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Project File Report

Municipal Class EA for Additional Wastewater Treatment Capacity for Jarvis

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

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1.0 INTRODUCTION

1.1 Project Overview

The community of Jarvis is located approximately 15 kilometres north of Lake Erie in the western part of Haldimand County (the County). The community has approximately 2,000 residents (Watson, 2018) and development there is predominantly residential. Industrial, commercial, and institutional (ICI) development is concentrated in the north side of the community along Highway 6.

Currently, all wastewater in Jarvis is conveyed to the Jarvis lagoons for treatment (ECA No. 9261-AKJL76). The County is conducting a Class EA to determine the preferred alternative to increase wastewater treatment capacity for Jarvis. The study area for the Class EA encompasses the urban boundary of Jarvis, Figure 1 illustrates the study area boundary.

1.2 Class Environmental Assessment

The Ontario Environmental Assessment Act (Act) sets out a planning and decision-making process to consider potential environmental effects 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. In 1987, the first Class EA document 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 study was initiated as a Schedule C Class Environmental Assessment, for additional wastewater treatment capacity at the Jarvis Wastewater Treatment Lagoons. Projects categorized as Schedule B or Schedule C undertakings have the potential for significant environmental impacts and are required to follow specific phases 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 or Environmental Study Report that documents the Class EA process.

1.3 Problem Statement

The Jarvis Lagoon is currently operating near its treatment capacity. The purpose of this Municipal Class Environmental Assessment is to determine the preferred wastewater treatment alternative to meet anticipated growth in Jarvis.

File Location: P:\28000\28176-000 - Jarvis Master Plan Update\3-Production\1-Civil\2019-06-07 EA_Figures\S28176 StudyArea.mxd

Plot Date: June 7, 2019 12:50:39 PM

PROJECT:

JARVIS CLASS EA
JARVIS, ONTARIO

DRAWING:

JARVIS CLASS EA STUDY AREA

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DESIGN:	LP
DRAWN:	KTK
CHECKED:	JW
JLR #:	28176

DRAWING #:
FIGURE 1

2.0 PUBLIC AND AGENCY CONSULTATION

2.1 Notice of Study Commencement and Public Information Centre (PIC)

A Notice of Study Commencement and PIC (provided in Appendix A) was prepared by the consulting team. Contact information was provided for stakeholders to contact with questions regarding the project. The Notice was issued via the following means:

- Placed on the County's website
- Placed in local newspaper twice between March 28 and April 10, 2019
- Mailed to property owners adjacent to the Jarvis and Townsend lagoons
- Submitted through the MECP Streamlined EA process June 4, 2019

2.2 Public Information Centre

The PIC for the Class EA took place on Wednesday April 10, 2019 at the Jarvis Public Library from 4:00 pm to 6:00pm. The Notice was placed on the County's website and placed in the local newspaper. Representatives from the project team and staff from the Municipality were available to answer questions during the PIC. The PIC was attended by approximately 12 members of the public. Comments received from the public at the PIC are summarized in Table 1. Refer to Appendix B for a copy of the display boards.

2.3 Review Agency Consultation

No comments from any review agency have been received to date regarding the Class EA.

2.4 Public Stakeholder Comments

Table 1 below provides a summary of public comments received to date regarding this Class EA. Refer to Appendix C for a summary of Public and Agency comments.

Table 1 Summary of Public Stakeholder Comments

Stakeholder	Comment	Action
Public Commenter 1	April 10, 2019 – Noted that the County should explore the option of sending waste directly to Townsend Lagoons. Recommended County look at complimentary opportunities during the Class EA Wastewater project (ex. Widening Concession and Townline Road).	Per Section 8.1 consideration will be given to pumping directly to the Townsend Lagoons during detailed design.
Public Commenter 2	April 10, 2019 – Concerned about the potential forcemain disturbing new street surfacing. Recommends a route that will create the least disturbance.	Per Section 9.3, where possible it is recommended that direction drilling be employed during construction.

3.0 EXISTING CONDITIONS

3.1 Wastewater Treatment System Description

3.1.1 Lagoon Volume

As shown in Table 2, the lagoon system consists of four (4) waste stabilization lagoons with overall storage capacity of 155,700 m^3. The treatment facility operates under ECA Number 9261-AKJL76, issued by the Ontario MECP May 11, 2017.

Table 2 Jarvis Lagoon Volume ECA No. 9261-AKJL76

Cell	Volume (m^3) (1)
Cell 1	33,686
Cell 2	40,109
Cell 3	29,593
Cell 4	52,312
Total	**155,700**

To facilitate phosphorous removal the cells are dosed prior to spring and fall discharge. The pumped flow to the Lagoons is split between two (2) forcemains which direct flow to either Cell No. 1 and 2 or Cells No. 3 and 4. Under normal operating conditions, Cells No. 3 and 4 are filled first followed by Cells No. 1 and 2. The cells are discharged in the same order in which they are filled. The lagoon operates with two (2) seasonal discharges in the fall and spring. As outlined in the ECA the Spring and Fall Effluent Discharge Periods begin March 15 and November 1 respectively, terminate within 45 days, and discharge is allowed for 30 days (consecutive or not) but no less than 21 days. Discharge is to Jarvis Drain No. 1 (Jarvis Creek) and ultimately Sandusk Creek. Two (2) Palmer Bowlus flumes measure discharge flow, one (1) for each pair of lagoon cells.

In 2011 and 2018, studies were conducted to asses the available storage volume in the lagoons. A technical memorandum was prepared (CPO, 2011) that used a plan sketch of the lagoons and depth measurements provided by Haldimand County Staff to estimate the volume of the lagoon for comparison to previously reported values. Additionally, the lagoons were surveyed via boat and using total station survey equipment to calculate the lagoon storage volume (Upper Canada Consultants, 2018). Table 3 and Table 4 summarize the findings of these two (2) studies.

Table 3 Jarvis Lagoon Volume - Jarvis Capacity Assessment Data (2011)

Component	Surface Area (m^2)	Side Slopes (assumed)	Working Depth (m) (1)	Volume (m^3) (2)
Cell 1	25,427	1:4	1.5	42,901
Cell 2	29,613	1:4	1.5	49,069
Cell 3	23,443	1:4	2.5	60,972
Cell 4	40,925	1:4	2.5	108,180
Total	**199,408**	**-**	**-**	**261,122**

Table 3 Notes:

1. Depth includes freeboard (0.3m) and minimum water depth (0.6m) following discharge.
2. Volume subtracting freeboard (0.3m) and minimum water depth (0.6m).

Table 4 Jarvis Lagoon Volume - Topographic Volumetric Survey of Jarvis Sewage Lagoons Data (2018)

Component	Surface Area (m^2)	Volume (m^3) (1)	Working Volume (m^3) (2)
Cell 1	29,627.79	50,106.78	39,653.78
Cell 2	24,827.85	40,416.56	27,115.56
Cell 3	23,375.21	41,329.72	39,199.72
Cell 4	38,104.77	62,743.18	61,080.18
Total	**115,935.62**	**194,596.24**	**167,049.24**

Table 4 Notes:

1. Volume subtracting freeboard (0.3m).
2. Volume subtracting freeboard (0.3m) and minimum water depth (0.6m).

In both studies, the total volume was greater than the value reported in the ECA. Based on data provided by the Upper Canada Consultants Topographic Volumetric Survey of Jarvis Sewage Lagoons (2018), when the freeboard is accounted for the lagoon volume is approximately 167,0004m^3, or 11,300m^3 greater then the volume reported in the ECA. This measured working volume has been used for analysis purposes.

3.1.2 Certificate of Approval Requirements

The wastewater treatment system is rated for an Average Day Flow (ADF) of 853 m^3/day. The key objective and compliance requirements for the treatment system are outlined in Table 5 and Table 6 below.

Table 5 Effluent Objectives (ECA No. 9261-AKJL76)

Parameter	Concentration in Effluent
Carbonaceous Biochemical Oxygen Demand (CBOD5)	15.0 mg/L
Total Suspended Solids	15.0 mg/L
Total Ammonia Nitrogen	15.0 mg/L
Total Phosphorus	0.5 mg/L
E.coli	200 organisms/100 mL
pH	6.5 – 8.5

Table 6 Effluent Limits (ECA No. 9261-AKJL76)

Parameter	Concentration in Effluent	Waste Loading in Effluent	Non-compliance
CBOD5	25.0 mg/L	21.3 kg/day	• Annual average concentration means the arithmetic mean of all the single sample concentrations of a contaminant in the effluent calculated for any particular calendar year • Annual average loading means the value obtained by multiplying the annual average concentration of a contaminant by the annual average daily flow over the same calendar year
Total Suspended Solids	25.0 mg/L	21.3 kg/day	• Annual average concentration means the arithmetic mean of all the single sample concentrations of a contaminant in the effluent calculated for any particular calendar year • Annual average loading means the value obtained by multiplying the annual average concentration of a contaminant by the annual average daily flow over the same calendar year
Total Ammonia Nitrogen	25.0 mg/L	-	• Single Sample Concentration exceeds concentration • Concentration of a contaminant in the effluent discharged on any day, as measured by a composite or grab sample, whichever is required

Total Phosphorus	0.5 mg/L	0.43 kg/day	• Annual average concentration means the arithmetic mean of all the single sample concentrations of a contaminant in the effluent calculated for any particular calendar year • Annual average loading means the value obtained by multiplying the annual average concentration of a contaminant by the annual average daily flow over the same calendar year
pH	Maintained between 6.0 – 9.5	-	• Maintained always

3.1.3 Land Use and Property Constraints

Jarvis lagoons are located on Parts 4 & 5, Concession VII, Registered Plan R 2904 and approximately 2500 metres south of Talbot Street. A land registry survey was not conducted; however, the adjacent land appears to be privately owned with a woodlot on the west property boundary, and agricultural land on the remaining three (3) sides. In 2015, the County acquired access rights to necessary land accessing the lagoon to install hydro upgrades for the site.

An aspect of land use planning that must be considered is MECP Guideline D-2 “Compatibility between Sewage Treatment and Sensitive land Use”. This Guideline states that the recommended separation distances between property/lot line of sensitive land uses (e.g., residences) and wastewater lagoon vary between 100 to 400 metres depending on the type of pond and characteristics of the waste. Guideline D-2 states that a separation distance of 150 metres is recommended for wastewater treatment plants of capacity between 500 m^3/day and 25,000 m^3/day. This will be considered in subsequent phases of the Class EA.

3.2 Pumping Station

The Jarvis SPS is located south of Talbot Street and to the east of the access road. The station has three (3) submersible pumps each with an approximate pumping capacity of 60 L/s. A pump has been upgraded since the 2010 MSP and the current the firm capacity of the SPS is120 L/s.

4.0 HISTORICAL DATA ANALYSIS

4.1 Wastewater Flow Update

4.1.1 Average Wastewater Flow Rates

Since 2007, raw sewage flow to the lagoon has been measured by a magnetic flow meter. A new replacement magnetic flow meter was installed in April 2017 and in 2009, a Milltronic Multi-Ranger unit was installed to calculate flows based on the level in the pump wet well. In recent years, effluent flow has been measured by two (2) Palmer Bowlus Flumes, one for Cell No. 1 and/or 2 and one for Cell No. 3 and/or 4.

