse bubble mixing recommendation of 0.33 l/s per m^3 (as per MECP). However, based on an air flow of 2,400 l/s, the surface air flow rate for fine bubble mixing is 0.34 l/s per m^2 for the total area of the cell but is 0.66 l/s per m^2 for the smaller, flat bottom surface area. The latter aeration rate (0.66 l/s per m² of flat bottom area) exceeds the MECP design recommendation of 0.61 l/s per m² for fine bubble aeration mixing.

Overall, therefore, full mixing of MLSS should be accomplished. Oxygen delivery exceeds oxygen demand requirements by a significant margin indicating that daily oxygen requirements could be provided in say 16 hours of aeration per day, for the current design capacity of 4,600 m³/day, allowing say 8 hours or settle and decant time per day if the overall system is operated as an SBR process.

However, for a future capacity of 6,000 m³/day, there would less time available for decanting and the secondary clarifier is assumed required if the WWTP was rerated to 6,000 m³/day.

Rated Capacity Increase

If rerating the WWTP to 6,000 m³/day, the following would need to be considered:

i) A Schedule C Class EA would have to be completed

ii) As part of the Class EA process, MECP would very likely require more stringent effluent requirements for the increased capacity.

iii) The current effluent compliance values for BOD, Suspended Solids and Total Phosphorus are 30 mg/l, 40 mg/l and 1.0 mg/l, respectively. The values for BOD and Suspended Solids would likely be reduced to approximately 20 mg/l. The compliance limit for phosphorus might remain at 1.0 mg/l or be lowered slightly (i.e. 30%) such that total phosphorus loadings to Presquile Bay stayed the same as currently permitted.

iv) For ammonia, the current compliance limits are 14 mg/l for the summer and 17 mg/l. These would likely be significantly reduced. Likely, future ammonia limits would be approximately 2 mg/l for the summer and 4 mg/l for the winter.

v) Overall, the proposed aeration system upgrade and secondary clarifier should achieve the new, estimated compliance limits for an increased design flow of 6,000 m³/day.

Potential Clarifier

MECP design guidelines recommend maximum overflow rates of 40 m/day for secondary clarifiers for extended aeration plants providing nitrification. This rate is usually based on the worst case peak flow rate. In the case of Brighton however, it is our opinion that the clarifier can be downsized as:

i) Solids wasting in the Brighton system may be accomplished be discharge of the aeration cell mixed liquor to the downstream stabilization lagoon and;

ii) Protection of water quality downstream of the clarifier is not critical as the stabilization lagoon is downstream of the clarifier.

At most, peak flows in the Brighton WWTP have been measured under extreme events as approximately 18,000 m^3 per day with flows rarely exceeding 10,000 m^3 per day. For discussion, it is recommended the clarifier be sized for twice the potential, future rated capacity of the WWTP or 12,000 m^3/day (6,000 m^3/day x 2). Based on this design flow rate (12,000 m^3/day), the required area would be 300 m^2, or equal to a clarifier with a diameter of approximately 20 m (66' ø).

Sludge Management

All biological treatment systems continuously produce sludge. As such, surplus sludge management is required. In sewage lagoons, it is quite common for surplus sludge to build up on the bottom of the lagoons over time. One method to deal with such accumulated sludge in lagoon systems is to periodically dredge or remove sludge from the lagoon bottom with application of the sludge on approved farmland.

However, accumulated sludge can release ammonia back to the flow stream as it degrades. Such ammonia feedback from bottom sludges appears to occur periodically in the Brighton lagoon system.

As such, alternatives for proactive sludge management should be considered for Brighton. If the clarifier was provided, the following options would be available for active sludge management:

i) Discharge surplus sludge to the facultative lagoon from the sludge return line but recognize that very regular lagoon removal of sludge from the north end of the lagoon would be required. Sludge removal would be required at least once per year.

ii) Regular (i.e. weekly) discharge of surplus sludge from the sludge return line to the sludge drying beds at the north end of the aerated cell. The underdrains from the sludge drying beds drain to the inlet of the aerated cell such that any ammonia in the underdrains is retreated in the aerated cell. Covering of the sludge drying cells may be necessary for winter operation.

iii) Periodic (i.e. monthly) discharge of surplus sludge from the sludge return line to new sludge dewatering facilities (i.e. geotubes) located near the edge of the aerated cell. Proper location of the geotubes would be required to ensure drainage from the tubes flows back into the aerated cell for retreatment.

Preliminary System Drawing

Drawing 15017-03 provides an overall layout of the proposed new blowers, air delivery lines and the 100 submerged aeration units. As well, the secondary clarifier is shown as well as new feed and effluent piping from the clarifier, the sludge return line to the inlet of the aeration cell, the new coagulant dosing point and a new flow measurement facility.

Budget Pricing

- Supply of Triple Point ACG Air Diffuser package, three blowers and associated air lines - $850,000

- Additional Cost for Radial Blowers versus conventional PD type blowers and other system upgrades $200,000

- Install blowers and aeration equipment including VFD's - $400,000

- Upgrade 600 V, 3 phase power supply - $200,000

Subtotal - $1,650,000 plus 30 % contingencies and engineering = $2,150,000 plus net HST. Note that the cost of relocation of Arena Creek is not included.

If Secondary Clarifier system also included:

- Construct new 20 m ø secondary, concrete clarifier including scraper mechanisms etc. - $1,500,000
- New clarifier inflow and effluent piping, sludge pumping system and sludge return line, new coagulant feed, new Parshall flume, manholes, etc. - $800,000

Subtotal Cost of Secondary Clarifier Upgrade = $2,300,000 plus 30% contingencies and engineering = $3,000,000 plus net HST. Note that cost of relocation of Arena Creek is not included.

Total preliminary cost estimate of the aeration upgrade and the secondary clarifier is therefore approximately $5,150,000 plus net HST. The cost of relocation of Arena Creek is not included.

<u>Conclusion</u>

If the proposed upgrade concept was considered further, we recommend the following:

i) That this proposal be peer reviewed by an engineering firm fully experienced in advanced sewage plant process design to confirm that year round ammonia removal (nitrification) would be provided in the aeration cell. Such peer review to consider ammonia feedback from any sludge stored in the downstream facultative lagoon.

ii) That Brighton apply to MOECC for an ECA that approved firstly the aeration upgrade and secondly the clarifier upgrade. The objective would be to seek approval to install only the aeration system now but to install the secondary clarifier once an approval to increase the rated capacity to 6,000 m^3/day was achieved through the Class EA process.

iii) While the WWTP operates under the current rated capacity of 4,600 m^3/day, operate the aerated cell as an SBR (no clarifier) to retain solids within the aerated cell. If the SBR decanting mode does not prove successful in maintaining elevated solids levels in the aerated cell, complete installation of the secondary clarifier as Phase 2 of the overall upgrade project in advance of rerating the system to 6,000 m^3/day.

Sincerely,

GSS Engineering Consultants Ltd.

Jeff Graham, P. Eng.
Designated Consulting Engineer

JTG/nc

APPENDIX A

Triple Point Aeration Proposal

The contents of this Appendix was removed as it contained proprietary information from equipment suppliers. This information can be provided upon request with permission from the Suppliers.

CONTRACT 15017
MUNICIPALITY OF BRIGHTON WWTP
PROPOSED AERATION AND TREATMENT UPGRADES
JUNE 2021
(UPDATED JULY 2021)

N.T.S.

DRAWING INDEX	
DRAWING No.	DRAWING NAME
15017–01	TITLE SHEET AND INDEX
15017–02	AERATED CELL – EXISTING CONDITIONS
15017–03	AERATED CELL – NEW AERATION SYSTEM AND CLARIFIER

DD/MM/YY	DESCRIPTION
	REVISION / ISSUE

Seal not valid unless signed and dated

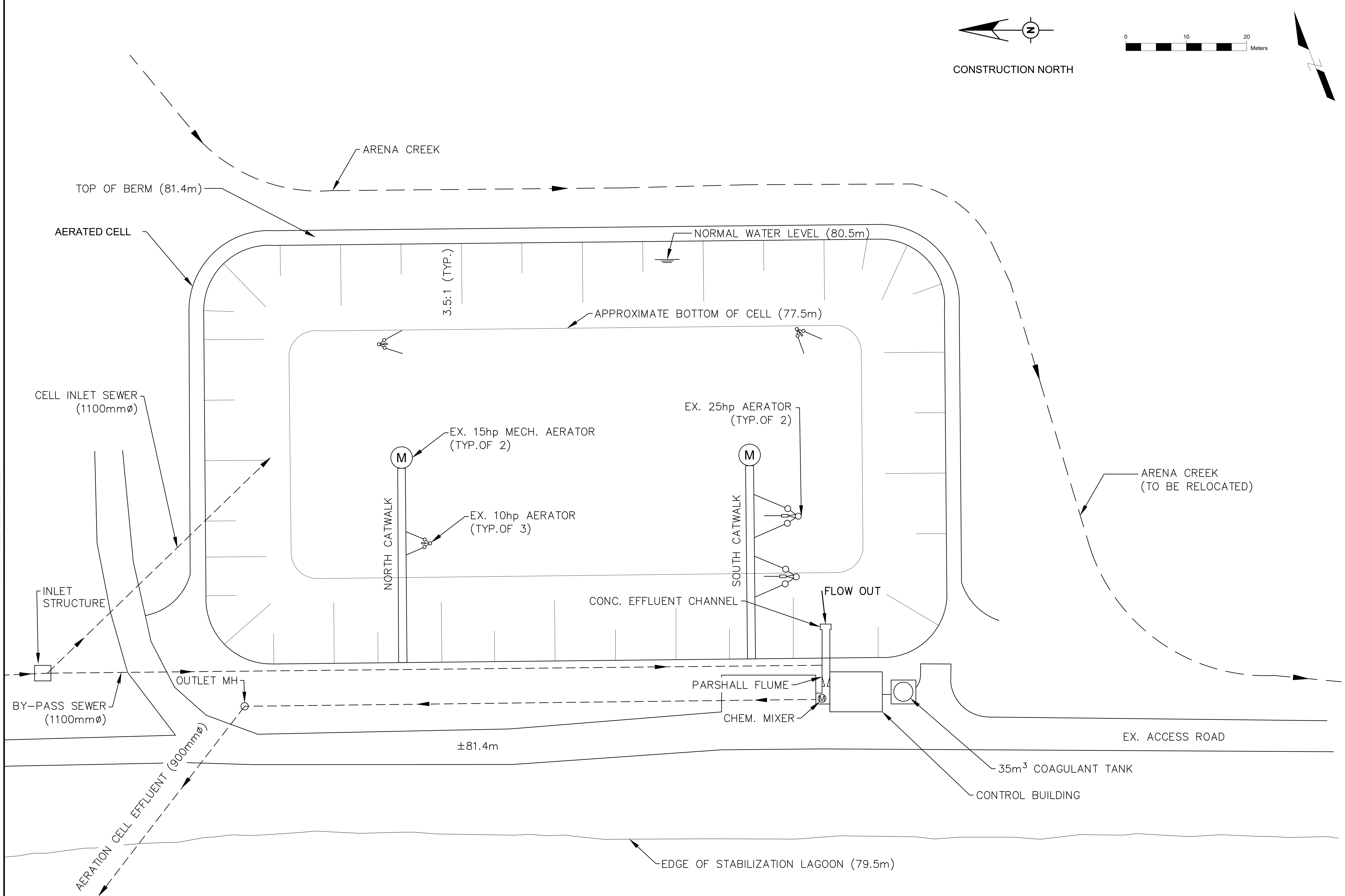
ENGINEERING CONSULTANTS LTD
Unit 104D 1010 9th Avenue West, Owen Sound, ON, N4K 5R7
Telephone: (519) 372–4828

Title:
TITLE SHEET AND INDEX
PROPOSED WWTP UPGRADES
BRIGHTON, ONTARIO

Client: MUNICIPALITY OF BRIGHTON

Design:	JTG	Scale:	NTS
Drawn:	MW	Approved:	Design Engineer
Checked:	JTG		
Date:	JUNE 2021		

Drawing No. 15017–01



KEY PLAN

CAUTION: THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS, PROPERTY LINES AND OTHER UNDERGROUND AND OVERGROUND UTILITIES ARE STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES, PROPERTY LINES & STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES, PROPERTY LINES & STRUCTURES, AND SHOULD ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

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REVISION / ISSUE	

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GSS ENGINEERING CONSULTANTS LTD