The average annual day flows from each recording device are summarized in Table 7.

Table 7 Historical Average Raw Sewage Flows (2013 – 2017)

Year	Magnetic Flow Meter (m^3/day)	Multi-Ranger Unit (m^3/day)	Palmer Bowlus Flumes (m^3/day) (1)
2013	887	623	739
2014	1295	594	945
2015	697	605	739
2016	691	553	583
2017	985	855	867
Average	911	646	775

Table 7 Notes:

1. Effluent flows measured by the Palmer Bowlus Flumes were adjusted by adding annual precipitation (from the Hamilton International Airport) and subtracting evaporation, estimated at 554 mm/year from CPO, Inc (2011).

In 2018, the Jarvis Lagoons Operation and Capacity Update study was conducted by Haldimand County to assess the capacity of the Jarvis Lagoons for re-rating (Haldimand County, 2018). The study reviewed historical average influent flow measurements and concluded that due to improper equipment installation, the flow measurement devices are unreliable and all the influent flow data is potentially inaccurate. Recent data is reportedly more accurate. As such, the 2017 Magnetic Meter average day flow of 985 m^3/day will be used for treatment system design purposes at the lagoon. Based on meteorological records, this was a relatively wet year and is a realistic but conservative estimate of the average day flow.

4.1.2 Maximum Day Wastewater Flow Rates

The maximum day flows from each recording device are summarized in the Table 8.

Table 8 Historical Maximum Day Raw Sewage Flows (2013 – 2017)

Year	Magnetic Flow Meter (m^3/day)	Multi-Ranger Unit (m^3/day)
2013	5210	1100
2014	5991	1065
2015	5620	9266
2016	4515	1070
2017	5363	2157 (1)
Average	5340	2932

Table 8 Notes:

1. Multi-Ranger Unit in 2017 had an error reading of 11,046 m^3/day as the maximum day raw sewage flow. This entry was excluded and the next highest maximum day raw sewage flow reading of 2157 m^3/day for 2017 was used.

For maximum day flow, the most accurate data is reported to be from the magnetic flow meter. The average maximum day flow is 5,340 m^3/day which will be used for treatment system design purposes at the lagoon.

4.2 Influent Quality

Composite samples from the inlet manhole to the lagoons are analyzed weekly for biochemical oxygen demand (BOD5), total suspended solids, total phosphorous, and total Kjeldahl nitrogen. The influent quality from these sampling events are summarized in Table 9 and Table 10.

Table 9 Summary of Wastewater Influent Quality Parameters Concentration Data

Year	BOD5 (mg/L)	CBOD (mg/L)	Total Suspended Solids (mg/L)	Total Phosphorous (mg/L)	pH	Temperature (Deg C)	Alkalinity (mg/L)	Total Ammonia Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)
2013	118.7	90.0	163.5	3.7	7.8 (1)	8.5 (2)	267.2	17.4	29.7
2014	118.4	99.6	161.6	4.0	7.4 (3)	20.0 (4)	269.7	16.4	27.7
2015	168.3	116.1 (5)	185.1	4.7	-	-	320.1	22.4	37.2
2016	172.8	-	199.4	7.0	-	-	341.0	22.9	37.5
2017	131.9	-	154.7	7.7	-	-	307.0	17.1	29.3
Average	**142.0**	**101.9**	**172.9**	**5.4**	**7.6**	**14.3**	**301.0**	**19.2**	**32.3**
Typical Wastewater Strength (6)	110 (Low) 190 (Med) 350 (High)	-	120 (Low) 210 (Med) 400 (High)	4 (Low) 7 (Med) 12 (High)	-	-	-	-	20 (Low) 40 (Med) 70 (High)

Table 9 Notes:

All parameters have data from the full sampling dates unless otherwise noted below.

1. pH data from Jan - Apr 2013
2. Temperature data from Jan - Apr 2013
3. pH data from August 2014
4. Temperature data from August 2014
5. CBOD data from Jan - Aug 2015
6. Typical Wastewater Strength - Metcalf and Eddy (2003)

Table 10 Summary of Wastewater Influent Quality Parameters Loading Data

Year	BOD5 Loading (kg/d)	CBOD Loading (kg/d)	Total Suspended Solids Loading (kg/d)	Total Phosphorous Loading (kg/d)	Total Ammonia Loading (kg/d)	Total Kjeldahl Nitrogen Loading (kg/d)
2013	68.4	51.0	95.7	2.1	9.9	17.3
2014	60.8	51.4	86.0	2.1	8.3	14.3
2015	80.9	60.8 (1)	92.5	2.4	10.7	18.2
2016	82.8	-	95.9	3.3	10.9	18.0
2017	60.9 (2)	-	83.7 (3)	4.6 (4)	9.0 (5)	14.9 (6)
Overall	**70.8**	**54.4**	**90.8**	**2.9**	**9.8**	**16.5**

Table 10 Notes:

All parameter have data from the full sampling dates unless otherwise noted below.

1. CBOD Loading data only Jan - Aug 2015
2. BOD5 Loading data only Jan - Apr 2017
3. Total Suspended Solids Loading data only Jan - Apr 2017
4. Phosphorous Loading data only Jan - Apr 2017
5. Ammonia Loading data only Jan - Apr 2017
6. Total Kjeldahl Loading data only Jan - Apr 2017

The results indicate that the concentration of BOD5, total suspended solids, total phosphorous and total Kjeldhal nitrogen in the influent wastewater are in the low to medium range of literature values for typical raw municipal wastewater strength.

4.3 Treated Effluent Quality

Grab samples of the treated effluent from the lagoon are taken on the first and last day of effluent discharge period and every three (3) calendar days during the effluent discharge period. A summary of data for the analyzed parameters are included in Table 11 and Table 12 for spring and fall discharge periods respectively.

Table 11 Summary of Spring Effluent Water Quality Parameters

	CBOD (mg/L)	Total Suspended Solids (mg/L)	Total Phosphorous (mg/L)	pH	Temp (Deg C)	Ammonia (mg/L)	Un-ionized Ammonia (mg/L)	E. coli (cfu/100mL)
Objective	15	15	0.5	-	-	15	-	200
Limit	25	25	0.5	6 - 9.5	-	25	-	-
2013	2.5	5.9	0.1	7.5	11.0	5.6	0.0	5.4
2014	13.7	14.1	0.5	7.7	8.9	6.8	0.1	*324.5*
2015	4.9	4.8	0.1	7.4	11.8	8.5	0.0	177.5
2016	2.3	4.9	0.1	7.5	5.3	8.2	0.0	2.9
2017	4.8	9.1	0.4	7.8	12.3	5.3	0.1	65.5
Overall	**5.6**	**7.7**	**0.2**	**7.6**	**9.8**	**6.9**	**0.1**	**35.7**

Table 12 Summary of Fall Effluent Water Quality Parameters

	CBOD (mg/L)	Total Suspended Solids (mg/L)	Total Phosphorous (mg/L)	pH	Temp (Deg C)	Ammonia (mg/L)	Un-ionized Ammonia (mg/L)	E. coli (cfu/100mL)
Objective	15	15	0.5	-	-	15	-	200
Limit	25	25	0.5	6 - 9.5	-	25	-	-
2013	5.5	8.6	0.2	7.4	10.7	4.9	0.3	*639.6*
2014	4.0	7.9	0.1	7.5	7.5	5.7	0.0	177.9
2015	2.9	5.1	0.1	7.5	8.3	4.5	0.0	43.1
2016	3.2	2.9	0.1	7.3	9.4	9.0	0.0	1.2
2017	3.3	6.4	0.2	7.8	6.4	2.7	0.0	147.0
Overall	**3.8**	**6.2**	**0.1**	**7.5**	**8.4**	**5.4**	**0.1**	**61.6**

The treated effluent quality has been within the ECA compliance requirements in all cases with the exception of E. coli. The E. coli concentration exceeded the objective during both the spring and fall discharge period in 2013. The overall average concentration of E. coli is below the objective, and the concentration has been below the objective in all subsequent years since 2013. There is no compliance objective or limit for un-ionized ammonia, though it is typically below 0.1 mg/L. Overall, effluent quality in both the spring and fall discharge periods has been below the limits.

4.4 Treatment Capacity

The MECP guideline for BOD5 loading is 22 kg/(Ha*day) or less for a facultative lagoon. The BOD5 loading and detention time were calculated for pairs of cells and for all cells cumulatively. Table 13 below shows the BOD loading for cells 1 & 2, 3 & 4 and all cells.

Table 13 BOD5 Loading and Detention Time for Jarvis Lagoon

Average Flow (m^3/day)	Cells Loaded	Total Area (Ha) (1)	Total Volume (m^3) (2)	BOD5 Loading (kg/(Ha*day))	Detention Time (days)
985	1 & 2	5.45	66,769	12.99	68
985	3 & 4	6.15	100,280	11.51	102
985	1, 2, 3 & 4	11.59	167,049	6.11	170

Table 13 Notes:

1. Total Area Data from Topographic Volumetric Survey of Jarvis Sewage Lagoons, 2018.
2. Volume excludes freeboard (0.3m).

Under the existing average day flow, each lagoon pair and overall the entire lagoon adequately meet the 22 kg/(Ha*day) MECP guideline for BOD5 loading. The longest detention time required for the Jarvis Lagoon is approximately 210 days between the spring and fall discharge. Each pair of lagoons respectively and the overall lagoon do not have a detention time to satisfy a maximum 210 day detention time.

Although BOD loading is within acceptable limits, it is important to note that the plant is currently operating at approximately 90% of the ECA rated capacity (refer to Table 7).

4.5 Receiving Water Body

The Jarvis Lagoon discharges to Jarvis Municipal Drain No. 1 (Jarvis Creek) which ultimately leads to Sandusk Creek. Each year a study is conducted by Hutchinson Environmental Sciences Ltd. to summarize water quality in Jarvis Creek and Sandusk Creek during the spring and fall discharge periods to support an application to the MECP to extend the discharge period to provide operational flexibility, and to minimize impact on the receiver. Water quality samples are taken at sampling location of Sandusk Creek downstream of Jarvis Creek inflow generally at Brooklin Road or south of Concession 4. The findings from 2013 to 2017 are summarized in Table 14.

Table 14 Summary of Field and Water Quality Parameters for Sandusk Creek

Field Parameter	Maximum	Minimum	Average	PWQO/ CWQG
Water Temperature (°C)	15.51	3.46	8.01	
Conductivity (µS/cm)	1049	331	573	
Dissolved Oxygen (mg/L)	15.8	8.58	12.03	
Dissolved Oxygen (%)	139.1	81.4	101.2	
pH	8.9	7.24	8.12	6.5-8.5
Water Quality (mg/L)				
Total Suspended Solids (TSS)	418	6.6	75	
Total Phosphorous (TP)	0.602	0.0628	0.244	0.03
Total Ammonia as Nitrogen (TAN)	1.77	0.042	0.421	
Un-ionized Ammonia (UI-TAN)	0.027	0	0.0056	0.0164
Nitrate-N	5.41	1.3	3.17	3
Biological Oxygen Demand (BOD) (1), (4)	2	2	2	
Carbonaceous Oxygen Demand (CBOD) (2), (4)	3	2	2.4	
Sulphide (as H_2S) (3)	<0.0021	<0.0021	<0.0021	0.002
E. coli (CFU/mL) (3)	800	0	51 (5)	100

Table 14 Notes:

All parameters have data from the full sampling dates unless otherwise noted below.

1. Data from October 7, 2013 to November 8, 2013
2. Data from April 06, 2016 to November 28, 2016
3. Data from April 06, 2016 to December 05, 2017
4. Results reported as less than the reported value were rounded to the recorded value for the purpose of calculating averages
5. A zero value was excluded from geometric mean

The purpose of the Provincial Water Quality Objectives (PWQO) is to provide a foundation for the level of water quality to protect aquatic life and recreational water use based on public health and aesthetic considerations in Ontario. PWQO provides guidance for decision making for water quality management decisions, and establishes a basis for setting waste effluent requirements for Certificates of Approval, and other regulatory documents.

Over the years sampled:

- The total phosphorous (TP) concentration consistently exceeded the PWQO limit. The average concentration is approximately eight (8) times greater than the limit. The minimum total phosphorous concentration in the last four (4) years is over double the PWQO concentration limit.

- The un-ionized ammonia concentration has generally remained below the PWQO limit. Most sample concentrations were notably below the limit, with the exception of two (2) consecutive samples that had un-ionized ammonia concentrations exceeding the PWQO limit.
- The average concentration of nitrate has exceeded the Canadian Water Quality Guideline (CWQG) limit. Half of the samples reported concentrations of nitrate exceeding the CWQG limit, while the other half reported concentrations less than the limit. Typically, more recent samples have reported higher nitrate concentrations.
- The average concentration of E. coli has been below the PWQO limit. Although the average E. coli concentration does not exceed the limit, it should be noted four (4) of the five (5) most recent samples have reported E. coli concentrations greater than the limit. Based on two (2) years of data only.

Overall, the concentration of total phosphorous and nitrate water quality parameters exceed the PWQO/CWQG limits. As a result, the receiving water body can be considered Policy II with respect to total phosphorous and nitrate concentrations. Per the PWQO Surface Water Quality Management Guideline, water quality that does not presently meet the PWQO may not be degraded further, and efforts must be taken to upgrade the water quality to meet objectives.

4.6 Existing Wastewater Treatment Constraints

Based on a review of the available background information, the following are the key findings and constraints at the Jarvis lagoons:

- Based on estimates of the average day flow the lagoon system is currently operating at 90% capacity.
- Raw sewage is typical of domestic sewage with monthly samples each year falling in the range of literature values for typically low to medium strength sewage.
- Few concerns related to effluent quality have been identified. The only exceedances of the objectives are related to E.coli. In all years under review, the ECA limits were met.
- There are discrepancies between the ECA lagoon volume and recent survey data; however, based on the surveyed surface area and volume, the lagoons meet the MECP guidelines for BOD loading and retention time.
- The receiving water body is Policy II for phosphorous and nitrogen.

5.0 FUTURE CONDITIONS

5.1 Equivalent Population

In Work Package 2 – Growth Forecast and Assessment of Future Needs (J.L. Richards & Associates Ltd., 2019) for Jarvis Master Servicing Plan Update residential and ICI growth projections were converted equivalent population for analysis purposes.

Anticipated growth in Jarvis is approximately 6.54 ha (120 units) of low density residential land, 1.85 ha (34 units) of medium density residential land, 0.35 ha (24 units) of high density residential land, and 2.91 ha of ICI land to be developed. A summary of future equivalent population is provided in Table 15.

Table 15 Summary of Future Equivalent Population for Jarvis

Year(s)	Equivalent Population
Total 2017 (1)	2560
2018-2038 Residential Growth	510
2018-2038 ICI Growth	262
Total Growth	772
Total Future	3332

Table 15 Notes:

1. From Work Package 1 (J.L. Richards & Associates Ltd., 2019)

5.2 Design Future Flow

5.2.1 Wastewater Treatment System Design Future Flow

Future flow for the wastewater treatment lagoon was determined using equivalent population and a uniform per capita sewage generation rate of 332 m^3/day from the GRCA 2017 Watershed Overview of Wastewater Treatment Plant Performance (Hagan & Anderson, 2018). The average day wastewater flow to be used for treatment system design purposes at the lagoon is 1272 m^3/day. See Table 16 for summary.

Table 16 Future Wastewater Treatment System Flow

	Average Day Flow (m3/day)
Existing	985 (1)
2018-2038 Growth	287
2038	1272

Table 16 Notes:

1. 2017 Magnetic Flow Meter Reading, representative of a wet year
2. Equivalent Population calculated in Work Package 2 – Growth Forecast and Assessment of Future Needs for Jarvis Master Servicing Plan Update (J.L. Richards & Associates Ltd., 2019)
3. Per Capita Sewage Generation Rate from 2017 Wastershed Overview of Wastewater Treatment Plant Performance (GRCA, 2018)

5.3 Wastewater Collection System Design Future Flow

One of the options to be considered in this Class EA is the feasibility of pumping flows from Jarvis to the Townsend Lagoons. As such, future collection system flows were also required.

In Work Package 2 – Growth Forecast and Assessment of Future Needs for Jarvis Master Servicing Plan Update (J.L. Richards & Associates Ltd., 2019) future flow for the wastewater collection system was estimated. The updated average, peaked dry weather, inflow and infiltration, and total peaked wet weather flow are summarized in Table 17.

Table 17 Summary of Modelled Wastewater Flow (Future)

Land Use	Average Day Dry Weather (L/s)	Peaked Dry Weather (L/s)	Inflow and Infiltration (L/s)	Total Peaked Wet Weather Flow (L/s)
Total 2017	8.56	31.3	28.7	60.0
Additional Residential to 2038	1.65	5.81	1.70	7.50
Additional ICI to 2038	0.85	1.93	0.57	2.50
Total 2038 Wastewater Flow	**11.1**	**39.0**	**31.0**	**70.0**

The updated future peaked wet weather wastewater flow rate is estimated to be 70.0 L/s (6,048 m^3/day).

5.4 Design Influent Quality

For preliminary design purposes the historical 5-year influent average concentration for the influent quality parameters have been used as the design concentration. The design influent loadings are calculated based on the future average day flow. Design concentration and loadings are summarized in Table 18.

Table 18 Influent Design Concentration and Loading

Parameter	Design Concentration (mg/L) (1)	Design Loading (kg/day) (2)
BOD5 (mg/L)	142	180.6
CBOD (mg/L)	101.9	129.6
Total Suspended Solids (mg/L)	172.9	219.8
Total Phosphorous (mg/L)	5.4	6.9
Alkalinity (mg/L)	301	382.7
Total Ammonia Nitrogen (mg/L)	19.2	24.4
Total Kjeldahl Nitrogen (mg/L)	32.3	41.1

Table 18 Notes:

1. Influent average concentration for 2013-2017. See Section 4.2 (Historic Influent Concentration)
2. Design loading calculation uses future average day flow 1272 m^3/day

5.5 Proposed Effluent Criteria

The receiving water body is Policy II with respect to phosphorous and nitrogen. For the purpose of alternatives development and evaluation proposed effluent criteria were developed with no increase in loading of any effluent parameter. Proposed effluent objectives and effluent limits summarized in Table 19 and Table 20 respectively.

Table 19 Proposed Effluent Quality Objective

Effluent Parameter	Concentration Objective from ECA (mg/L)	Loading Objective (kg/day) (1)	Proposed Concentration Objective (mg/L) (2)
BOD5 (mg/L)	15	12.8	10.1
Total Suspended Solids (mg/L)	15	12.8	10.1
Total Ammonia Nitrogen (mg/L)	15	12.8	10.1
Total Phosphorous (mg/L)	0.5	0.43	0.34
E. Coli (organism/100 mL)	200	-	

Table 19 Notes

1. Loading objective based on ECA flow of 853 m^3/day
2. Proposed Concentration Objective calculated using average day flow of 1272 m^3/day

Table 20 Proposed Effluent Quality Limit

Effluent Parameter	Concentration Limit from ECA (mg/L)	Loading Limit (kg/day) (1), (2)	Proposed Concentration Limit (mg/L) (3)
BOD5	25	21.3	16.8
Total Suspended Solids	25	21.3	16.8
Total Phosphorous	0.5	0.43	0.34
Total Ammonia Nitrogen	25	21.3	16.8
pH			pH of the effluent maintained between 6.0 to 9.5, inclusive, at all times

Table 20 Notes:

1. Loading values are calculated and are not provided in the ECA
2. Waste Loading based on ECA flow of 853 m^3/day
3. Proposed Concentration Objective calculated using average day flow of 1272 m^3/day

5.6 Treatment Capacity Assessment

The MECP guideline for BOD5 loading is 22 kg/(Ha*day) or less for a facultative lagoon. As the cells at Jarvis Lagoon are operated in pairs BOD5 loading and detention time were generated in their respective lagoon pairings and for all cells cumulatively. Table 21 below shows the BOD loading for cells 1 & 2, 3 & 4, and all cells.

Table 21 BOD5 Loading and Detention Time for Jarvis Lagoon

Average Flow (m3/day)	Cells Loaded	Total Area (Ha) (1)	Total Volume (m3) (2)	BOD Loading (kg/(Ha*day))	Detention Time (days)
1272	1 & 2	5.45	74,187	33.13	58
1272	3 & 4	6.15	85,629	29.36	67
1272	1, 2, 3 & 4	11.59	159,816	15.58	126

Table 21 Notes:

1. Total Area Data from Topographic Volumetric Survey of Jarvis Sewage Lagoons, 2018
2. Volume excludes freeboard (0.3m)

Under the future average day flow, each lagoon pair and overall the entire lagoon does not meet the 22 kg/(Ha*day) MECP guideline for BOD5 loading. The longest detention time required for the Jarvis Lagoon is approximately 210 days between the spring and fall discharge. Each pair of lagoons respectively and the overall lagoon do not have a detention time to satisfy a maximum 210 day detention time.

5.7 Lagoon Seasonal Capacity Assessment

For the purpose of alternatives development and evaluation, the seasonal storage capacity of the lagoon was simulated for spring discharge and fall discharge. Summarized in Table 22 and Table 23 are three discharge scenarios and the associated cumulative volume for the spring and fall discharge periods. The cumulative volume for each scenario was compared to the working volume of the Jarvis Lagoon, calculated in Section 3.1.1. Refer to Appendix D for the full detailed lagoon seasonal capacity assessment tables.