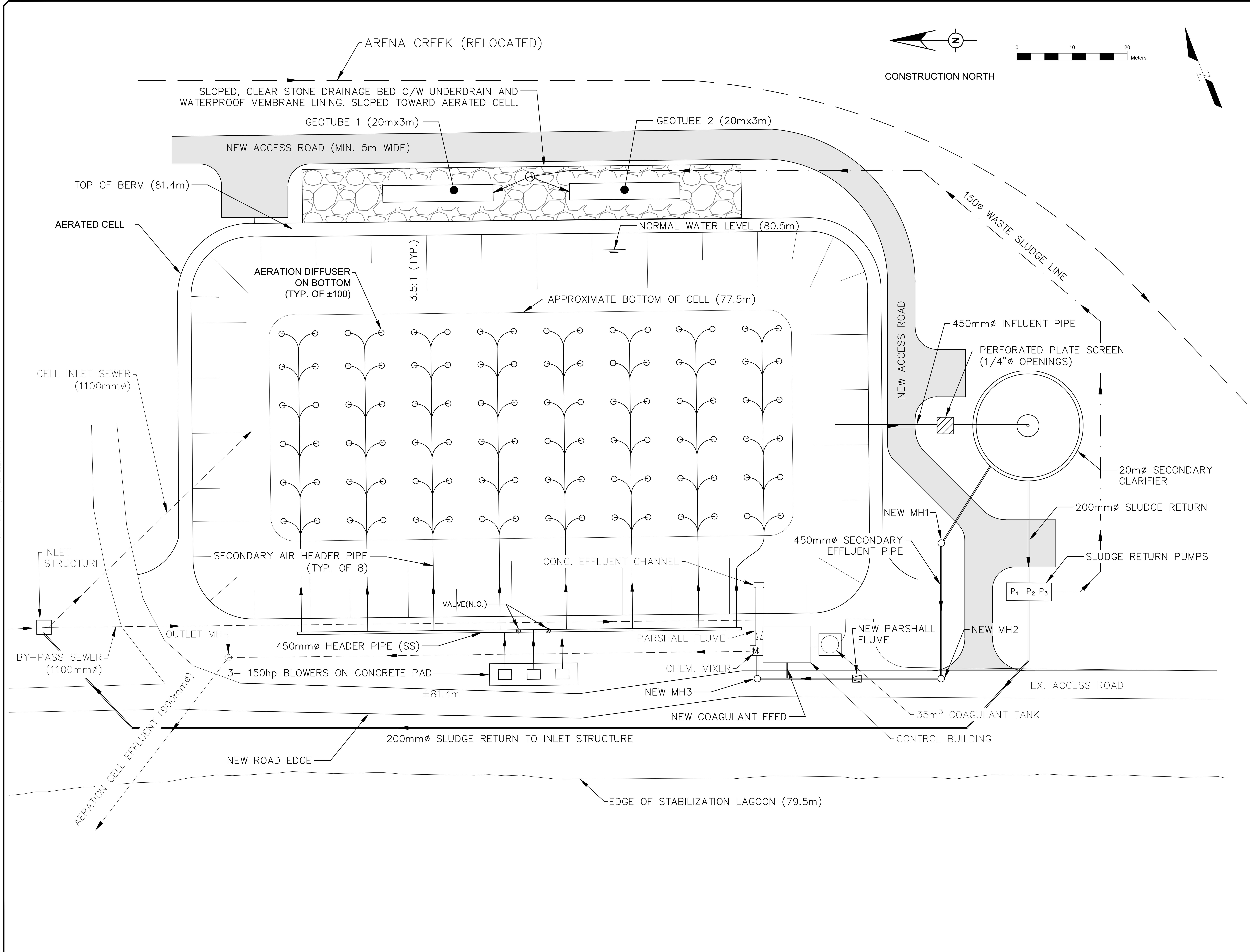
Unit 104D 1010 9th Avenue West, Owen Sound, ON, N4K 5R7
Telephone: (519) 372-4828

Title:
AERATED CELL
EXISTING CONDITIONS
PROPOSED WWTP UPGRADES

Client: MUNICIPALITY OF BRIGHTON

Design:	JTG	Scale:	1:300
Drawn:	MW	Approved:	Design Engineer
Checked:	JTG		
Date:	JUNE 2021		

Drawing No. 15017-02



KEY PLAN

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DD/MM/YY	DESCRIPTION
29/07/21	ADD WASTE SLUDGE LINE, SEWAGE SCREEN, GEOTUBES

REVISION / ISSUE

Seal not valid unless signed and dated

GSS ENGINEERING CONSULTANTS LTD
Unit 104D 1010 9th Avenue West, Owen Sound, ON, N4K 5R7
Telephone: (519) 372-4828

Title:
AERATED CELL NEW AERATION SYSTEM AND CLARIFIER PROPOSED WWTP UPGRADES

Client: MUNICIPALITY OF BRIGHTON

Design:	JTG	Scale:	1:300
Drawn:	MW	Approved:	Design Engineer
Checked:	JTG		
Date:	JUNE 2021		

Drawing No. 15-017-03

January 19, 2022 RVA 216011

35 Alice Street,
Brighton, Ontario K0K 1H0

Attention: Ms. Amy Russel, Environmental Services Manager, Municipality of Brighton, ON

Dear Ms. Russell:

Re: <u>Technical Review of the Brighton WWTP Upgrade</u>

Please find the enclosed Final Report for the referenced project.

Please contact the undersigned if you have any questions.

Yours very truly,

R.V. ANDERSON ASSOCIATES LIMITED

Harpreet Rai, Ph.D., P.Eng.
Project Manager

LICENSED PROFESSIONAL ENGINEER
H. S. RAI
100128863
RVA#216011
Jan 19,2022
PROVINCE OF ONTARIO

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Encls.

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Brighton WPCP Proposed Upgrade

Technical Review

Final

Municipality of Brighton

RVA 216011

January 19, 2022

Brighton WPCP Proposed Upgrade
Technical Review

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1.0 INTRODUCTION

The existing Brighton Wastewater Pollution Control Plant (WPCP) is a lagoon-based system. The WPCP is located at 100 County Road 64. Wastewater collected from the serviced area of the Municipality passes through four treatment components at the WPCP, in the order listed below:

1- A 0.68-hectare flow through Aerated Cell (Lagoon #1) with two stationary mixers with power ratings of 7.5 kW and 11.2 kW in the North section: and three floating aerators in the south section with power ratings of 18.6 kW, 18.6 kW and 11.2 kW.

2- A chemical mixing chamber where ferric chloride is added.

3- A 5.44-hectare facultative Waste Stabilization Pond (Lagoon #2) equipped with three floating baffles to improve flow distribution.

4- A two-celled Constructed Wetland having a total surface area of 6.2 hectares.

The influent passes through the flow-through aerated lagoon, followed by a facultative stabilization lagoon and a constructed wet land to polish the aerated lagoon effluent. The effluent from the constructed wetland is discharged continuously into a provincially significant natural wetland that borders Presqu’ile Bay, which is located off the northeast shore of Lake Ontario. The WPCP is currently operating at 72% of its rated capacity of 4,600 m^3/d. The effluent from the waste stabilization pond has been exceeding the seasonal compliance limits for Total Ammonia Nitrogen (TAN) limits stated in the Plant Environmental Compliance Approval (ECA).

1.1 Project Background

In December 2018, JL Richards Consulting Engineers (JL) completed a Schedule B Class EA to review alternatives to upgrade the Brighton WPCP to lower levels of total ammonia nitrogen (TAN) in the treated effluent to ensure compliance with the Brighton ECA. The Class EA report identified six general alternatives that JL identified as potential, feasible alternatives. One of these (Option 3E) was a fixed film, biological process at the downstream end of the lagoon system. This process (the MBBR) was selected as the recommended preferred solution and was the basis for the MBBR project that was tendered in the fall of 2020.

However, the quoted prices of “Brighton WPCP-MBBR Addition” Tender were much higher than the originally estimated budget by JL and the Municipality is now reviewing another feasible alternative.

In June 2021, GSS Engineering, acting as owner's engineer in the Class EA process, reviewed a proposal submitted by Triplepoint™ to upgrade aeration in the aerated cell component of Brighton WPCP. GSS found the Triplepoint's proposed aeration system appears to provide sufficient oxygen to satisfy the future BOD and TKN oxygen demands associated with both the current and anticipated future rated capacities of 4,600 m^3/d and of 6,000 m^3/d respectively. GSS suggested to build a new secondary clarifier to separate the biological solids from the cell effluent flow and return the concentrated solids back to the inlet of the aerated cell. GSS also suggested that the system does not require screening or grit removal for the raw sewage as the aeration units have no moving parts. However, the proposed upgrade includes a screen downstream of the aerated cell to protect the moving equipment in the secondary clarifier.

Further to that the Municipality retained R.V. Anderson Associates Limited (RVA) to conduct a technical review of the proposed upgrade of the Brighton WPCP to address the ongoing issue of non-compliance with the plant's effluent ammonia limits. The objective of this Technical Review is to review the conceptual design of the proposed upgrade regarding the validity of the concepts used in preliminary design, process sizing, and the technical viability of the concept to meet the treatment objectives, as presented in the memo entitled – Brighton WPCP Aeration System Upgrades with Option to Expand Capacity, Dated June 15, 2021– by GSS Engineering Consultants Limited.

It should be noted that the review is limited to the conceptual viability of the proposed upgrade and does not include a review of the process mechanical design and/or installation details of the proposed upgrades and/or equipment. For instance, design information pertaining to the installation of blowers, electrical and control systems, piping design, and all associated installation details have not been reviewed.

2.0 EXISTING TREATMENT PROCESS

The existing WPCP is a lagoon-based system with an aerated lagoon followed by a larger waste-stabilization facultative lagoon for sludge storage and polishing of the aerated lagoon effluent. The raw sewage enters the aerated cell on the northwest end and the mixed liquor comprising treated effluent and bacterial biomass exits on the southeast corner. The mixed liquor from aerated cell enters the facultative lagoon at its northwest corner. The aerated lagoon has a total volume of 14,300 m^3 and has five (5) mechanical aerators (2x18.6 kW, 2x11.5 kW and one 7.5 kW). The volume of the aerated lagoon corresponds to a Hydraulic Retention Time (HRT) of 4.3 d at current average flow of 3,317 m^3/d and 3.1 d at design flow of 4,600 m^3/d. Since it is a flow-through aerated lagoon with no recycle of the active sludge back to the lagoon, the Solids Retention Time (SRT) in the aerated cell equals the HRT.

The mixed liquor from the aerated lagoon enters the polishing lagoon at its Northwest corner and flows through four (4) compartments in the polishing lagoon created by using partitioning curtains, with an objective to prevent hydraulic short circuiting and maximizing effective use of the lagoon volume. Prior to the mixed liquor entry in the polishing lagoon, ferric chloride is added to the mixed liquor to remove phosphorus. The precipitated phosphorus along with the biomass in the mixed liquor settles in the polishing lagoon, and the treated effluent from aerated lagoon gets additional treatment via natural physical and biological activity in the polishing lagoon. The effluent from this lagoon flows into a constructed wetland located east of the lagoon. The design intent of the constructed wetland was to provide further polishing of the effluent via removal of organics and nutrients contained in the polishing lagoon effluent. While it does provide some degree of polishing to the lagoon effluent, the treatment provided is non consistent and therefore can not be relied upon to meet effluent objectives. The constructed wetland effluent flow finally discharges into a natural wetland that borders Presqu'ile Bay of Lake Ontario. Figure 2.1 shows the process schematic of the WPCP.

The rated capacity of the WPCP is 4,600 m^3/d, with discharge compliance limits for $cBOD_5$, TSS, TAN and TP, of 30 mg/L, 40 mg/L, 14/17 mg/L (summer/winter) and 1.0 mg/L respectively, and the corresponding objectives of 15 mg/L, 15 mg/L, 10/15 mg/L (summer/winter), and 0.8 mg/L respectively. Also, it is important to note that the compliance limits and objectives are applicable on the stabilization lagoon effluent and not the constructed wetland per the current ECA (# 6166-AJJTGW, dated: March 20, 2017) given the unreliability of the latter to provide consistent treatment.

The WPCP has never had any exceedance issues with $cBOD_5$, TSS and TP. However, there have been recurring events of TAN exceedance over the past several years. In addition, frequent exceedances of TSS objectives and E-Coli limits/objectives have been observed over the last four (4) years.