Table 22 Spring Seasonal Storage Capacity

Scenario	Cumulative Volume Required (m3) (1)	Volume Surplus or Deficit (m3)
Scenario 1: 45 Days Discharge Period - March 15 to April 28	**175,062**	-8,013
Scenario 2: 21 Days Discharge Period - March 15 to April 4	**236,983**	-69,934
Scenario 3: 30 Days Discharge Period - April 5 to May 4	**177,405**	-10,356

Table 22 Notes:

1. Exceeds lagoon volume

Table 23 Fall Seasonal Storage Capacity

Scenario	Cumulative Volume Required (m3) (1)	Volume Surplus or Deficit (m3)
Scenario 1: 45 Days Discharge Period - November 1 to December 15	163,689	3,360
Scenario 2: 21 Days Discharge Period - November 1 to November 21	**197,208**	-30,159
Scenario 3: 30 Days Discharge Period - November 1 to November 30	**226,485**	-59,436

Table 23 Notes:

1. Exceeds lagoon volume

With the exception of fall scenario one (1), the cumulative volume of discharge for each spring and fall discharge scenario exceeds the available lagoon volume of 167,000 m^3.

5.8 Future Wastewater Treatment Constraints

Based on a review of the future conditions, the following are the key findings and future constraints at the Jarvis lagoons:

- Based on future estimates of the average day flow with no additional treatment capacity the lagoon system would be operating at approximately 50% over capacity.
- Under the future average day flow, the lagoon does not meet the MECP guideline for BOD5 loading and retention time.
- The cumulative volume of discharge for both the spring and fall discharge period exceeds the available lagoon volume.

Option to address these issues are identified in Section 6.0.

6.0 EVALUATION AND SELECTION METHOD

6.1 Evaluation and Selection Overview

The main objective of Phase 2 of a Class EA is to identify and evaluate possible alternatives to the problems and/or opportunities identified in Phase 1. All reasonable potential alternatives to the problem(s), including the ‘Do Nothing’ alternative, are considered. Class EAs for wastewater projects generally result in the identification and review of a broad range of alternatives. It is also important to note that the objective of Phase 2 is to focus on determining a general solution to the problem and that design details are typically further defined during a preliminary and detailed design stage.

In order to facilitate the evaluation and selection of the preferred alternative during Phase 2, a transparent and logical three (3) part assessment process was established. This process included:

- Initial screening of alternatives;
- Detailed evaluation of screened alternatives; and
- Selection of a preferred alternative.

The first evaluation stage considers the overall feasibility of the potential alternatives and identifies those alternatives that fully address the problem statement. This step ensures that unrealistic alternatives are not carried forward to a more detailed evaluation stage. Based on the initial screening, a detailed assessment of the short list of alternatives was conducted. Evaluation criteria were developed based on a review of the background information, experience on similar assessments and in consultation with County staff. The evaluation was conducted using criterion in the following major criteria categories:

- Natural Environment
- Social and Cultural Environment
- Technical Environment
- Economic Environment

Once the detailed evaluation was completed, a recommended preferred alternative was identified for presentation to stakeholders to solicit input prior to finalizing a preferred alternative.

6.2 Capital Costs Methodology

An Opinion of Probable Construction Costs (OPCC) with a Class ‘D’ Indicative Estimate level of accuracy was developed for each of the alternatives and includes allowances for design elements that have not fully been developed. The OPCC’s were developed based on past experience on similar projects, professional judgement, and equipment costs provided by suppliers.

7.0 IDENTIFICATION OF WASTEWATER TREATMENT ALTERNATIVES

7.1 Initial Screening of Alternatives

Several alternatives to increase the wastewater treatment capacity in Jarvis are presented below in Table 24. A review of each alternative, along with a recommendation to either carry the alternative forward for further evaluation or not, is also provided.

Table 24 Description and Preliminary Evaluation of Alternatives

Alternative	Review/Recommendation
Alternative 1: Do Nothing.	**Review:** This option will not address the problem statement. **Recommendation:** Do not carry forward.
Alternative 2: Implement water conservation measures and I&I reduction program.	**Review:** This option has the potential to reduce flow to the lagoon, though it will not address the problem statement on its own. **Recommendation:** Carry forward in combination with other options.
Alternative 3: Optimize operations within the current discharge volume and periods.	**Review:** Capacity is limited by allowable influent volume and discharge windows. Optimizing operations will not address the issue on its own. **Recommendation:** Carry forward in combination with other options.
Alternative 4: Increase rated capacity of the lagoon without additional storage or treatment; no change in discharge periods.	**Review:** While some additional capacity can be realized through this alternative, the capacity increase possible is less than the 20-year design flows. **Recommendation:** Do not carry forward.
Alternative 5: Increase rated capacity of the lagoon and add post aeration cell with alum feed; extend the spring discharge (start March 1).	**Review:** At design flows there would be sufficient volume in the lagoon to store accumulated wastewater and precipitation during the winter storage period. The storage deficit during the summer storage period would remain. **Recommendation:** Do not carry forward.
Alternative 6: Increase rated capacity of the lagoon; extend the fall discharge (start October 15).	**Review:** At design flows there would be sufficient volume in the lagoon to store accumulated wastewater and precipitation during the summer storage period. The storage deficit during the winter storage period would remain. **Recommendation:** Do not carry forward.
Alternative 7: Increase rated capacity of the lagoon, enhance treatment, and change to continuous discharge periods.	**Review:** This alternative has higher capital and operating costs compared to other options, however, lagoon capacity could potentially be increased. The receiver is sensitive (Policy II) and there may be limited capacity for it to accept discharge in the summer months and accommodate flows beyond 20 years. **Recommendation:** Carry forward.

Alternative	Review/Recommendation
Alternative 8: Increase rated capacity of the lagoon, acquire land to add a new lagoon cell; no change in discharge period.	**Review:** A new cell would be constructed to meet 20-year demands. The revised capacity would be ultimately limited by the allowable discharge volumes in the spring/fall. This option has moderate capital and operating costs. **Recommendation:** Carry forward.
Alternative 9: Treat sewage at Jarvis lagoon (no change in rated capacity) and pump the surplus to the Townsend lagoons for treatment.	**Review:** Higher cost operation compared to other options, however, no charge to the rated capacity or discharge periods at the Jarvis lagoon is required. Could be scaled up to accommodate flows beyond 20-years. **Recommendation:** Carry forward.
Alternative 10: Decommission the Jarvis lagoons and pump all sewage to the Townsend lagoons for treatment.	**Review:** Operation costs may be high due to long distance pumping. The Jarvis lagoon is performing well, so there is no technical driver to decommission it. This option could be considered as part of Alternative 9. **Recommendation:** Do not carry forward.
Alternative 11: Decommission the Jarvis lagoons and build a mechanical treatment plant at the same site or new site.	**Review:** This option has the ability to meet the stringent effluent criteria that would be required for an increase in discharge volume. The costs are anticipated to be higher than other options. **Recommendation:** Carry forward.

7.2 Shortlisted Alternatives for Detailed Evaluation

From the initial screening as detailed in Section 7.1, the following alternatives are being carried forward for the wastewater treatment capacity in Jarvis:

- **Alternative 7:** Increase rated capacity of the lagoon, enhance treatment and change to continuous discharge periods.
- **Alternative 8:** Increase rated capacity of the lagoon, acquire land to add a new lagoon cell and make no changes to discharge periods.
- **Alternative 9:** Treat sewage at Jarvis lagoon (no change in rated capacity) and pump the surplus sewage to the Townsend lagoons for treatment.
- **Alternative 11:** Decommission the Jarvis lagoons and build a mechanical treatment plant at the same site or new site.

Further details are provided for the shortlisted alternatives in Section 7.3 below.

7.3 Description of Shortlisted Alternatives

7.3.1 Alternative 7 – Add Enhanced Treatment System

Alternative 7 involves increasing the rated capacity of the lagoon and changing to continuous or extended discharge periods. The treatment system would be expanded, to include new enhanced treatment cells, a new filter for TSS removal, and a continuous alum feed system. Other works include a mechanical/chemical building, and associated yard pipes and valves. This alternative would require adjacent land acquisition. Refer to Figure 2 for the proposed site plan for Alternative 7. The capital cost estimate for Alternative 7 is provided below in Table 25.

PROJECT:

JARVIS CLASS EA

JARVIS, ONTARIO

DRAWING:

ALTERNATIVE 7 – ADD ENHANCED TREATMENT SYSTEM PROPOSED SITE PLAN

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JLR #:	28176

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FIGURE 2

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Table 25 Total Estimated Cost of Alternative 7 (2018$)

Discipline	Estimated Capital Cost (2018$)
Civil Works and Associated Infrastructure	$1,130,000
Building	$70,000
Mechanical (Process)	$2,255,000
Mechanical (Building)	$5,000
Electrical	$58,000
Instrumentation and Controls	$5,000
Land Acquisition	$40,000
Subtotal	$3,563,000
Contractor Mobilization/Demobilization (3%)	$106,890
Contingencies (30%)	$1,100,967
Engineering (12%)	$427,560
Total (Rounded)	**$5,200,000**

7.3.2 Alternative 8 – Add a New Lagoon Cell

Alternative 8 involves increasing the rated capacity of the lagoon and acquiring land to add a new 70,000 m^3 lagoon cell. Other works include associated yard pipes and valves. This alternative would require adjacent land acquisition. Refer to Figure 3 for the proposed site plan for Alternative 8. The capital cost estimate for Alternative 8 is provided below in Table 26.

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PROJECT:

JARVIS CLASS EA

JARVIS, ONTARIO

DRAWING:

ALTERNATIVE 8 – ADD A NEW LAGOON CELL PROPOSED SITE PLAN

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FIGURE 3

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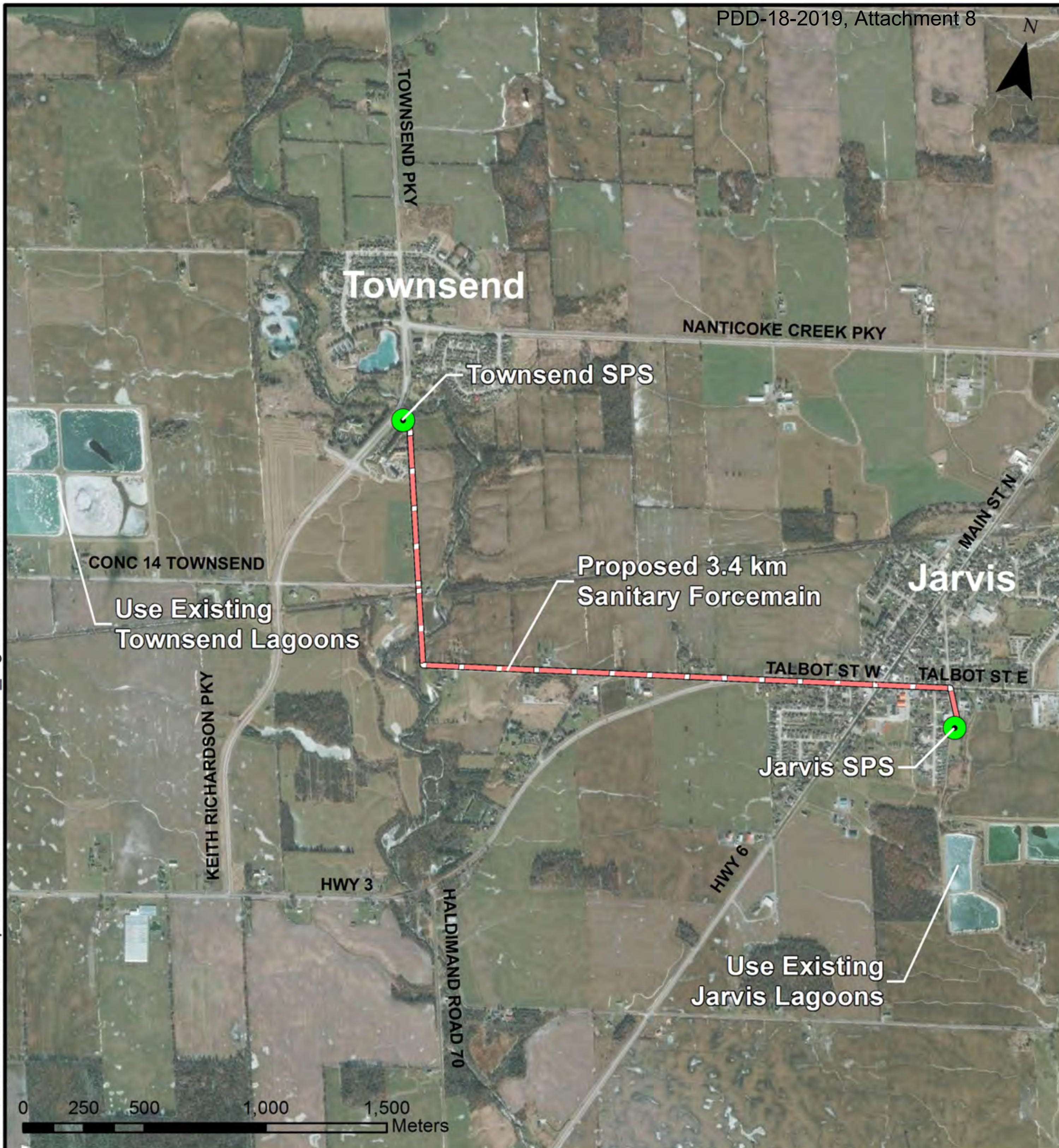
Table 26 Total Estimated Cost of Alternative 8 (2018$)

Discipline	Estimated Capital Cost (2018$)
Civil Works and Associated Infrastructure	$4,980,000
Land Acquisition	$70,000
Subtotal	$5,050,000
Contractor Mobilization/Demobilization (3%)	$151,500
Contingencies (30%)	$1,560,450
Engineering (12%)	$606,000
Total (Rounded)	**$7,400,000**

7.3.3 Alternative 9 – Pump Surplus Sewage to Townsend Lagoon

Alternative 9 involves making no changes to the rated capacity at the Jarvis lagoon, and pumping excess wastewater to the Townsend lagoon. A 3.4 km forcemain would be built to connect the Jarvis lagoon and Townsend Sewage Pumping Station. The three (3) existing pumps at the Jarvis Sewage Pumping Station are to be replaced. Other works include modifications to the yard piping at the Jarvis Sewage Pumping Station. Refer to Figure 4 for the proposed site plan for Alternative 9. The capital cost estimate for Alternative 9 is provided below in Table 27.



PROJECT:

JARVIS CLASS EA
JARVIS, ONTARIO

DRAWING:

ALTERNATIVE 9 – PUMP SURPLUS SEWAGE TO TOWNSEND LAGOON PROPOSED SITE PLAN

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FIGURE 4

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Table 27 Total Estimated Cost of Alternative 9 (2018$)

Discipline	Estimated Capital Cost (2018$)
Civil Works and Associated Infrastructure	$3,400,000
Mechanical (Process)	$300,000
Subtotal	$3,700,000
Contractor Mobilization/Demobilization (3%)	$111,000
Contingencies (30%)	$1,143,300
Engineering (12%)	$444,000
Total (Rounded)	**$5,400,000**

7.3.4 Alternative 11 – Build a Mechanical Treatment Plant

Alternative 11 involves decommissioning the Jarvis lagoons and constructing a new mechanical treatment plant at the same site or new site. This alternative would require land acquisition. The total capital cost of this alternative has been estimated at $10,000,000. Refer to Figure 5 for the proposed site plan for Alternative 11.

PROJECT:

JARVIS CLASS EA

JARVIS, ONTARIO

DRAWING:

ALTERNATIVE 11 – BUILD A MECHANICAL TREATMENT PLANT PROPOSED SITE PLAN

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FIGURE 5

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7.4 Detailed Evaluation of Wastewater Treatment Alternatives

The following tables summarizes the detailed evaluation of the screened alternatives. Each alternative was assigned an evaluation impact level (refer to Table 28) for each of the four (4) evaluation criteria. This method provides an overall assessment of the positive and negative impacts of each alternative. Table 29 provides a summary evaluation matrix of the evaluation. For the full detailed evaluation matrix, refer to Appendix E.

Table 28 Evaluation Impact Level

Evaluation Impact Level	Indicator
Very Positive	⮝⮝
Positive	⮝
Neutral	●
Negative	⮟
Very Negative	⮟⮟

Table 29 Summary Evaluation Matrix

Criteria	Alternative 7	Alternative 8	Alternative 9	Alternative 11
	Rating	Rating	Rating	Rating
Natural Environment				
Groundwater	●	●	●	●
Fish, Aquatic Life, Vegetation	⮝⮝	⮟⮟	●	⮝⮝
Terrestrial Vegetation & Wildlife	●	●	●	●
Soils and Geology	●	●	●	●
Social and Cultural Environment				
Community Development	⮝⮝	⮟⮟	⮝⮝	⮝⮝
Public Health	●	●	●	●
Noise	●	●	●	●
Aesthetics	●	●	●	●
Air Quality and Odours	⮟	⮟	●	⮟
Archaeological and Heritage Resources	●	●	●	●
Technical Environment				
Constructability and Construction Schedule	⮟	⮟	⮟	⮟⮟
Phasing and Expandability	⮝	●	⮝⮝	⮝
Operational Control	⮝	⮟⮟	⮝	⮝⮝

Criteria	Alternative 7	Alternative 8	Alternative 9	Alternative 11
	Rating	**Rating**	**Rating**	**Rating**
Operational Complexity	⮟	⮝⮝	●	⮟⮟
System Redundancy and Resiliency	⮝	●	⮝⮝	⮝⮝
Utilizes Existing Infrastructure	⮝	⮝	⮝⮝	⮟⮟
Economic Environment				
Capital Costs	$5,200,000	$7,400,000	$5,400,000	$10,000,000
Operational Costs (per year)	$130,000	$30,000	$34,500	$250,000
20-Year Lifecycle Costing	$7,800,000	$8,000,000	$6,100,000	$15,000,000
Overall Rating	⮝	⮟	⮝⮝	●

8.0 PREFERRED SOLUTION

8.1 Description of the Preferred Alternative

Based on the evaluation methodology utilized, it was determined that the preferred alternative is to send excess sewage to the Townsend lagoons via a 3.4 km forcemain connecting the Jarvis lagoons and Townsend Sewage Pumping Station (Alternative 9). Consideration could also be given to pumping directly to the Townsend Lagoons (shown as “alternate route” on Figure 6). The three (3) existing pumps at the Jarvis Sewage Pumping Station are also to be replaced with larger pumps. Refer to Figure 6 for the proposed site plan for the preferred alternative.

The main benefits of this alternative include:

- The Townsend lagoons will have sufficient surplus capacity to service long-term growth in Jarvis.
- Lagoon based systems are simple and cost effective to operate compared to other alternatives.
- Enables the County to utilize existing treatment infrastructure in Jarvis and Townsend.
- Moderate capital cost relative to other considered alternatives.

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PROJECT:

JARVIS CLASS EA

JARVIS, ONTARIO

DRAWING:

PREFERRED ALTERNATIVE PROPOSED SITE PLAN

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FIGURE 6

8.2 Opinion of Probable Cost for Preferred Solution

An Opinion of Probable Construction Costs (OPCC) with a Class 'D' Indicative Estimate level of accuracy was developed for full implementation of all elements of the preferred solution. Allowances for design elements that have not been fully developed are included. The OPCC's were developed based on past experience on similar projects, professional judgement, and equipment costs provided by supplier. The OPCC for the preferred alternative is provided below in Table 30.

Table 30 Opinion of Probable Cost for Preferred Alternative

Discipline	Estimated Capital Cost (2018$)
Civil Works and Associated Infrastructure - Construct a new 3.4 km 250mm forcemain - Supply and installation of isolation valve near Jarvis Sewage Pumping Station	$3,400,000
Mechanical (Process) - Supply and installation of three new pumps in the Jarvis Sewage Pumping Station	$300,000
Subtotal	$3,700,000
Contractor Mobilization/Demobilization (3%)	$111,000
Contingencies (30%)	$1,143,300
Engineering (12%)	$444,000
Total (Rounded)	**$5,400,000**

9.0 MITIGATION MEASURES

9.1 Impacts to Natural Environment

Construction of the forcemain will occur over a relatively long distance through agricultural and natural areas and has the potential to disrupt vegetation and wildlife. Potential impacts to the identified natural features in the study area must be assessed during the detailed design and planning phase. Best management practices and standard mitigation should be applied throughout construction to reduce or eliminate potential project effects. A number of mitigation measures are also available if it is not possible to avoid sensitive features, and fish and wildlife habitat (e.g. timing of work in water, erosion control measures, tree protection measures, restoration planting, etc.).

9.2 Archeological and Cultural Heritage

It is recommended to screen the proposed forcemain route for archaeological and cultural heritage significance prior to construction. Should a full archaeological assessment (Stage 1 or Stage 2) of a Cultural Heritage Assessment Report be required it should be conducted by a licenced professional in that field prior to implementation of the preferred alternative.

9.3 Impact during Construction

Temporary impacts and disruption to properties during construction is a concern during implementation of the preferred alternative. To mitigate disruptions, the public and owners of adjacent properties should be consulted regarding construction scheduling and notified in advance of planned disruptions. To minimize the impact during construction consideration should be given to directional drilling along Talbot Street.

10.0 REVIEW OF CLASS EA SCHEDULE NEXT STEPS

The proposed alternations at Jarvis Sewage Pump Station and the construction of the forcemain are classified as Schedule A+ wastewater management projects as outlined in Appendix 1 – Project Schedules for Schedule A+ - Pre-Approved Activities (MEA, 2015).

Establish, extend, or enlarge a sewage collection system and all necessary works to connect the system to an existing sewage or natural drainage outlet, provided all such facilities are in either an existing road allowance or an existing utility corridor, including the use of Trenchless Technology for water crossings.

Increase pumping station capacity by adding or replacing equipment and appurtenances, where new equipment is located in an existing building or structure and where its existing rated capacity is exceeded.

Schedule A+ projects are pre-approved; however, the public must be advised prior to implementation. Per the requirements for Schedule A+ projects, the public will be notified prior to implementation.