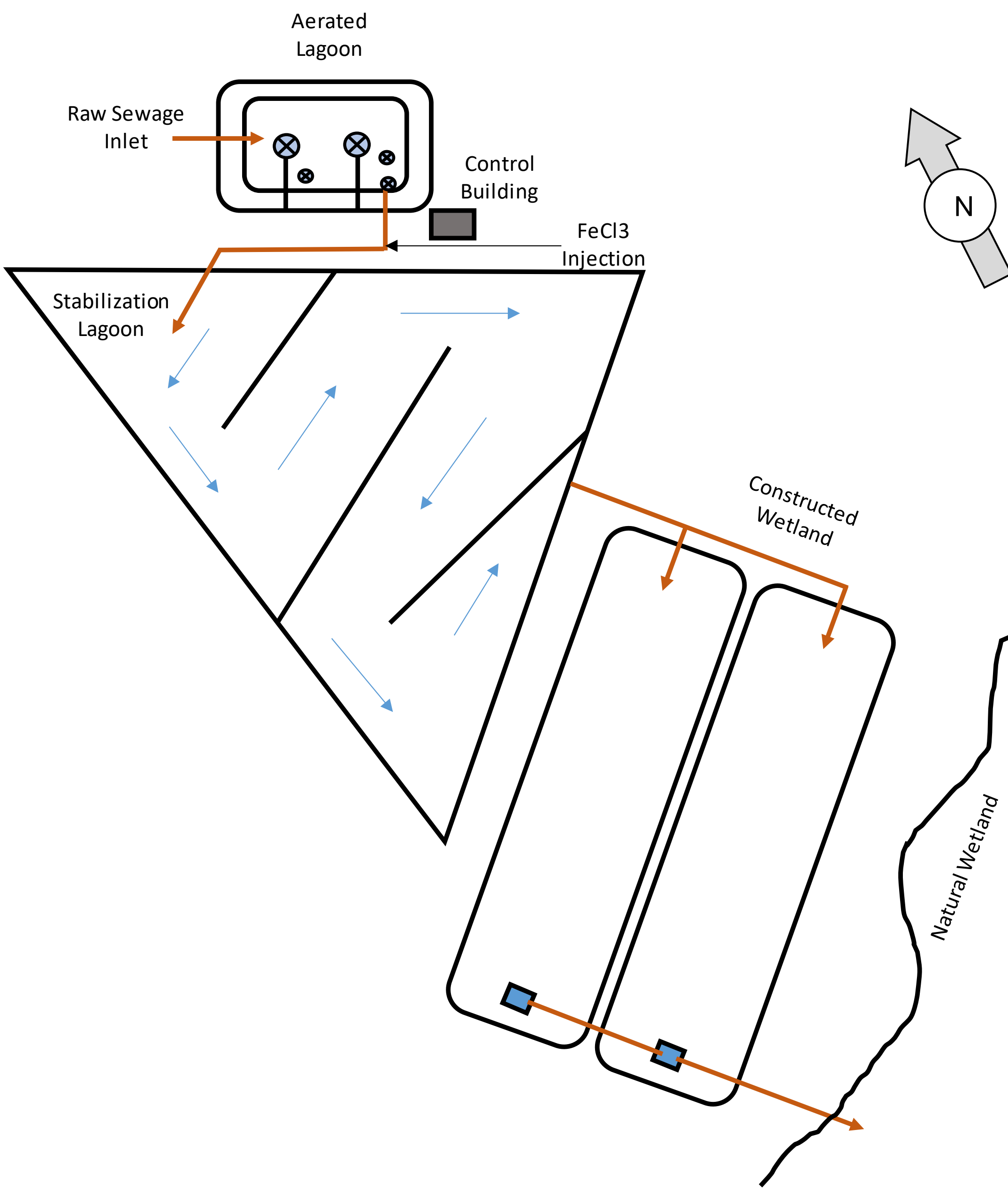

Figure 2.1 – Process Schematic of the Existing WPCP

3.0 WPCP INFLUENT FLOW AND CHARACTERISTICS

3.1 Influent Flowrates and Characteristics

Table 3.1 and 3.2 illustrate the historic average monthly flowrates and characteristics. The historic flow data indicates average day flow (ADF) value of 3,317 m^3/d which is 72% of the current rated capacity of the plant. The absolute and 99.5 percentile peak day flows (PDF) values over the reported historic period are 14,009 m^3/d and 9,960 m^3/d, translating into PDF peaking factor of values of 3.93 and 2.89 respectively. With less than 1% frequency of the peaking factor exceeding 2.89, this value flows represents a realistic peaking factor for the plant. It is also important to note that high flows typically occur from late winter to spring (January to May) as the high flows coupled with low temperatures during these months has a major bearing on nitrification in the aerated cell. See Figure 3.1 for historic monthly average flow trends based on the flow measurements of the aerated cell effluent. The average and maximum month influent characteristics represent a low to medium strength sewage for $cBOD_5$ and TSS, medium to strong sewage for TP and TKN. See Table 3.2 for details.

Table 3.1 – Brighton WPCP Historic Influent Flow Data

Month	Influent Flow (m^3/d)				
	2018	2019	2020	2021	Average
Jan	3583	3534	5175	2952	
Feb	4910	3260	3873	2137	
Mar	3794	4314	5943	2951	
Apr	6724	6016	4512	2855	
May	4043	7112	4777	2254	
Jun	3270	5487	1501	1489	
Jul	2285	3812	1146	2242	
Aug	1921	3178	1295	1993	
Sep	2079	2592	1433	2640	
Oct	2219	3083	2222	3052	
Nov	3500	3526	2124	-	
Dec	3627	3677	2939	-	
Average	3,480	4,137	3,071	2,421	3,317
Max Day	13,087	10,614	14,009	11,313	
Max Month	6,724	7,112	5,943	3,052	

Table 3.2 – Brighton WPCP Influent Characteristics

Year	$cBOD_5$		TSS		TP		TKN	
	Annual average	Max month	Annual average	Max month	Annual average	Max month	Annual average	Max month
2018	113	175	185	239	5.2	7.5	45	65
2019	121	167	179	319	5.5	7.0	47	58
2020	97	169	189	359	5.1	8.6	45	76
2021	120	160	207	289	6.5	8.3	58	71
Average	113	168	190	301	5.6	7.8	49	68

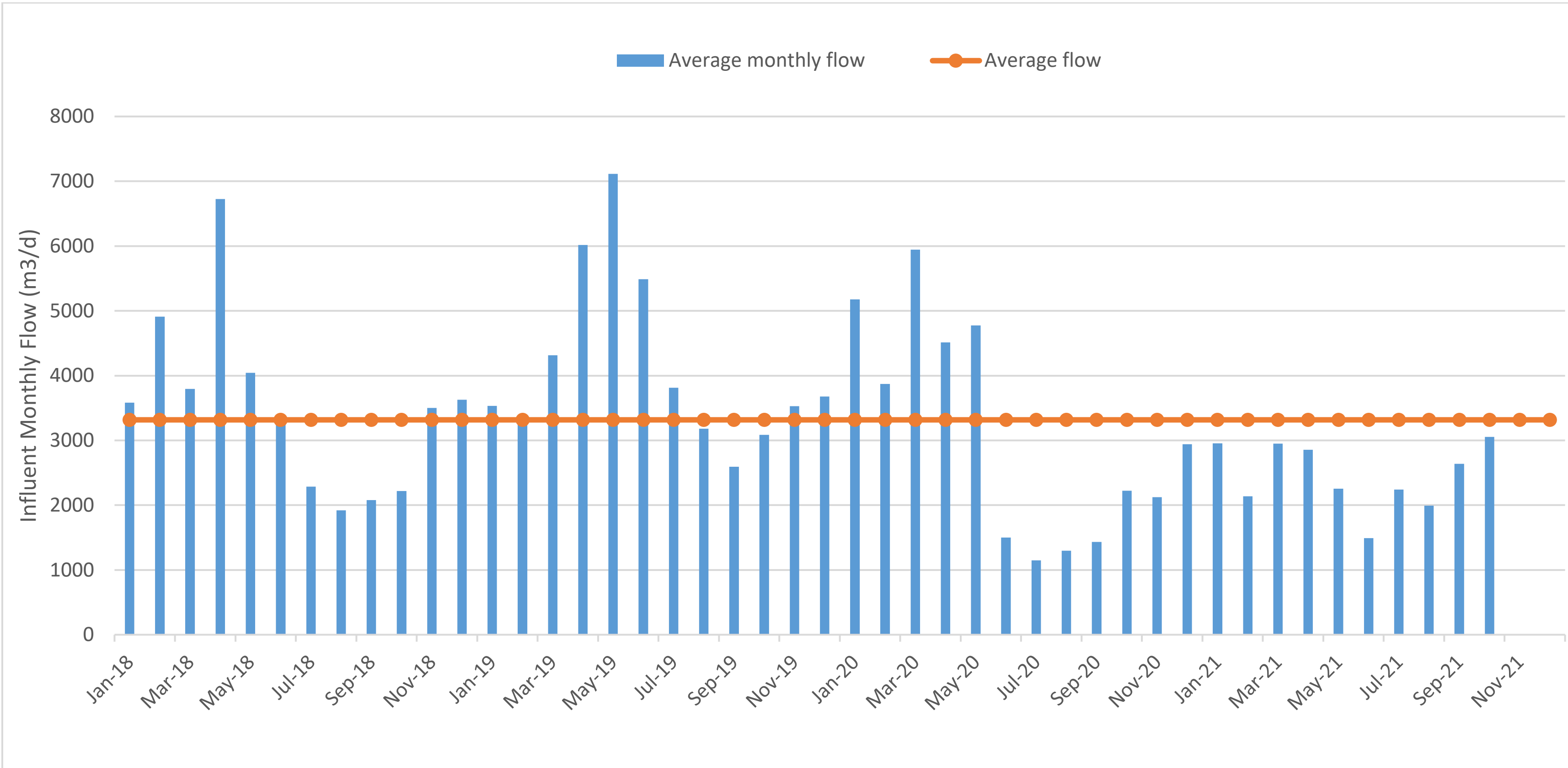

Figure 3.1 – Brighton WPCP Historic Influent Flows

4.0 WPCP HISTORIC PERFORMANCE AND ISSUES

4.1 Aerated Cell and Stabilization Pond Effluent Characteristics

Tables 4.1 and 4.2 summarize the historic effluent characteristics of the aerated cell and the stabilization pond.

Table 4.1 – Aerated Cell Effluent Characteristics

Item	Unit	2018	2019	2020	2021	Average
$cBOD_5$	mg/L	28	24	24	25	25
TSS	mg/L	120	113	253	194	170
TP	mg/L	3.2	2.4	5.0	4.5	3.8
TAN	mg/L	14.0	10.2	9.5	14.4	12.1

Table 4.2 – Stabilization Lagoon Effluent Characteristics

Item	Unit	2018	2019	2020	2021	Average
$cBOD_5$	mg/L	2.8	3.7	2.6	3.7	3.2
TSS	mg/L	7.2	7.8	7.8	9.1	8.0
TP	mg/L	0.2	0.2	0.2	0.3	0.2
TAN	mg/L	15.1	11.7	12.5	18.0	14.3

4.2 General Observations on WWTP Performance

Figure 4.1 illustrates the monthly average $cBOD_5$ and TSS values in the stabilization lagoon effluent with comparison to the ECA objectives and limits. As indicated, there were no exceedances of $cBOD_5$ and TSS limits, while there are occasional minor exceedances of the monthly average TSS objective of 15 mg/L.

The high effluent $cBOD_5$ and TP in the aerated cell effluent are primarily contributed by the high TSS in the aeration cell effluent, which means a major fraction of these parameters is in particulate form in the aerated cell effluent. As such the treatment provided by the stabilization lagoon is primarily the removal of particulate fractions via settling.

The average values of total ammonia nitrogen (TAN) in the stabilization pond are 10-30% higher than those in the aerated cell effluent. This means that not only is there little or no TAN removal in the stabilization pond, but some TAN gets added to the aerated cell effluent loads leading to worsening of effluent quality for this parameter. See Figure 4.2 for details.

Figure 4.4 illustrates the monthly *E.Coli* values of the stabilization lagoon and constructed wetland effluents. The ECA stipulated that the Geometric Mean Density of *E.Coli* in the constructed wetland effluent should not exceed 200 organisms per 100 millimeters for any calendar month. However, Figure 4.2 indicates that the stabilization lagoon effluent has roughly exceeded the *E. Coli* objective in all cold weather months (Nov throughout May). Further, while the constructed wetland effluent shows some reduction in *E.Coli* in most cases, there are numerous instances when the *E.Coli* in wetland effluent exceeded than in the stabilization effluent, which is a further confirmation of the unreliability and inconsistency in the treatment provided by the same.