11.0 CONCLUSION

This Work Package has been prepared for the exclusive use of Haldimand County, for the stated purpose. Its discussions and conclusions are summary in nature and cannot be properly 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 was prepared for the sole benefit and use of Haldimand County and may not be used or relied on by any other party without the express written consent of J.L. Richards & Associates Limited.

J.L. RICHARDS & ASSOCIATES LIMITED

Prepared by:	Reviewed by
Jane Wilson, P.Eng. Environmental Engineer	Michael Troop, P.Eng. Senior Environmental Engineer

12.0 REFERENCES

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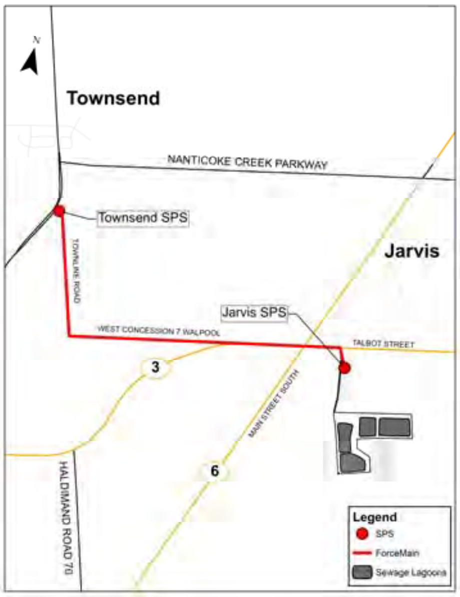
Appendix A

Notice of Study Commencement and Public Information Centre

Notice of Commencement and Public Information Centre

Jarvis Schedule C Municipal Class Environmental Assessment for Additional Wastewater Treatment Capacity

Haldimand County has initiated a Municipal Class Environmental Assessment (Class EA) to determine the preferred wastewater treatment alternative to meet anticipated growth in Jarvis.



How Will This Affect Me?

Wastewater in Jarvis is currently conveyed to the Jarvis wastewater treatment lagoons which are owned and operated by the County. Based on current estimates of the average wastewater flows the lagoon system is currently operating near its capacity. To address this issue, this study has evaluated the community's 20-year wastewater treatment infrastructure needs and has identified a preferred wastewater treatment solution.

The preliminary preferred alternative identifed by this study is to construct a new forcemain to pump surplus wastewater from Jarivs to the larger Townsend lagoons for treatment.

How Do I Get More Information?

A mailing list for notification of study status and opportunities for public input is being compiled. If you wish to add your contact information to the study mailing list, or if you have any questions regarding the study, please contact one of the people listed below.

An Public Open House is being held to gather input from stakeholders to review the future upgrades that are being considered as part of this proposed project. All those interested in the project are invited to attend the Public Open House on:

Date: **Wednesday, April 10, 2019**
Time: **4:00 – 6:00 pm**
Location: **Jarvis Library**
Address: **2 Monson St., Jarvis, ON**

Project information will also be available to the public at the municipal office and on the County's website. If you have any questions regarding the study please contact one of the people listed below. We welcome your feedback.

Michael Troop, P.Eng.	Phil Wilson
Manager, Senior Environmental Engineer J.L. Richards & Associates Limited 107-450 Speedvale Ave W Guelph, ON N1H 7Y6 Phone: 519-763-0713 ext. 6522	Manager, Water & Wastewater Engineering Haldimand County, Caledonia Satellite Office 282 Argyle St. S Caledonia, ON N3W 1K7 Phone: 905-318-5932 Ext. 6431

This study is being conducted according to the requirements of Phases 1 to 4 of the Municipal Class Environmental Assessment which is an approved process under the Environmental Assessment Act. This notice originally issued March 19, 2019.

Appendix B

Public Information Centre Display Boards

Welcome

to the Public Information Centre
for the

Haldimand County
Jarvis Municipal Class Environmental Assessment for Additional Wastewater Treatment Capacity

We want to hear from you.

Please fill out the comment sheet from today's Public Information Centre and leave it in one of the boxes provided.

Additional information is available on the County's website at www.haldimandcounty.ca and at the Municipal Office.

THE MUNICIPAL CLASS EA PROCESS

Data Collection and Review → Identify Problems and Opportunities → Identify and Evaluate Solutions →

Phase 1 – Problem/ Opportunity

WE ARE HERE
Consult with Review Agencies and Public

Select Preferred Alternative →

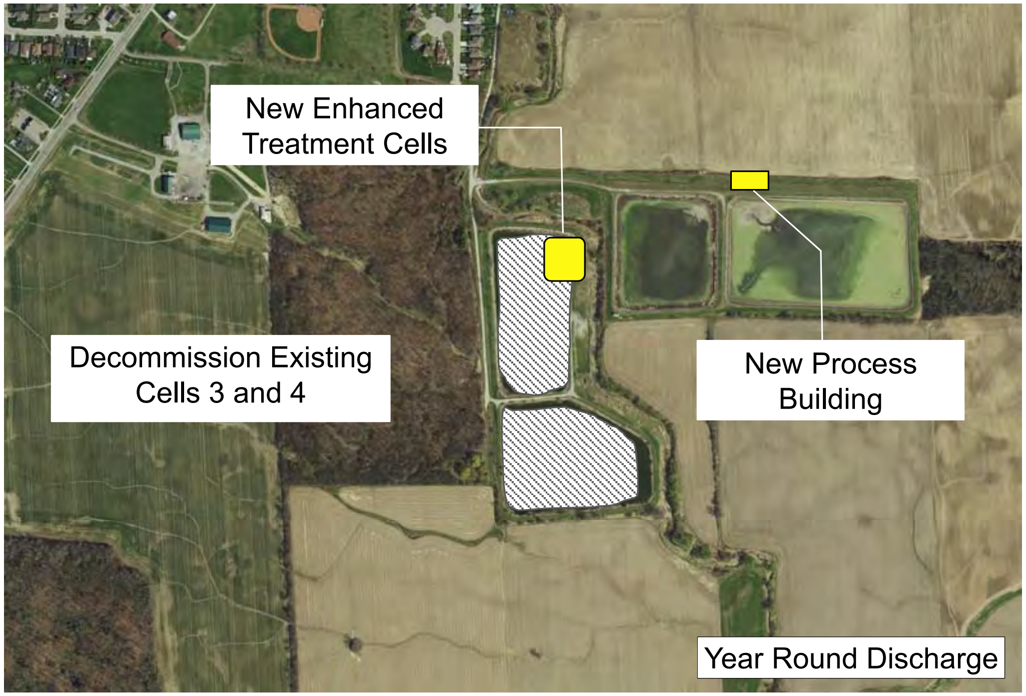
Issue Project File Report (if required) for 30-day Review
Summer 2019

Phase 2 – Alternative Solutions

The Jarvis Lagoon is currently operating near its treatment capacity. The purpose of this Municipal Class Environmental Assessment (Class EA) is to determine the preferred wastewater treatment alternative to meet anticipated growth in Jarvis.

OVERVIEW OF ALTERNATIVES 1 & 2

Alternative 1 – Add Enhanced Treatment System



System Components:

- Two new treatment tanks
- New process building
- Capacity Increase: 420 m³/day
- Lifecycle Cost: $7,800,000 ($2.55 per m³)
- Rating: Positive

Advantages/ Disadvantages:

- Very good effluent quality
- Capacity to expand
- Complex to operate
- Relatively high capital costs

Alternative 2 – Add a New Lagoon Cell

System Components:

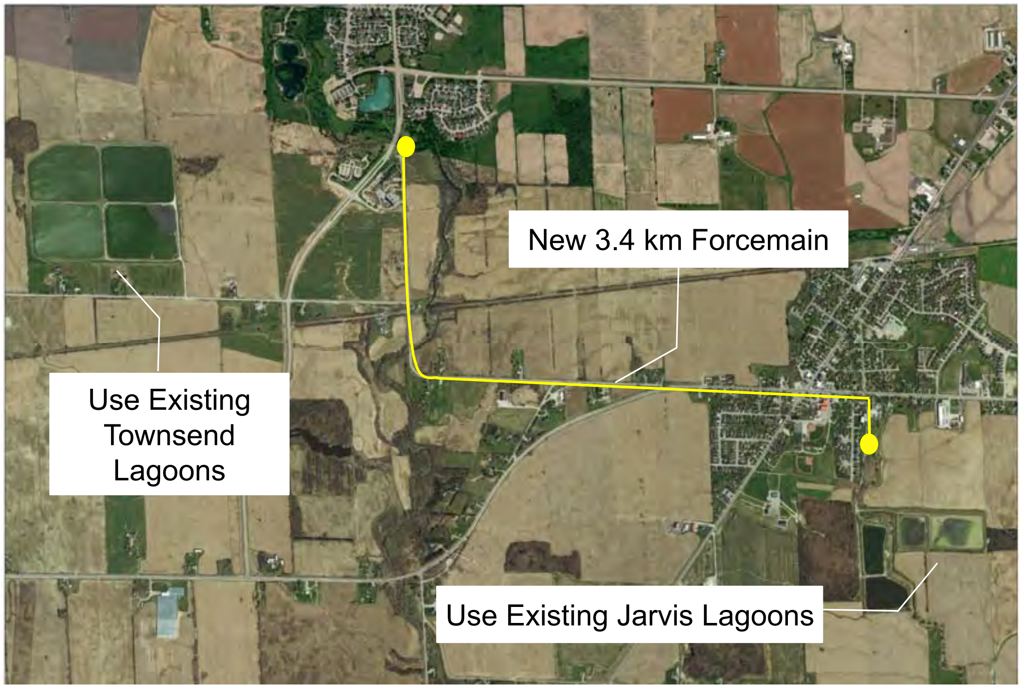
- New 70,000 m³ lagoon cell
- Capacity Increase: 420 m³/day
- Lifecycle Cost: $8,000,000 ($2.61 per m³)
- Rating: Negative

Advantages/ Disadvantages:

- May not meet ammonia limits
- Limited capacity to expand
- Simple to operate
- Relatively high capital costs