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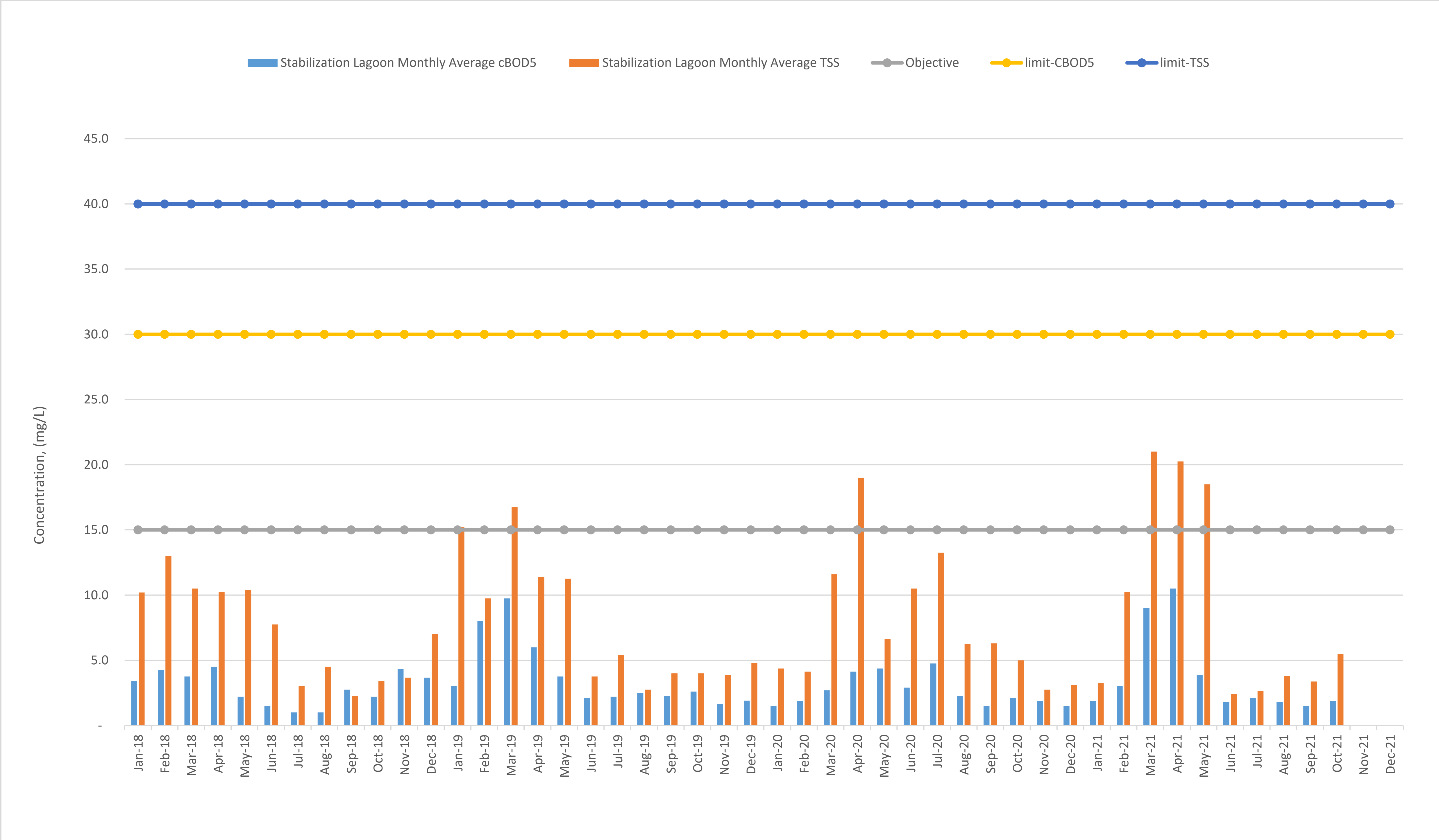

Figure 4.1 – Stabilization Lagoon Effluent cBOD$_5$ and TSS Trends

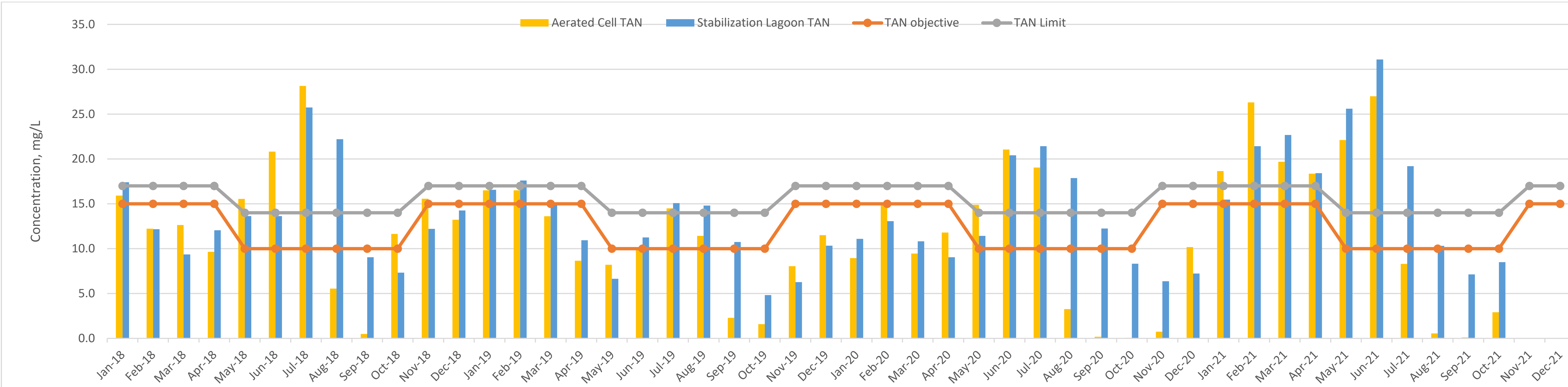

Figure 4.2 – Aerated Cell and Stabilization Lagoon Effluent TAN Trends

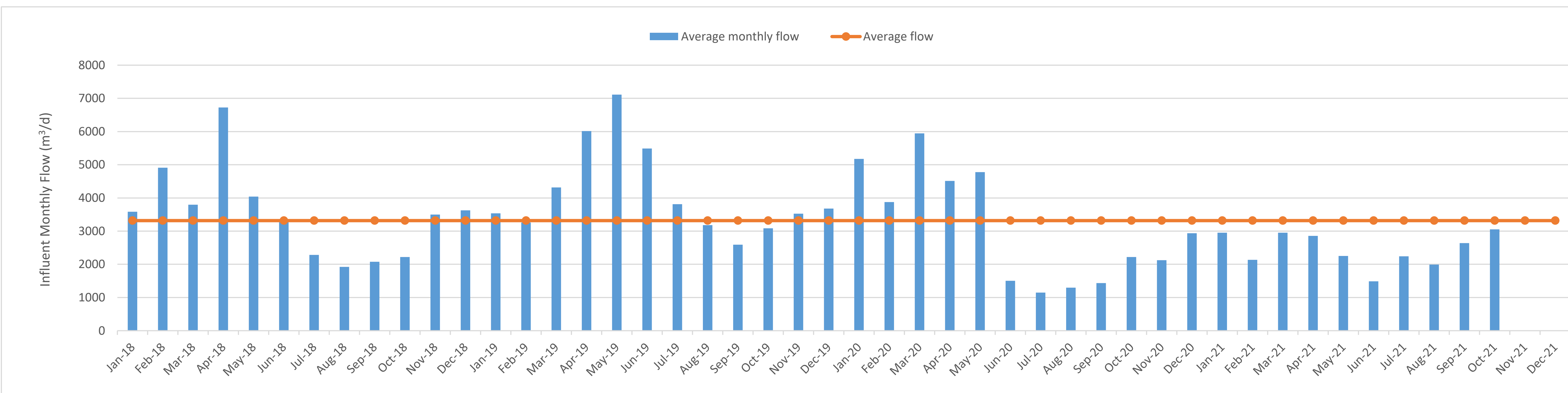

Figure 4.3 – Monthly Average Influent Flow Trends

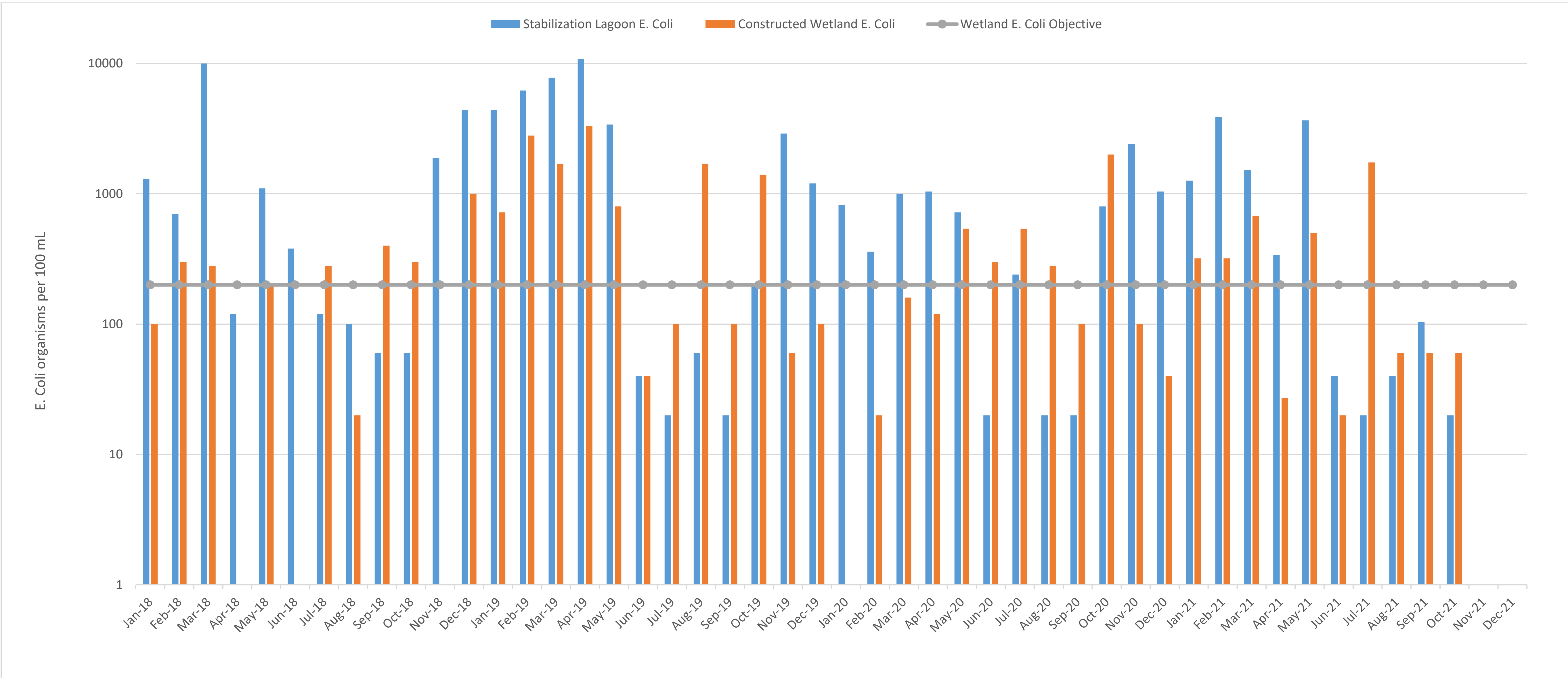

Figure 4.4 – Stabilization Lagoon and Constructed Wetland E. Coli Trends

4.3 TAN Removal in the Aerated Cell

Given below are the key observations on TAN removal in the aerated cell.

- Figure 4.3 illustrates the historic monthly average TAN of both aerated cell and stabilization lagoon effluent verses the ECA objectives and limits. As indicated, there are frequent exceedances of TAN objectives and/or limits in the aerated cell and stabilization lagoon effluents most of the year with the exception of some months in fall.
- Effluent ammonia trends indicate limited nitrification in the aerated cell with ammonia levels mostly ranging between 10-20 mg/L for most months except for the period between August to October when it falls to 5 mg/L or below indicating significant nitrification activity.
- Nitrification limitation in winter months is likely due to combined effect of low temperatures and high flows due to wet weather. The flows during these months average around 4,500 m^3/d, decreasing the SRT of the aerated cell to 3.2 d from an already low annual average of approximately 4.3 days. This coupled with the low temperature range (2-10°C) in the cell during these months' limits nitrification.
- The high effluent TAN values during winter and spring are typically followed by further spikes in the months of June and July before a decrease to 5 mg/L or below from August to September and extending as far as November in some years.
- The high TAN values in the month of June and July are likely due to increase in temperature in the aerated cell, and enhanced activity in the bottom zone bringing any settled solids into the upper mixed and biologically active layers. The settlement of mixed liquor and influent solids during the other months indicates mixing limitation of currently installed mechanical aerators in the aerated cell. Breakdown of these sludge solids leads to release of ammonia causing the TAN spikes during these months.
- The above period is followed by the typically dry period from August to September when the flows average between 1,500 -2,500 m^3/d giving an SRT range of 6-9 days at average temperature of 20°C. These operating conditions enhance the nitrification activity leading to removal of the solubilized TAN in the preceding months and marked reduction in the TAN concentration in the aerated cell effluent during this period.

4.4 TAN Removal in the Stabilization Lagoon

The effluent TAN values from the stabilization lagoon are mostly equal or slightly lower than the aerated cell effluent during most months except for dry and warm period from August to September (some years extending up to November). This indicates little to no TAN removal in the stabilization lagoon. This means either no nitrification activity in the stabilization lagoon or nullification of any TAN removal by TAN release from the sludge deposits during most months. In August and September however, the TAN release from the sludge deposits decisively exceeds any TAN removal in the stabilization lagoon leading to the high TAN values in the lagoon effluent causing exceedances despite near full nitrification achieved in the aerated cell. These high TAN values produced by the stabilization lagoon are indicative of significant sludge deposits in the lagoon.

5.0 PROPOSED UPGRADE ASSESSMENT

5.1 Upgrade Design Concept

On June 15, 2021, GSS provided an outline of the Triplepoint proposal to upgrade aeration in the aerated cell component of the WPCP and convert it into a fully oxygenated and mixed activated sludge basin (ASB). In addition, the ASB will be equipped with active SRT control via solid separation either by operating it in sequential batch reactor (SBR) mode or provision of a secondary clarifier with a return activated sludge (RAS) facility.

The proposal includes the following:

1- Removal of the existing catwalks, original mechanical mixers, and the floating aerators in the aerated cell.

2- Installation of the new Triplepoint shore based three 150 hp air blowers (2 duty /1 standby) along with the submerged aeration units. These blowers would be housed within acoustic weatherproof enclosures. The Triplepoint design indicates that the blowers are to be VFD controlled and the total air flow with two blowers running at 100% speed would be approximately 8,883 m^3/h (5.050 cfm) and provide approximately 3,900 kg of dissolved oxygen per day to the aerated cell.

3- Construction of new secondary clarifier to separate the biological solids from the cell effluent flow and return the concentrated solids back to the aerated cell. The proposed clarifier diameter is 20 m, which translates into a HRTs of 6.6 h at the rated capacity flow of 4,600 m^3/d.

GSS also suggested that screening aerated cell effluent upstream of the secondary clarifier to protect the moving parts in the latter. Screening and/or grit removal from raw sewage was deemed unnecessary based on a rationale that the aeration cell would not have any moving parts.

As a supplement to the proposed upgrade to the liquid train, GSS also suggested the following alternatives for proactive sludge management:

- Discharge surplus sludge to the stabilization lagoon from the sludge return line and allow for annual sludge removal from the lagoon.
- Regular discharge of waste sludge from the sludge return line to the sludge drying beds at the north end of the aerated cell, drainage from the bed recycled back to the inlet of the aerated cell and covering of the sludge drying cells for winter operation.

- Periodic discharge of waste sludge from the sludge return line to geotubes located near the edge of the aerated cell and directing the drained liquid back into the aerated cell.

5.2 WPCP Operation Assessment with Proposed Upgrade

BioWin software was used to model the current plant rated capacity (4,600 m^3/day) and the proposed future upgraded rate capacity of (6,000 m^3/day). One of the basis assumptions in the modelling is that the lagoons have been emptied of sludge, to avoid the impacts seen in the existing which leads to TAN exceedances. In both models, influent characteristics higher than the average historical influent characteristics were used to present tougher operation conditions. Given the significant difference in operation of the upgraded and current systems, particularly the varying SRT and mechanic aeration in the existing system, a calibrated model of the existing system was not prepared to predict the performance of the upgraded system. As such, models of the upgraded system for the current and future rated capacities were prepared using the default values of BioWin operating parameters to achieve this goal. Both models were set for 20 days SRT (minimum 15 days per the MECP guideline), for efficient nitrification and partial sludge stabilization. Table 5.1 illustrates the influent characteristics used in both models.

Note that while the influent BOD_5 values used in the model are higher than the observed maximum month value, the TKN value is lower than the observed maximum month value. See Tables 3.2 and 5.1 for comparison of the BOD_5 and TKN values. The excess BOD_5 value used in the model compensates for the lower TKN value. As such the values given in Table 5.1 were used as such in the models. Further the TP value in Table 5.1, despite being lower than the recorded values was used as such as this has no bearing on the air demand and nitrification ability of the system. The higher TP value observed in the field can be addressed by increasing the dose of ferric chloride.

For both rated capacities, the alternative of Complete Mix Activated Sludge was modeled using BioWin by converting the aerated cell into a completely mixed activated sludge cell with the addition of the proposed 20 m diameter Secondary Clarifier. Table 5.2 illustrates the treatment facilities dimensions.

The operating parameters of the complete-mix activated sludge models at both rated capacities of 4,600 and 6,000 m^3/day at summer and winter are summarized in the in Table 5.3.

Table 5.1 – Influent Characteristics Used in BioWin Modeling

Operating Parameter	Unit	Current Capacity		Future Capacity	
		Summer	Winter	Summer	Winter
Rated Capacity	m^3/day	4,600		6,000	
Influent Temp	°C	20	10	20	10
Influent BOD_5	mg/L	200	200	200	200
Influent TSS	mg/L	250	250	250	250
Influent TKN	mg/L	60	60	60	60
Influent TP	mg/L	3.3	3.3	3.3	3.3

Table 5.2 – Aerated Cell and Secondary Clarifier Dimensions

Unit Process	Unit	Value
Aerated Cell		
Volume	m^3	14,300
Depth	m^3	2.7
Secondary Clarifier		
Diameter	m	20
Depth	m	4.0
Volume	m^3	1,256
HRT at current capacity	h	6.5

Table 5.3 – Operation Summary for Current and Future Capacity

Parameter	Unit	Current Capacity		Future Capacity		Remarks/ guideline
		Summer	Winter	Summer	Winter	
Average Day Flow (ADF)	m^3/d	4,600		6,000		
Peak Day Flow (PDF)[1]	m^3/d	13,294		17,340		
Peak Hourly Flow (PHF)[2]	m^3/d	17,813		23,236		
Influent Temp	°C	20	10	20	10	
MLSS	mg/L	1021	1065	1316	1374	
HRT	h	75	75	57	57	> 15
SRT	d	20	20	20	20	> 15

Parameter	Unit	Current Capacity		Future Capacity		Remarks/ guideline
		Summer	Winter	Summer	Winter	
Mixing Air Demand, Coarse Bubble	m^3/h	16,988	16,988	16,988	16,988	0.33 L/ (m^3.s)
Mixing Air Demand, Fine Bubble	m^3/h	11,631	11,631	11,631	11,631	0.61 L/ (m^2.s)
Biological Air Demand	m^3/h	4,775	4,597	6,442	6,202	
Average mixing Demand[3]	m^3/h	14,309	14,309	14,309	14,309	
Overall air demand[4]	m^3/h	14,309	14,309	14,309	14,309	
Aeration capacity of proposed system	m^3/h	8,883	8,883	8,883	8,883	
Sec Clarifier SOR at PHF	m^3/m^2-d	57	57	74	74	< 37
Sec Clarifier SLR at PDF	kg/m^2-d	74	74	74	74	< 170
Effluent $cBOD_5$	mg/L	2.5	2.8	2.9	3.3	
Effluent TSS	mg/L	8.8	8.9	11.8	11.8	
Effluent TAN	mg/L	0.08	0.16	0.08	0.16	
Wasted Sludge	m^3/day	235	236	229	229	
Wasted Sludge Conc	%	0.30%	0.30%	0.40%	0.40%	

1. Based on historic PDF factor of 2.89
2. Based on WEF guidelines for PDF and PHF peaking factor
3. Average of the coarse-bubble and fine-bubble mixing demands
4. Higher of the mixing and biological air demands.

Given below are the key observations on the predicted performance of the upgraded WPCP.

- The complete-mix activated sludge lagoon provides very long hydraulic retention time (HRT), 75 and 57 hour for the plant rated capacities of 4,600 and 6,000 m^3/day, respectively, which are much higher than the minimum 15 h requirement for extended aeration systems per the MECP guidelines.

- The proposed secondary clarifier with 20 m diameter has surface overflow rates (SOR) of 57 and 74 m^3/m^2-d at the design peak hourly flows under the current and future capacity respectively. These SOR values are significantly higher than the MECP guideline of maximum 37 m^3/m^2-d, which indicates a high probability of effluent TSS spikes in the secondary effluent to the stabilization pond during peak flows. On the other hand, the solids loading rates (SLR) range of 22-39 kg/m^2-d at peak day flows for the current and future capacity is significantly lower than the MECP guideline of maximum of 170 kg/m^2-d. As such, the low SLR and the solids removal in the stabilization lagoon are significant mitigating factors for the high SOR for the secondary clarifier.

- The biological air demands for summer season are 4,775 and 6,442 m^3/h, respectively for rated capacities 4,600 and 6,000 m^3/d respectively. The required aeration capacity for complete mixing of the lagoon is calculated for both coarse and fine bubble diffusers aeration. The mixing aeration demands with coarse bubble and fine bubble aeration demands are estimated at 16,988 m^3/h and 11,631 m^3/h respectively based on the MECP guideline. As the aeration system in the proposed upgrade provides both coarse-bubble and fine-bubble aeration, the overall estimated demand, taken as the average of the above two value, equals 14,309 m^3/h, which is significantly higher than the aeration capacity of 8,883 m^3/h of the proposed aeration system. As such while the proposed system has adequate capacity for biological demand for both capacities, it does not meet the requirements for mixing based on MECP guidelines. This will mean that the aerated cell will not be "completely mixed" and that the incomplete mixing will lead to settlement of solids in the unmixed zones.
    - The predicted wasted sludge flowrate at the plant rated capacity of 4,600 m^3/d after converting the aerated cell into complete-mix activated sludge lagoon is 235 m^3/d at 0.3% solids concentration. The waste sludge will be further stabilized and expected to be naturally thickened (typically of 8-10% solids concentration) in the polishing lagoon the wasted sludge will be.
    - Given the existing sludge accumulation and the associated ammonia release issues with the same, the proposed approach of waste sludge storage in the lagoon would nullify the upgrade benefits to a large extent unless the accumulated sludge is removed and disposed off periodically.

Note that the approach for intermittent aeration to operate the aerated cell in the SBR mode is not considered practically viable without the automated controls, equipment to operate it as an SBR, and modifications to the aeration cell. Further, the tank geometry and depth would not only make the SBR equipment retrofit a challenge, but also pose significant operational challenges as an SBR system. As such, this option for design upgrade is not recommended and therefore not given any further consideration.

5.3 Operation Cost Implications

The aeration blowers in the proposed upgrade have rated power of 300 HP or 225 kW, which is approximately 225 kW higher than the combined power of 59.6 kW of the existing four mechanical aerators. Considering current average power cost of approximately $0.12/kW-h, this translates into approximately $160K of additional energy cost per annum, which is significant. Further, the increased power demand at the plant should be compared with the existing power supply to identify upgrades required if any to the power supply, and the cost implications of these upgrades considered in the overall cost analysis.

6.0 CONCLUSIONS SUMMARY AND SUGGESTED IMPROVEMENTS

6.1 Existing WWTP

- The TAN exceedances in the existing WWTP are caused by operational limitations in both the aerated cell as well as the stabilization lagoon. The aerated cell being a flow through system operates at low average SRT of 3 days which is insufficient for nitrification in during wet weather and/or winter months.
- The existing aeration system provides limited mixing in the aerated cell thereby allowing some settlement of the solids in the mixed liquor. Over time, these settled solids undergo anoxic degradation as the cell temperature increases in the months of May and June, resulting in release of ammonia, leading to elevated TAN concentrations in aerated cell effluent during these months (as shown in the results). This period is followed by the typically warmer and dryer condition in the period from August to September (sometimes extending further into Fall) when the high temperatures and high SRTs (induced by low flows) enhance the nitrification activity leading to removal of the solubilized TAN in the preceding months and marked reduction in the TAN concentration in the aerated cell effluent during this period.
- There is very little to no TAN removal in the stabilization lagoon. This means either no nitrification activity in the stabilization lagoon or nullification of any TAN removal by TAN release from the sludge deposits during most months. In August and September however, the TAN release from the sludge deposits decisively exceeds any TAN removal in the stabilization lagoon leading to the high TAN values in the lagoon effluent causing exceedances despite near full nitrification achieved in the aerated cell. These high TAN values produced by the stabilization lagoon are indicative of significant sludge deposits in the lagoon.

6.2 Proposed Upgrade

The proposed upgrade concept recognizes most of the limitations in the existing system and is designed to address the same. Provision of a completely mixed aeration system with full oxygenation capacity and mixing, together with the addition of proper secondary clarification with capability of returning sludge would be able to mitigate the current effluent TAN exceedances. However, there are the following limitations in the proposed upgrades that would need to be addressed further to achieve the desired improvements:

- Given the existing sludge accumulation and the associated ammonia release issues with the same, the proposed approach of waste sludge storage in the stabilization lagoon would likely nullify the benefit of the proposed upgrade (particularly for the warm months) to a large extent unless the existing accumulated sludge is removed and disposed off, and this practice is adopted as a scheduled maintenance activity on a periodic basis. However, it should be noted that this activity can incur significant operational cost. As such other options of sludge management suggested in the GSS proposal including – geotube dewatering and storage, or dewatering via the existing sludge drying beds – should be considered against lagoon storage with regard to capital and operational costs and other operational considerations including ease of operation, maintenance and odour potential.