OVERVIEW OF ALTERNATIVES 3 & 4

Alternative 3 – Pump Sewage to Townsend Lagoon



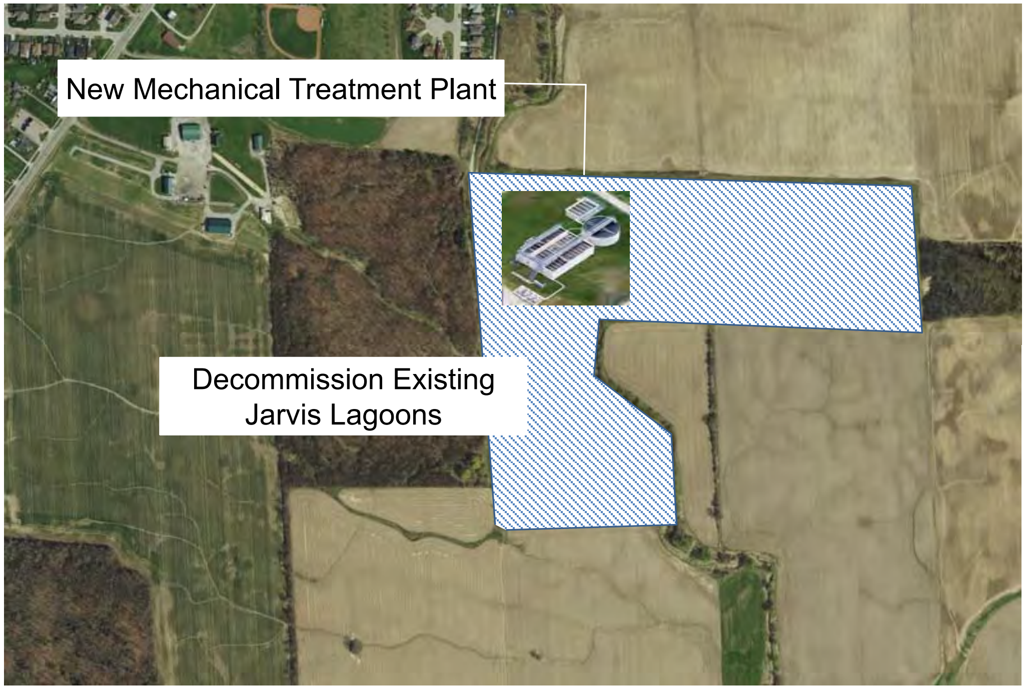
System Components:

- Existing lagoons
- 3.4 km forcemain
- New pumps at Jarvis SPS
- Capacity Increase: 420 – 745 m^3/day
- Lifecycle Cost: $6,100,000 ($1.12-$1.99 per m^3)
- Rating: Very Positive

Advantages/ Disadvantages:

- Uses existing lagoons
- Capacity to expand
- Operational flexibility
- Moderate capital costs
- Low operational costs

Alternative 4 – Build a Mechanical Treatment Plant



System Components:

- New treatment plant
- Decommission lagoon
- Capacity Increase: 420 m^3/day
- Lifecycle Cost: $15,000,000 ($4.90 per m^3)
- Rating: Neutral

Advantages/ Disadvantages:

- Very good effluent quality
- Capacity to expand
- Complex to operate
- High capital costs
- High operating costs

SELECTION OF ALTERNATIVES

Step 1 – Screening and Evaluation: Criteria were used to rate each potential alternative.

Natural Environment

- Effect on Fish, Aquatic Life, Vegetation
- Effect on Groundwater, Soils, Geology
- Effect on Terrestrial Vegetation and Wildlife

Social and Cultural Environment

- Opportunity for Community Development
- Impact on Public Health
- Air Quality, Odours, Noise and Aesthetic Issues
- Archaeological and Heritage Resources

Technical Environment

- Constructability and Construction Schedule
- Opportunities for Phased Implementation and Expandability
- Operational Control and Complexity
- System Redundancy and Resiliency
- Optimized Use of Existing Infrastructure

Economic Environment

- Capital Costing
- Operating Costs
- Lifecycle Costs

Impact Score	Score
Very Positive	▲▲
Positive	▲
Neutral	●
Negative	▼
Very Negative	▼▼

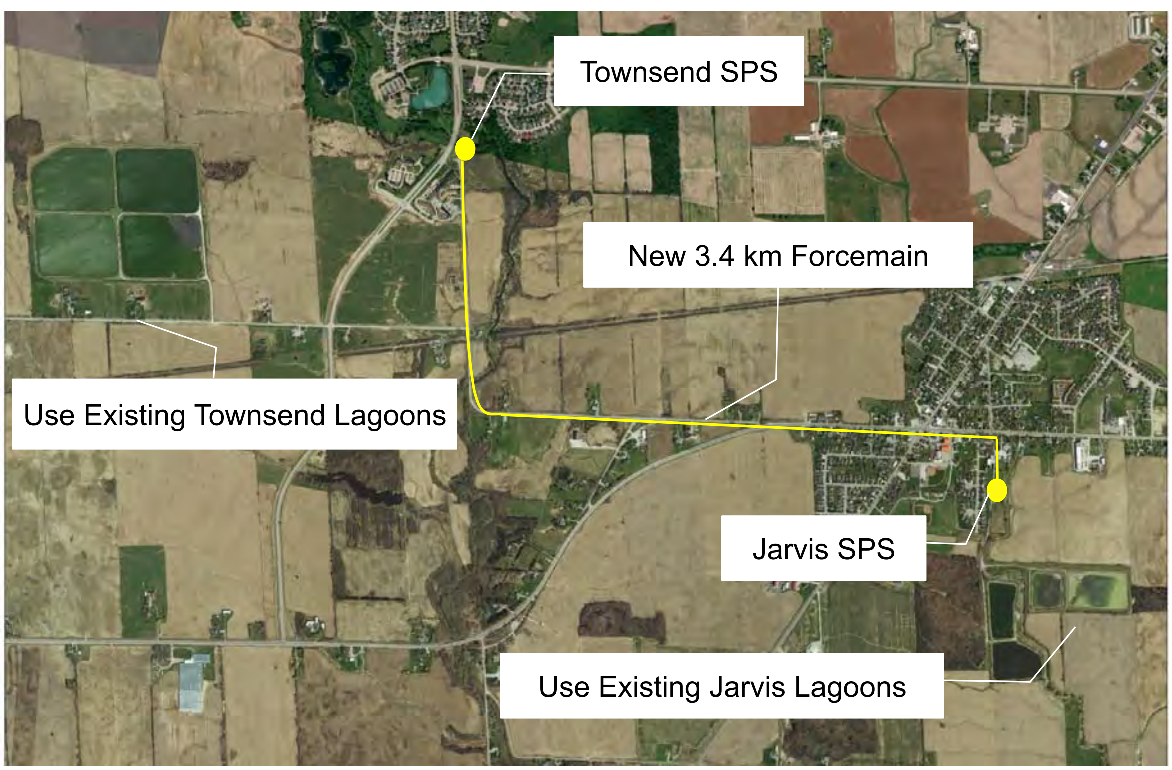
Step 2 – Selection of Preferred Alternative: The highest scoring alternative was selected as the preferred alternative.

PREFERRED ALTERNATIVE

Alternative 3:

Construct a Forcemain to Townsend and Utilize Townsend and Jarvis Lagoons for Treatment

System Components	Advantages/ Disadvantages
• Construct 3.4 km forcemain to Townsend to convey wastewater to the Townsend lagoons. • Upgrade pumps at the Jarvis SPS. • Treat Jarvis wastewater at Jarvis or Townsend lagoons. • Capacity Increase: 420 – 745 m^3/day Capital Cost: $5,400,000 20-Year Lifecycle Cost: $6,100,000 ($1.12 - $1.99 per m^3) Rating: ⮝⮝ High Positive	• Townsend lagoons have sufficient surplus capacity to service long-term growth in Jarvis. • Lagoon based systems are simple and cost effective to operate compared to other alternatives. • Enables the County to utilize existing treatment infrastructure in Jarvis and Townsend. • Modest capital costs relative to other alternatives.



NEXT STEPS

Data Collection and Review → Identify Problems and Opportunities →

Phase 1 – Problem/ Opportunity

Identify and Evaluate Solutions →

WE ARE HERE
Consult with Review Agencies and Public

Select Preferred Alternative →

Presentation to Council
Spring 2019

Phase 2 – Alternative Solutions

- The proposed project is classified as a Schedule A+ undertaking. Schedule A+ projects are smaller scale with minimal adverse environmental impact. Schedule A+ projects are pre-approved; however, the public must be advised prior to implementation.
- Following this Information Center, public comments will be incorporated in a draft report to be presented to County Council this spring.
- The public will be notified prior to project implementation.

Appendix C

Public and Agency Comments

HAVE YOUR SAY

Haldimand County
Jarvis Master Municipal Class Environmental Assessment for Additional Wastewater Treatment Capacity

COMMENT FORM

Name (please print): [redacted] **Date:**

I represent a(n):
(please select the most applicable [redacted]

Do you wish to receive upd[redacted]

Contact N[redacted]

Agency (if applic[redacted]

Address (number, street, ap[redacted]

City, Province, Postal [redacted]

Ph[redacted]

Please indicate any issue(s) that need to be explored/investigated as part of this Class EA:

SUPPORT ACT #3 PUMP TO TOWSEND LAGOONS
FORCE MAIN DIRECTLY TO TOWSEND LAGOONS
- MIN. EXTRA DISTANCE, SINGLE FORCE, ADDED TOTAL CAPACITY.

Please provide any additional comments about this Class EA:

HAVE COUNTY LOOK AT COMPLIMENTARY OPPORTUNITES.
WIDEN CONCESSION & TOWNLINE ROAD (EVEN A LITTLE)
THIS IS ON ROAD CYCLING ROUTE

Michael Troop, P.Eng.
Manager, Senior Environmental Engineer
J.L. Richards & Associates Limited
107-450 Speedvale Ave W
Guelph, ON N1H 7Y6
Phone: 519-763-0713 ext. 6522

Phil Wilson
Manager, Water & Wastewater Engineering
Haldimand County, Caledonia Satellite Office
282 Argyle Street South
Caledonia, ON N3W 1K7
Phone: 905-318-5932 Ext. 6431

Please return completed form to mtroop@jlrichards.ca

Note: Comments and information regarding this Study are being collected to assist the Ministry in meeting the requirements of the EA Act. This material will be maintained on file for use during the Study and may be included in project documentation. With the exception of personal information, all comments will become part of the public record

HAVE YOUR SAY

Haldimand County
Jarvis Master Municipal Class Environmental Assessment for Additional Wastewater Treatment Capacity

COMMENT FORM

Name (please print [redacted] **Date:** April. 10, 2019

I represent a(n): [redacted]
(please select the most applic [redacted]

Do you wish to receive u [redacted]

Contac [redacted]

Agency (if ap [redacted]

Address (number, street, [redacted]

City, Province, Pos [redacted]

Please indicate any issue(s) that need to be explored/investigated as part of this Class EA:

Try to route as much as possible without disturbing new street surfacing.