- The proposed upgrade does not include removal of accumulated solids from the aerated cell and the stabilization lagoon, a factor, that is potentially critical to achieving the desired outcome with the upgrades. As such, this step needs to be included as a pre-requisite to implementation of the proposed upgrades.
- Provision of a screen between the aerated cell and the secondary clarifier, while protecting the latter, will not be protective of the aerated cell as the rags could be a significant operational risk for aeration diffusers. In addition, the absence of grit removal from raw sewage would lead to grit accumulation in the aerated cell which would not only lower the effective treatment volume over time but also be an additional fouling risk for the fine bubble aeration system. As such screening and grit removal facilities upstream of the aerated cell must be an essential component of the upgrade for a robust and complete upgrade solution.
- The method of installation of diffusers and the ability to inspect and clean, repair or relace diffusers should be considered carefully. In addition, installation methods and support provisions for air piping need to properly designed.
- The aeration system capacity of 8,585 m^3/hr in the proposed upgrade, while adequate for the biological demands for the current and future capacities of 4,600 m^3/d and 6,000 m^3/d, is limited for mixing based on the MECP guidelines. The design aeration capacity of the proposed upgrade seems adequate to provide mixing at the flat bottom of the lagoon, but not the entire cell. This could cause accumulation of the sludge on the sloped sides of the cell, which in the longer run would create anerobic condition and high-concentration ammonia bleed-outs in the summer and fall months as experienced with the current system.
- The proposed secondary clarifier with 20 m diameter is hydraulically limited for the design peak hourly flows for both current and future capacity, as the peak SOR values of 57 m^3/m^2-d and 74 m^3/m^2-d significantly exceed the MECP guideline of maximum 37 m^3/m^2-d. While the low peak SLR values at the current and future capacity could mitigate the hydraulic limitation to some extent, there is still the danger of solids loss to the effluent. Also, while the availability of the stabilization lagoon provides a buffer to capture potential high effluent TSS from the secondary clarifier,

the consultant should select a design SOR value that protect the process from solids washout, and that can be defended to the ministry during ECA amendment of the WWTP.

- It is also noted that the MECP guidelines are normally conservative and there are references in the WEF guidelines of lower unit rates for mixing with fine-bubble systems. In addition, the mixing demand calculation in this assessment report was based on the average cross-sectional area of the aerated cell as opposed to the bottom area used by the supplier. As such there may be mitigating conditions for the identified aeration limitation. Should that be the case the proponent should be asked for a guarantee to meet both mixing and oxygenation requirements and ensure that the design of the aeration system should either satisfy the MECP reviewer's requirements and support the ECA amendment or is upsized to meet the MECP guidelines.
- The approach for intermittent aeration to operate the aerated cell in the SBR mode is not considered practically viable without automated controls, proper equipment to operate it as an SBR, and modifications to the aeration cell, and therefore not recommended for this upgrade.
- The Consulting Engineer should ask Triplepoint™, the mode of securing/anchoring the air-feed pipe and diffuser assemblies to prevent their movement and damage. Also, the bearing capacity of the aerated cell bottom should be considered for the latter's ability to support the diffuser assembly bases, which appear to be made of steel and therefore carrying concentrated weights.
- The proposed upgrade has the potential to set-up the WPCP for future re-rating to a capacity of 6,000 m^3/d. The existing aerated cell and the proposed aeration system in the current upgrade are large enough to accommodate a rated capacity of 6,000 m^3/d and therefore would not require upsizing for the higher capacity. The headworks facility (screening and grit removal), the secondary clarifier and the sludge management facility will however have to be sized for 6,000 m^3/d in the current upgrades to set-up the WPCP for re-rating in future. It should be noted that while upsizing these unit processes in the current upgrade will add a marginal cost to the upgrades for 4,600 m^3/d capacity, it will be significantly more cost-effective compared to a future expansion to 6,000 m^3/d. The MECP should be pre-consulted for their buy-in for this approach particularly with regard to the anticipated effluent criteria for the rated capacity of 6,000 m^3/d.

Based on the above discussion and suggestions, Table 6.1 gives a summary of the key processes and considerations for a robust solution for the WWTP upgrade.

Table 6.1 – Proposed Upgrade Summary and Additional Considerations

Unit Process	Upgrade	Consideration
Headworks	New Headworks facility with screening (6 mm or less) and grit removal system	Recommended to be provided upstream of the aerated cell.
Aerated cell	Installation of fine-bubble aeration system	The air supplied by the proposed aeration system should be confirmed with the supplier for its ability to provide full mixing of the aerated cell.
	Removal and disposal of the accumulated sludge	The accumulated sludge in the aerated cell needs to be removed and properly disposed as a part of this upgrade, and this cost should be included in the upgrade cost estimate.
Secondary Clarifier	A new secondary clarifier with sludge recycling facility	Upsizing the proposed clarifier diameter should be considered to bring it closer to MECP guidelines.
Stabilization pond	Removal and disposal of the accumulated sludge	The accumulated sludge in the stabilization pond needs to be removed and properly disposed as a part of this upgrade, and this cost should be included in the upgrade cost estimate.
Sludge management	Provision/implementation of a sludge management facility/plan	Waste sludge storage in the stabilization lagoon, geotube dewatering/storage, or dewatering via sludge drying beds should be evaluated with regard to capital and operational costs, O&M requirements and odours, and the best option implemented as a part of this upgrade. The capital cost of any sludge management facility/plan cost should be included in the upgrade cost estimate and/or life-cycle cost analysis.

Appendix B

Sludge Management Workshop Presentation and Minutes, August 18, 2022

J.L. Richards
ENGINEERS · ARCHITECTS · PLANNERS

J.L. Richards & Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 728 6012

Municipality of Brighton
Brighton Wastewater Treatment System Schedule 'B' Class EA Addendum and Conceptual Design

Sludge Management Workshop
Minutes of Meeting No. 3

Attendance:			
	Bob Casselman (BC)	Municipality of Brighton (Municipality)	BCasselman@brighton.ca
	Scott Poole (SP)	Municipality of Brighton (Municipality)	SPoole@brighton.ca
	Adam Walraven (AW)	Municipality of Brighton (Municipality)	awalraven@brighton.ca
	Jeff Graham (JG)	GSS Engineering Consultants Limited (GSS)	jeffgraham@gssengineering.ca
	Matt Morkem (MM1)	J.L. Richards & Associates Limited (JLR)	mmorkem@jlrichards.ca
	Susan Shi (SS)	J.L. Richards & Associates Limited (JLR)	sshi@jlrichards.ca
	Matthew Marcuccio (MM2)	J.L. Richards & Associates Limited (JLR)	mmarcuccio@jlrichards.ca

The meeting commenced at 10:00 a.m. on Thursday, August 18, 2022 via Video Conference (Microsoft Teams).

The following summary of the discussions of this meeting has been prepared to record decisions reached and actions required for the project. Please advise the undersigned of any errors or omissions within the next three business days.

ITEM — **ACTION BY**

3.1 MEETING OBJECTIVES

The objective is to provide the Municipality with the information needed to select a preferred solids treatment and sludge management solution. The focus of this meeting was not necessarily to pick a treatment technology, but to eliminate certain options and identify the approach for sludge treatment and management.

3.2 EXISTING LAGOON TREATMENT PROCESS

JLR provided a brief summary of the existing treatment process.

3.3 PROPOSED TREATMENT PROCESS

JLR provided a summary of proposed upgrades to the treatment system:

- New headworks
- Existing aeration lagoon
- New Clarifier (concept endorsed by council)
- Effluent from clarifier would either pass through stabilization lagoon (polishing) or a new disinfection unit (depending on the sludge management option.
- RAS is recirculated back to aeration lagoon
- WAS to solid treatment (method to be determined)

J.L. Richards
ENGINEERS · ARCHITECTS · PLANNERS

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Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 728 6012

Municipality of Brighton
Brighton Wastewater Treatment System Schedule 'B' Class EA Addendum and Conceptual Design

Sludge Management Workshop
Minutes of Meeting No. 3

ITEM | **ACTION BY**

3.4 SLUDGE TREATMENT AND SOLIDS MANAGEMENT OVERVIEW

JLR provided a general overview of a sludge treatment and solids management process, consisting of WAS thickening, sludge stabilization and biosolids management.

- JLR noted that treatment step may be skipped, depending on the technology selected and the intended end use / disposal option.
- JLR noted that considerations for the selection of a preferred option includes:
  - End use,
  - Plant size, economies of scale
  - Land use, odour impact
  - Energy requirements
  - Sludge characteristics

3.5 "EXIT STRATEGY" FOR SLUDGE TREATMENT AND SOLIDS MANAGEMENT

JLR outlined the various points in the sludge treatment process where the Municipality can turn over to a third party to handle and dispose.

- Municipality prefers to stabilize the sludge on site.
- Municipality prefers to land apply treated biosolids.

3.6 RECEIVERS FOR SLUDGE/BIOSOLIDS DISPOSAL

JLR provided a summary of the various disposal options available for sludge and treated biosolids.

- Landfilling:
  - Landfilling of sludge or biosolids is generally being discouraged due to the limited space at available sites.
  - This option will not be carried forward for detailed evaluation.
- Land Application:
  - This option will provide a beneficial reuse of the sludge produced by the clarifier. The land application process can be managed by a third party.
  - The Municipality prefers this option over landfilling.
  - This option will be carried forward for detailed evaluation.
- Treatment at another WWTP:
  - Municipality does not desire to transport sludge to other plants for treatment. There are a limited number of large treatment plants nearby (i.e. Belleville, Cobourg), which would still be a long distance and costly to haul sludge daily.
  - This option will not be carried forward for detailed evaluation.

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

J.L. Richards
& Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 728 6012

ITEM **ACTION BY**

- Soils Management:
  - JLR mentioned this option is not feasible, due to the additional permitting, site upgrades, management and upkeep required to receive and excess soils and mix with sludge/biosolids.
  - This option will not be carried forward for detailed evaluation.

3.7 **WAS Thickening**

JLR provided an overview of the typical WAS thickening technologies available.

- JLR noted that thickening may not be needed depending on the stabilization technology selected.
- As all thickening options are feasible, the Municipality noted for the selection of a specific WAS thickening option would generally be made based on the capital and operating costs.

3.8 **Sludge Stabilization**

JLR provided an overview of the typical sludge stabilization technologies available. The following is a summary of the review and screening of the items:

- Lagoon Treatment
  - This option is common for treatment facilities that are lagoons converting to a mechanical treatment plant. This option is desirable for Brighton as the existing facultative lagoon is available to be converted into a WAS stabilization/storage pond.
  - This option will be carried forward into detailed evaluation
- Aerobic Digestion
  - This option is common for smaller treatment plants.
  - This option will be carried forward into detailed evaluation
- Anaerobic Digestion
  - This option is more common in larger treatment plants, where there is more biogas generation for heating/power generation.
  - This option will not be carried forward for detailed evaluation
- Lime Stabilization
  - This option is not common for municipal wastewater treatment. The process produces a higher volume of biosolids than influent sludge, and produces hazardous gasses to be managed. The option is not recommended,
  - This option will not be carried forward for detailed evaluation

J.L. Richards
ENGINEERS · ARCHITECTS · PLANNERS

J.L. Richards & Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
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ITEM		ACTION BY

3.9 Biosolids Dewatering and Storage

JLR provided an overview of the typical biosolids dewatering technologies available. The following is a summary of the review and screening of the items:

- Geotube®
  - JLR noted this technology is effective at dewatering biosolids, and has recently been installed in a few treatment plants in Ontario.
  - JLR noted that year-round operation would require additional winterization, including a greenhouse for a Geotube® pad, for filling during the winter.
  - This option will be carried forward into detailed evaluation
- Drying beds
  - Municipality noted that there are existing drying beds on site, but were abandoned as the beds were undersized for the sludge generated and process was labour intensive to fill and empty the beds
  - This option will not be carried forward into detailed evaluation
- Centrifuge
  - This option is not desirable, due to the high capital and operating costs (polymer, operation and maintenance, additional storage). It would be more feasible for a larger treatment plant.
  - This option will not be carried forward for detailed evaluation

3.10 Phasing

JLR noted that the EA Addendum will consider interim phasing of the upgrades.

3.11 Feasible Solutions

JLR will take the screened options discussed in the meeting to develop a list of alternative solutions for detailed evaluation — **Action by: JLR**

- One of the feasible solutions were discussed, which consisted of converting the facultative lagoon into a WAS stabilization lagoon (either the full area or install a berm to section a portion to for WAS stabilization). JLR will review feasibility.
  - JLR noted other Municipalities who use a WAS stabilization/storage pond, such as Thornbury and Lindsay WWTP
  - JLR to consider means to decant and address the risk of freezing, especially with the lower flows from just the WAS stream.
    - AW noted that the lagoon does freeze over the winter, except for the area around the inlet. They have never experienced an operation issue due to the freezing.

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

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& Associates Limited
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Municipality of Brighton
Brighton Wastewater Treatment System Schedule 'B' Class EA Addendum and Conceptual Design

Sludge Management Workshop
Minutes of Meeting No. 3

ITEM **ACTION BY**

- Options that were brought up include adding surface aerators to keep the water moving, or add a small constant flow of effluent water which would decant back to the aerated lagoon.

3.12 NEXT MEETING

- To be determined.

3.13 ADJOURNMENT

a. Meeting adjourned at 11:00 a.m.

Prepared by: Reviewed by: Issued on: September 27, 2022

Matthew Marcuccio
Civil Engineer

Susan Shi
Senior Environmental Engineer

Distribution: All attendees
CC: N/A
Attachments: - Brighton Lagoon EA Addendum – Sludge management Workshop Presentation

J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

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Brighton Lagoon Schedule 'B' Class EA Addendum

Workshop - Solids Treatment and Sludge Management Options

Presented by: J.L. Richards & Associates Limited
JLR No.: 31795-000
Date: August 18, 2022

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Meeting Agenda

- Meeting Objectives
- Overview of Existing Lagoon Treatment
- Proposed Upgrades
- Overview of Sludge Management Technologies / Alternatives
- Level of Involvement for Solids Treatment and Sludge Management
- Review of Solids Treatment and Sludge Management Options
- ***Discuss long-term planning and phased implementation (to be completed at the meeting)***
- ***Develop short-listed options (to be completed at the meeting)***

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Objectives

- The objective of this meeting is to provide the Municipality with the information needed to select a preferred solids treatment and sludge management solution.
- Through the Class EA Addendum process, a preferred solids treatment and sludge management solution should be selected to:
  - Effectively treat and manage sludge generated from the secondary clarifier
  - Provide a solution that requires a reasonable level of effort (i.e., "exit strategy")
  - Facilitate long-term site planning, even beyond 20 years
  - Provide flexibility for implementation
  - Promote beneficial use of sludge/ biosolids
  - Minimize environmental impacts and satisfy MECP requirements

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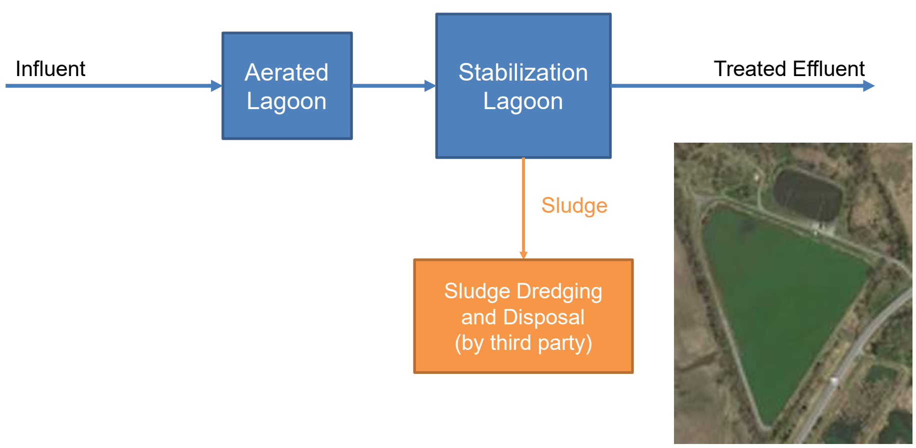
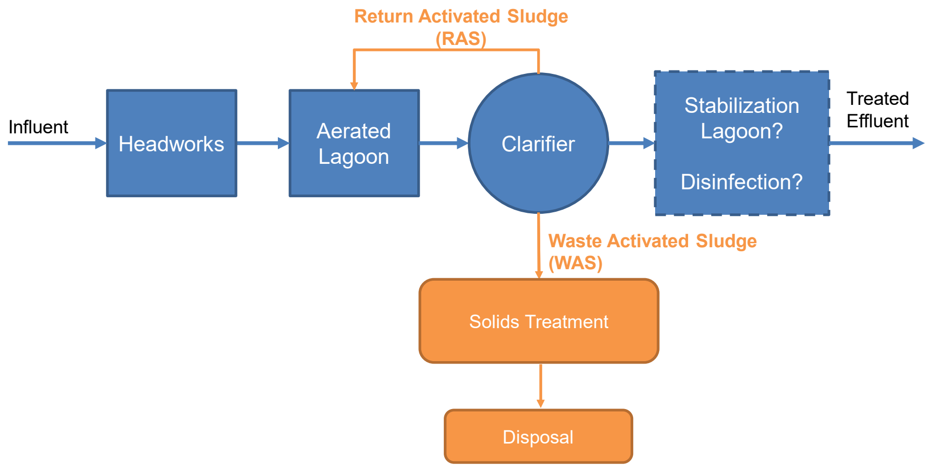
Brighton Lagoon Schedule 'B' Class EA Addendum
Solids Treatment and Sludge Management Options
BRIGHTON

Existing Lagoon Treatment Process

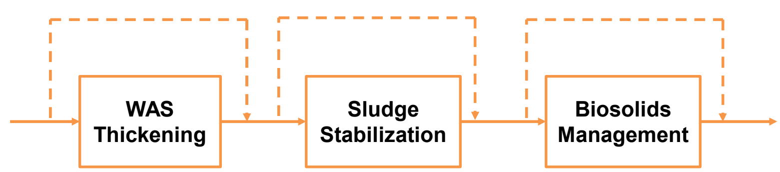


Proposed Upgrades



Solids Treatment and Sludge Management

Solids Treatment and Sludge Management
generally consists the following steps.

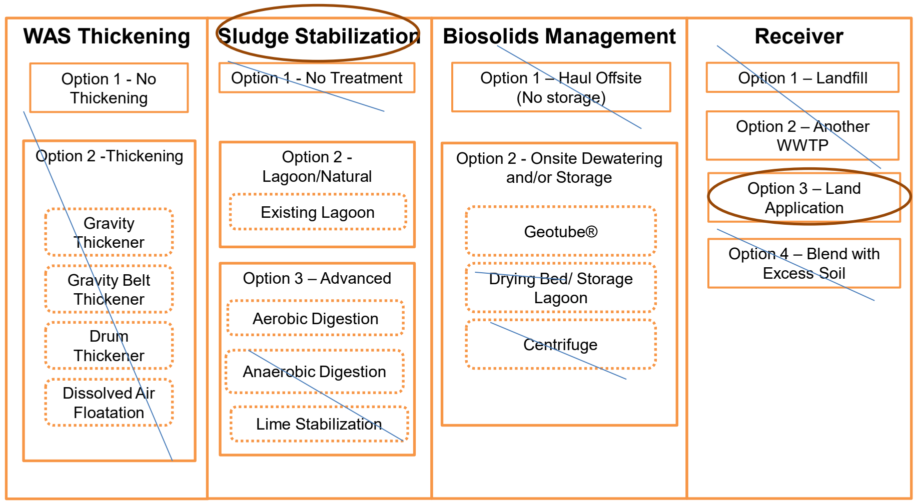


Considerations for selecting a preferred solids treatment and sludge management solution:

- End use
- Plant size and economy-of-scale
- Land use; odor impact
- Energy requirements
- Sludge characteristics

Brighton Lagoon Schedule 'B' Class EA Addendum
Solids Treatment and Sludge Management Options

Overview of Solids Treatment and Sludge Management



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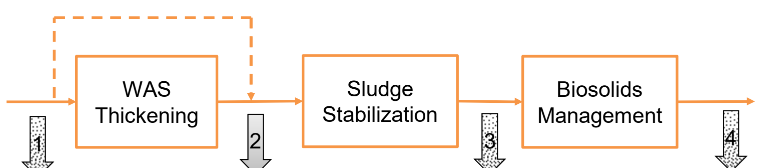
Brighton Lagoon Schedule 'B' Class EA Addendum
Solids Treatment and Sludge Management Options

"Exit Strategy" For Solids Treatment and Sludge Management

The chart demonstrates the various "exit points" for solids treatment and sludge management.



1	2	3	4
Haul un-thickened, un-treated WAS (0.3-0.4% solids)	Haul thickened un-treated WAS (2-8% solids)	Haul stabilized sludge (0.5-4.5% solids or up to 10% for lagoon sludge)	Haul stabilized and dewatered sludge (15-40+% solids)
Frequency: Daily Capital Cost: $ Hauling Cost: $$$$ Disposal: $$$$	Frequency: 2-3 times / week Capital Cost: $$ Hauling Cost: $$ Disposal: $$$$	Frequency: Once every two months (Once every 5-10 years for lagoons) Capital Cost: $$$ to $$ Hauling Cost: $$$ Disposal: Included in hauling	Frequency: Once or twice per year Capital Cost: $$$$ Hauling Cost: $ Disposal: Included in hauling
Receiver: • Another WWTP • Landfill not feasible	Receiver: • Another WWTP • Landfill (slump test)	Receiver: • Land application by Third Party (e.g. GFL) • Landfill (slump test)	Receiver: • Land application by Third Party (e.g. GFL) • Landfill (slump test)

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Receivers

Option 1 – Landfill

Disposal at landfill. Usually requires slump test.

- Pros:
  - Less stringent treatment requirements
- Cons:
  - Haulage/tipping fees.
  - Limited landfill sites.
  - Poor environmental impact. Generally being discouraged.

Legislation: O.Reg. 347 (General – Waste Management)

Option 2 – Another WWTP

Haul to another WWTP in the area for further treatment. Usually requires an agreement with the other municipalities or facilities.

- Pros:
  - Promote beneficial reuse of sludge
- Cons:
  - Haulage and disposal fees
  - Negotiation with other municipalities or facilities; may not be feasible for the long term

Option 3 – Reuse/Land Application

Using treated biosolids as fertilizer or soil conditioning. Requires sludge stabilization for this option to become feasible.

- Pros:
  - Beneficial use instead of landfill.
- Cons:
  - Requires site storage during periods when land application is not feasible.
  - Stringent sampling/testing requirements.
  - Requires Approval of Non-Agricultural Source Materials (NASM) Plan by Ministry of Agriculture.
  - Additional effort for agreements, permits and procedures (if managed by Municipality) .

Legislation: O.Reg. 267/03 (Nutrient Management Act)

Option 4 - Soils Management

Temporary storage of sludge or biosolids with excess soils.

- Pros:
  - Provides excess soil storage.
- Cons:
  - Requires additional permitting (ECA Waste) to become a soils waste site.
  - Not feasible from a beneficial reuse perspective.

Legislation: O.Reg. 406/19 (On-Site and Excess Soil Management)

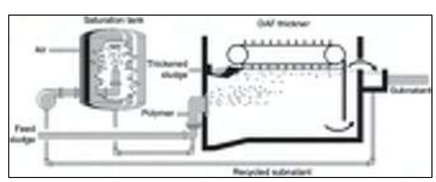
Brighton Lagoon Schedule 'B' Class EA Addendum
Solids Treatment and Sludge Management Options

WAS Thickening Options

Gravity Thickener

Gravity Belt Thickener
(requires sludge storage)

Rotary Drum Thickener
(requires sludge storage)



Dissolved Air Flotation

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Solids Treatment and Sludge Management Options

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Sludge Stabilization Options

Lagoon Treatment
(feasible for mechanical plant converted from lagoons; modifications option available)

Aerobic Digestion
(suitable for small plant and commonly used)

Anaerobic Digestion
(suitable for large plant or limited space)

Lime Stabilization
(not common)

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Brighton Lagoon Schedule 'B' Class EA Addendum
Solids Treatment and Sludge Management Options

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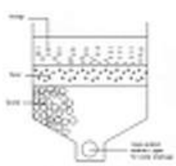
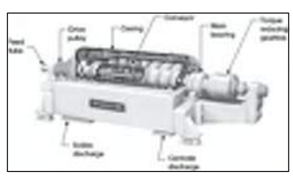
Biosolids Management Options



Sludge Drying Bed/ Storage Lagoon

Geotube ®
(No additional storage required)



Centrifuge
(Additional storage required)

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Phasing of Proposed Solids Treatment and Sludge Management

To discuss the Municipality's general approach:

- Ultimately, the Municipality should select a solids treatment and sludge management strategy that will work for the long term (i.e. beyond 20 years planning horizon).
- Solids treatment and sludge management upgrades is required with the new secondary clarifier.
- The implementation of the ultimate solids treatment and sludge management strategy can be phased.
- To be further explored and discussed at the meeting… For example:
  - If advanced stabilization is preferred, an interim solution is available (i.e. reuse facultative lagoon as WAS storage) until the Municipality is ready to implement the advanced treatment system.
  - Biosolids dewatering (e.g., Geotube®) may be constructed now to facilitate the facultative lagoon dredging operation (i.e. reduced volume to haul away), which will be ultimately be converted to a year-round dewatering facility as a part of the overall solution.

Brighton Lagoon Schedule 'B' Class EA Addendum
Solids Treatment and Sludge Management Options

Discussion with Municipality on "Exit Strategy" and Short-Listed Options

WAS Thickening → **Sludge Stabilization** → **Biosolids Management** → **Receiver**

WAS Thickening: Yes or No?

Sludge Stabilization: Short Listed Options:
- To be discussed

Biosolids Management: Yes or No?
Short Listed Options:
- To be discussed

Receiver: Short Listed Options:
- To be discussed

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Solids Treatment and Sludge Management Options

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Proposed Solids Treatment and Sludge Management Options

To be completed at the meeting

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Thank you!

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Brighton Lagoon Schedule 'B' Class EA Addendum
Solids Treatment and Sludge Management Options

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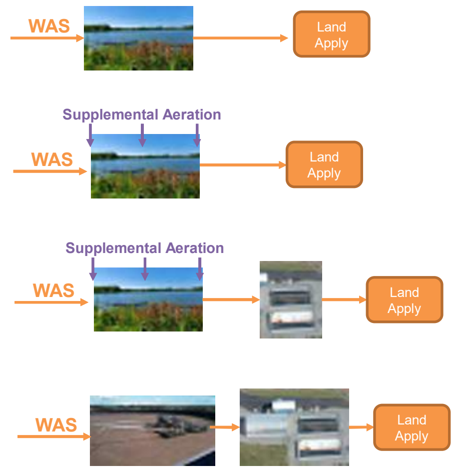
Feasible Solutions

(In the order of increased treatment efficiencies and capital costs)

- Solution 1A – Convert existing facultative lagoon to WAS storage pond without aeration. Periodic lagoon clean out. (TBD – Build in small WAS pond for interim)
- Solution 1B – Convert existing facultative lagoon to WAS storage pond, with supplemental aeration. Periodic lagoon clean out
- Solution 2 – Convert existing facultative lagoon to WAS storage pond, with supplemental aeration. Install Geotube to dewater sludge during periodic lagoon cleanout.
- Solution 3 – Install aerobic digester. Install Geotube to dewater and storage biosolids year-around.



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Phase 1 – Aeration, berm to contain solids, baffle modification
Phase 2 – Headworks (with PS), Clarifier, Sludge treatment

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www.jlrichards.ca

Ottawa

343 Preston Street
Tower II, Suite 1000
Ottawa ON Canada
K1S 1N4
Tel: 613 728-3571
ottawa@jlrichards.ca

Kingston

203-863 Princess Street
Kingston ON Canada
K7L 5N4
Tel: 613 544-1424

kingston@jlrichards.ca

Sudbury

314 Countryside Drive
Sudbury ON Canada
P3E 6G2
Tel: 705 522-8174

sudbury@jlrichards.ca

Timmins

834 Mountjoy Street S
Timmins ON Canada
P4N 7C5
Tel: 705 360-1899

timmins@jlrichards.ca

North Bay

501-555 Oak Street E
North Bay ON Canada
P1B 8E3
Tel: 705 495-7597

northbay@jlrichards.ca

Hawkesbury

326 Bertha Street
Hawkesbury ON Canada
K6A 2A8
Tel: 613 632-0287

hawkesbury@jlrichards.ca

Guelph

107-450 Speedvale Ave. West
Guelph ON Canada
N1H 7Y6
Tel: 519 763-0713

guelph@jlrichards.ca

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NATURAL HERITAGE MEMORANDUM

Cambium Inc.
P.O. Box 325
Peterborough, Ontario. K9J 6Z3
Telephone: (705) 742.7900 1 (866) 217.7900

To: Susan Jingmaio Shi, Sr. Environmental Engineer
J.L. Richards and Associates Ltd.
sshi@jlrichards.ca

From: Matthew Wheeler, Sr. Ecologist
Cambium Inc.
matthew.wheeler@cambium-inc.com

Date: August 25, 2022

Re: **Natural Heritage Existing Conditions and Impact Assessment Memorandum**
Brighton, Ontario
Cambium Project Number: 16197-001
J L Richards Project Number: 31795-000.1

Introduction

The Municipality of Brighton is carrying out an addendum to the Municipal Class Environmental Assessment (MCEA) Schedule B project, for facility upgrades at the existing Wastewater Treatment Plant (WWTP) in Brighton, Ontario. The details of the proposed Schedule B Class EA addendum can be found on the Municipality's public website advertising the Notice of Study Commencement. Cambium Inc. (Cambium) was retained by J.L. Richards and Associates Limited (JLR) to conduct a desktop review of Natural Heritage features as required by the MCEA process (Figure 1).

The existing Brighton Wastewater Pollution Control Plant (WPCP) is a lagoon-based system located at 100 County Road 64, Brighton, Ontario. The WPCP requires updates to the existing infrastructure to ensure compliance with the limits stated in the Environmental Compliance Approval (ECA) for current operations and to meet future needs of the municipality. The entire property will be considered the Site for this report.

Description of Natural Heritage Features

The natural heritage features have been reviewed based on existing publicly accessible data sets. However, a field investigation was not completed as a part of the natural heritage review process. The Site is within Ecoregion 6E of Ontario (Crins, Gray, Uhlig, & Wester, 2009). The Site contains or is adjacent to (within 120 m of) the following mapped natural heritage and/or hydrologic features:

- Arena Creek (on Site and adjacent lands) is coldwater fish habitat
- Unevaluated wetlands (on Site and adjacent lands)
- Woodlands (on Site and adjacent lands)
- Presqu'ile Bay Marsh, a coastal Provincially Significant Wetland (PSW) (on adjacent lands)
- Potential habitat for provincially listed species at risk (SAR) on and adjacent to the Site from element occurrence data from the Natural Heritage Information Centre (NHIC) and air photo interpretation of potential SAR habitat;
    - Wood Thrush (Special Concern)
    - Black Tern (Special Concern)
    - Grass Pickerel (Special Concern)
    - Midland Painted Turtle (Special Concern)
    - Snapping Turtle (Special Concern)
    - Blanding's Turtle (Threatened)
    - Barn Swallow (Threatened)
    - Least Bittern (Threatened)
- No federally listed aquatic SAR are documented to be present in Arena Creek. However, aquatic SAR are mapped as present within the PSW of Presqu'ile Bay Marsh, approximately 400 m downstream. The Department of Fisheries and Oceans (DFO) SAR mapping contains records for the following SAR which occur, or may occur, on adjacent lands south of County Road 64;
    - Grass Pickerel (Special Concern)
    - Eastern Pondmussel (Special Concern)
    - Bridle Shiner (Special Concern)
    - Pugnose Shine (Threatened)
    - Shortnose Cisco (Endangered)

The provincial and federal background data does not contain a name for the watercourse on the Site. However, it is locally known as Arena Creek as the watercourse flows through the King Edward Arena property, north of the Site. The watercourse conveys water on the Site southward and outlets into Presqu'ile Bay Marsh coastal PSW. The Land Inventory Ontario Aquatic Resource Area data set documents the following fish species in this coldwater watercourse; Banded Killifish, Blackchin Shiner, Brook Stickleback, Creek Chub, Fathead Minnow, Northern Redbelly Dace, White Sucker, and Yellow Perch. While the provincial database indicates this is a coldwater thermal regime, the fish species within the data set indicates that it is likely a mixed thermal regime of coolwater and warm water species. No fall spawning species are documented in the system.

The Site is within the jurisdiction of the Lower Trent Conservation and their regulated area encompasses portions of the Site associated with Arena Creek and the unevaluated wetlands. As the Site contains wetlands and a watercourse, the Study will consider regulations on the infrastructure as imposed by the local Conservation Authority's Regulation under the *Conservation Authorities Act*, 1990 (i.e., O. Reg. 163/06).

The *Endangered Species Act, 2007* (ESA) protects endangered and threatened species and their habitats from harm or destruction. Habitat for endangered and threatened species is also afforded protection under provincial natural heritage policy; however, it is ultimately the proponent's responsibility to ensure that no harm to these species or their habitats occurs on their property.

Impact Assessment and Recommendations

Fisheries

An environmental consultant knowledgeable in fish and fish habitat regulations, mitigation, and design strategies should be retained as a part of the team designing the relocation of Arena Creek. A field investigation should be performed to determine if fish can pass from south of County Road 64 northward into Arena Creek. In addition, it is recommended that fish community sampling and habitat mapping be completed within Arena Creek and within the proposed channel relocation area. Potential constraints and opportunities for the construction of a new channel should be identified during the field investigation. Confirmation of existing conditions and fish species present, including aquatic SAR, will contribute to the channel relocation detail design.

The DFO does not typically participate in the pre-construction design or planning of projects. DFO should be engaged to complete a Request for Project Review after the channel relocation detail design is 90% complete. The design team should provide DFO with an explanation of the proposed works, design drawings and a statement demonstrating how the design meets the requirements of the *Fisheries Act* and regulations. A geomorphologist may be required to review the location and design of the relocated channel to prevent impacts to the aeration pond and minimize future maintenance work on the new channel from erosion.

The creek relocation should be designed to comply with fish and fish habitat protection provisions in the *Fisheries Act.* In particular, measures should be implemented to avoid;

- causing the death of fish
- the harmful alteration, disruption or destruction of fish habitat in your work, undertaking or activity

Measures to protect fish should consider:

- **In-water Work Window**: Based on the documented fish assemblage in Arena Creek, the restricted activity timing window to protect fish and fish habitat is from April 1 to July 15. All in water work is prohibited during this period when fish are potentially spawning. In-water work is permitted from **July 16 to March 31**.
- **Habitat Elements**: if possible, the new channel design should include substrates or habitat structures to support fish spawning. Where possible, riparian vegetation should be maintained, and re-vegetation areas should include planting and/or seeding of native species. If tree removal is planned, consider utilizing coarse woody debris or root wads for the new channel.
- **Channel Stability**: The new channel should be created in a 'fish-friendly' manner with natural channel design to ensure long term stability of the channel. Live willow stakes, a soil bio-engineering technique, can be incorporated into the banks of the new channel to provide biophysical stability, shading of the watercourse and allochthonous materials for fish. Soil bio-engineering will actively prevent erosion of the new watercourse channel.
- **Erosion and Sediment Control**: An erosion and sediment control plan should be developed to prevent sediment from entering the watercourse and harming fish or fish habitat during construction.
- **Permits and Approvals**; It is recommended that the DFO Request for Review process should be undertaken through consultation with DFO. if a *Fisheries Act* Authorization is required, the tender and drawings for construction work should include all conditions of the authorization or letter of advice. A Conservation Authority permit is likely required to work within their regulated area (i.e., in-water work, work adjacent to the watercourse and wetlands).

Migratory Birds

Nesting birds and their nests, eggs, and young are protected under the *Migratory Birds Convention Act*, 1994. Vegetation clearing on the Site should occur outside the breeding bird season, which extends from April 15 to August 15 in the local area (as per Environment and Climate Change Canada Guidelines).

If vegetation clearing or construction is to occur between April 15 and August 15, the vegetation should be investigated by a qualified biologist to confirm if any active nests are present, prior to site alteration. Vegetation clearing can proceed provided there are no active nests. If active nests are confirmed, the nests should be left undisturbed until young have fledged or the nest is determined to be inactive. Note that some birds nest on the ground and in low-lying vegetation and shrubs; therefore, all habitat types should be inspected prior to ground disturbance if removals are to occur during the breeding season.

Species at Risk

Midland Painted Turtle, Snapping Turtle and Blanding's Turtle have the potential to be encountered on and adjacent to the Site. Turtles and snakes are particularly vulnerable to construction-related impacts on sites adjacent to wetlands, watercourses, and waterbodies. Arena Creek is unlikely to support turtle overwintering. However, turtles may utilize the aeration cell, waste stabilization pond and the watercourse for travel and foraging.

As the Site is located adjacent to potential habitat for turtles, workers should be aware turtles nest in terrestrial habitats from May 15 to July 15 and eggs can incubate until September 15. As a mitigative strategy, it is recommended that silt fence can be installed around the construction area to exclude turtles from the work area. All stockpiled materials should be kept inside the exclusion fencing area and ideally should be covered and well secured around the base, to prevent turtles from nesting in loose substrates such as sand, soil, wood chips and aggregates. Should any nesting turtles be encountered, work should stop immediately, and the turtle should be left to finish nesting undisturbed. The turtle should be photographed, and the nest marked to ensure it is not disturbed during construction, or until eggs have hatched (late August – September). If a nest is laid in a stockpile or other area that requires disturbance, Cambium should be contacted to determine if the nest can be relocated.

If individual turtles are encountered, they should be photographed and allowed time to move out of harm's way. SAR should not be handled by unauthorized individuals.

Closing

This memo provides a description of the existing conditions within the Study Area, assessment of potential effects on natural heritage elements, and provides recommendations to eliminate or minimize negative environmental effects during and post-construction. Enhancement measures are recommended to provide long term stability to the new channel and associated terrestrial and aquatic ecosystems. Agency consultation for permits, approvals and authorizations are specified in this memo. Feel free to contact the undersigned should you have any questions regarding this memo.

Kind regards,

Cambium Inc.

Matthew Wheeler, B.A. Hons.
Project Manager / Senior Ecologist

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