Please provide any additional comments about this Class EA:

The forcemain definitely is the ~~west~~ best solution

Michael Troop, P.Eng.
Manager, Senior Environmental Engineer
J.L. Richards & Associates Limited
107-450 Speedvale Ave W
Guelph, ON N1H 7Y6
Phone: 519-763-0713 ext. 6522

Phil Wilson
Manager, Water & Wastewater Engineering
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Please return completed form to mtroop@jlrichards.ca

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Appendix D

Lagoon Seasonal Storage Capacity

28176 Jarvis Lagoon Spring Storage

Scenario 1: 45 Days Discharge Period - March 15 to April 28

Month	Projected Average Daily Flow (m3/day)	Net Precipiation/ Evaoporation (m3/day)	Combined Net Precipitation/ Evaporation Average Daily Flow (m3/day)	Number of Days in Month	Number of Storage Days	Volume ADDED (m3)	Cumulative Volume (m3)	
March	1,638	288	1,926	31	0	0	0	
April	2,584	-4	2,580	30	2	5,160	5,160	*Assume lagoon empty on April 29
May	1,401	-52	1,349	31	31	41,829	46,989	
June	842	-100	742	30	30	22,266	69,255	
July	772	-75	697	31	31	21,605	90,860	
August	687	-4	683	31	31	21,167	112,027	
September	724	99	823	30	30	24,689	136,715	
October	1,044	193	1,237	31	31	38,346	175,062	*Fall discharge begins November 1
						175,062		

Scenario 1: 21 Days Discharge Period - March 15 to April 4

Month	Projected Average Daily Flow (m3/day)	Net Precipiation/ Evaoporation (m3/day)	Combined Net Precipitation/ Evaporation Average Daily Flow (m3/day)	Number of Days in Month	Number of Storage Days	Volume ADDED (m3)	Cumulative Volume (m3)	
March	1,638	288	1,926	31	0	0	0	
April	2,584	-4	2,580	30	26	67,082	67,082	*Assume lagoon empty on April 5
May	1,401	-52	1,349	31	31	41,829	108,910	
June	842	-100	742	30	30	22,266	131,176	
July	772	-75	697	31	31	21,605	152,781	
August	687	-4	683	31	31	21,167	173,948	
September	724	99	823	30	30	24,689	198,637	
October	1,044	193	1,237	31	31	38,346	236,983	*Fall discharge begins November 1
						236,983		

Scenario 3: 30 Days Discharge Period - April 5 to May 4

Month	Projected Average Daily Flow (m3/day)	Net Precipiation/ Evaoporation (m3/day)	Combined Net Precipitation/ Evaporation Average Daily Flow (m3/day)	Number of Days in Month	Number of Storage Days	Volume ADDED (m3)	Cumulative Volume (m3)	
March	1,638	288	1,926	31	0	0	0	
April	2,584	-4	2,580	30	5	12,900	12,900	
May	1,401	-52	1,349	31	27	36,431	49,332	* Assume lagoon empty on May 5
June	842	-100	742	30	30	22,266	71,598	
July	772	-75	697	31	31	21,605	93,203	
August	687	-4	683	31	31	21,167	114,369	
September	724	99	823	30	30	24,689	139,058	
October	1,044	193	1,237	31	31	38,346	177,405	* Fall discharge begins November 1
						177,405		

28176 Jarvis Lagoon Fall Storage

Scenario 1: 45 Days Discharge Period - November 1 to December 15

Month	Projected Average Daily Flow (m3/day)	Net Precipiation/ Evaoporation (m3/day)	Combined Net Precipitation/ Evaporation Average Daily Flow (m3/day)	Number of Days in Month	Number of Storage Days	Volume ADDED (m3)	Cumulative Volume (m3)	
November	1,292	313	1,605	30	0	0	0	
December	976	295	1,272	31	16	20,344	20,344	* Assume lagoon empty on December 16
January	1,827	253	2,080	31	31	64,486	84,830	
February	1,549	236	1,784	28	28	49,962	134,792	
March	1,638	288	1,926	31	15	28,897	163,689	*Spring discharge begins March 15
						163,689		

Scenario 2: 21 Days Discharge Period - November 1 to November 21

Month	Projected Average Daily Flow (m3/day)	Net Precipiation/ Evaoporation (m3/day)	Combined Net Precipitation/ Evaporation Average Daily Flow (m3/day)	Number of Days in Month	Number of Storage Days	Volume ADDED (m3)	Cumulative Volume (m3)	
November	1,292	313	1,605	30	9	14,447	14,447	*Assume lagoon empty on November 22
December	976	295	1,272	31	31	39,417	53,864	
January	1,827	253	2,080	31	31	64,486	118,349	
February	1,549	236	1,784	28	28	49,962	168,311	
March	1,638	288	1926.441704	31	15	28,897	197,208	*Spring discharge begins March 15
						197,208		

Scenario 3: 30 Days Discharge Period - November 1 to November 30

Month	Projected Average Daily Flow (m3/day)	Net Precipiation/ Evaoporation (m3/day)	Combined Net Precipitation/ Evaporation Average Daily Flow (m3/day)	Number of Days in Month	Number of Storage Days	Volume ADDED (m3)	Cumulative Volume (m3)	
November	1,292	313	1,605	30	0	0	0	* Assume lagon empty on November 30
December	976	295	1,272	31	31	39,417	39,417	
January	1,827	253	2,080	31	31	64,486	103,903	
February	1,549	236	1,784	28	28	49,962	153,865	
March	1,638	288	1,926	31	31	59,720	213,584	
April	2,584	-4	2,580	30	5	12,900	226,485	* Spring discharge begins April 5
						226,485		

Appendix E

Detailed Alternatives Evaluation Matrix

▲▲ Very Positive
▲ Positive
● Neutral
▼ Negative
▼▼ Very Negative

Haldimand County
Municipal Class EA for Additional Wastewater Treatment Capacity in Jarvis
Evaluation Matrix

	Alternative 7		Alternative 8		Alternative 9		Alternative 11	
Criteria		**Increase Rated Capacity of the Lagoon, Enhance Treatment, and Change to Continuous Discharge Period.**		**Increase Rated Capacity of the Lagoon, Acquire Land to Add a New Lagoon Cell, No Change in Discharge Period**		**Pump Sewage to Townsend Lagoon and Maintain Existing Jarvis Lagoon (no change in rated capacity)**		**Alternative 11: Decommission the Jarvis Lagoons and Build a Mechanical Treatment Plant at the Same Site or New Site.**
System Components		- New enhanced treatment cells - New filter for TSS removal - Continuous alum feed system - Mechanical/chemical Building - Associated yard pipes and valves - Land acquisition		- 70,000 m3 lagoon cell - Associated yard pipes and valves - Land acquisition		- 3.4 km forcemain to Townsend - Modifications to yard piping at SPS - Replace 3 existing pumps - Does not include upgrades at Townsend SPS if required		- New mechanical treatment plant - Decommission existing lagoon - Land acquisition
Natural Environment								
Groundwater	●	Potential Negative Impact - There is the potential to negatively impact groundwater due to dewatering activities during construction.	●	Potential Negative Impact - There is the potential to negatively impact groundwater due to dewatering activities during construction.	●	Potential Negative Impact - There is the potential to negatively impact groundwater due to dewatering activities during construction.	●	Potential Negative Impact - There is the potential to negatively impact groundwater due to dewatering activities during construction.
Fish, Aquatic Life, Vegetation	▲▲	High Positive: Very high effluent quality can be achieved so that there is no increase in loading to the receiving water body (Sandusky Creek) if rated capacity is increased.	▼▼	High Negative: Good quality effluent will be produced with respect to cBOD and TSS, however, with lagoon treatment alone it will be difficult to achieve the ammonia limits required to protect aquatic life.	●	Neutral: There will be no change to effluent quality at Jarvis and discharge at Townsend will be within existing ECA limits.	▲▲	High positive: Very high effluent quality can be achieved, potentially decreasing loading to the receiving water body (Sandusky Creek) even if rated capacity is increased.
Terrestrial Vegetation & Wildlife	●	Potential Negative Impact: Construction has the potential to disrupt vegetation and wildlife. This should be should be confirmed prior to construction.	●	Potential Negative Impact: Construction has the potential to disrupt vegetation and wildlife. This should be should be confirmed prior to construction.	●	Potential Negative Impact: Construction of the forcemain will occur over a relatively long distance though agricultural and natural areas and has the potential to disrupt vegetation and wildlife. This should be should be confirmed prior to construction.	●	Potential Negative Impact: Construction has the potential to disrupt vegetation and wildlife. This should be should be confirmed prior to construction.
Soils and Geology	●	Neutral: No settlement or slope stability issues are anticipated. Geotechnical conditions should be confirmed prior to construction.	●	Neutral: No settlement or slope stability issues are anticipated. Geotechnical conditions should be confirmed prior to construction.	●	Neutral: No settlement or slope stability issues are anticipated. Geotechnical conditions should be confirmed prior to construction.	●	Neutral: No settlement or slope stability issues are anticipated. Geotechnical conditions should be confirmed prior to construction.
Social Environment								
Community Development	▲▲	High Positive Impact: Enhanced treatment could be designed to service residential, commercial and industrial users beyond 20-years. With enhanced treatment the lagoons should have sufficient capacity to service long-term growth in Jarvis.	▼▼	High Negative Impact: It may be very difficult to consistently achieve the effluent quality required to service to 20-year populations.	▲▲	High Positive Impact: The pumping station could be expanded to service residential, commercial and industrial users beyond 20-years. The Townsend lagoons have sufficient surplus capacity to service long-term growth in Jarvis.	▲▲	High Positive Impact: A mechanical treatment plant could be expanded to service residential, commercial and industrial users beyond 20-years. A mechanical treatment plant will have sufficient capacity to service long-term growth Jarvis.
Public Health	●	Neutral: The proposed system is a municipal wastewater treatment system which is required to meet strict regulatory standard to protect public health. No change to public heath impacts are anticipated.	●	Neutral: The proposed system is a municipal wastewater treatment system which is required to meet strict regulatory standard to protect public health. No change to public heath impacts are anticipated.	●	Neutral: The proposed system is a municipal wastewater treatment system which is required to meet strict regulatory standard to protect public health. No change to public heath impacts are anticipated.	●	Neutral: The proposed system is a municipal wastewater treatment system which is required to meet strict regulatory standard to protect public health. No change to public heath impacts are anticipated.
Noise	●	Potential Negative: Depending on the treatment option selected, there may be a slight increase in noise on site due to the operation of aeration equipment etc., however, impacts are anticipated to be modest. There will be temporary increases in noise related to construction.	●	Neutral: No changes to noise on site are anticipated as part of this alternative. There will be temporary increases in noise related to construction.	●	Neutral: No changes to noise on site are anticipated as part of this alternative. There will be temporary increases in noise related to construction.	●	Potential Negative: Depending on the treatment option selected, there may be an increase in noise on site due to the operation of aeration equipment etc. and delivery of chemicals. Impacts may be noticed by adjacent land owners. There will be temporary increases in noise related to construction.
Aesthetics	●	Neutral: Changes to the site will be modest and the aesthetic impact of infrastructure will be similar to existing.	●	Neutral: Changes to the site will be modest and the aesthetic impact of infrastructure will be similar to existing.	●	Neutral: Changes to the SPS site will be modest and the aesthetic impact of infrastructure will be similar to existing. The forcemain will be buried with no impact on aesthetics.	●	Negative: Significant changes will occur on site (e.g. new treatment buildings and concrete tankage) that may have a negative aesthetic impact.
Air Quality and Odours	▼	Potential Negative: There have not been odour complaints associated with the existing system. There may be an increase in odours on site due to changes to the treatment process. There is potential to impact nearby residential properties.	▼	Potential Negative: There have not been odour complaints associated with the existing system. There may be an increase in odours on site due to changes to the treatment process. There is potential to impact nearby residential properties.	●	Neutral: There have not been odour complaints associated with the existing system, no significant change in odour is anticipated. More treatment will be occurring in Townsend away from residential properties.	▼	Potential Negative: There have not been odour complaints associated with the existing system. There may be an increase in odours on site due to changes to the treatment process. There is potential to impact nearby residential properties.
Cultural Environment								
Archaeological and Heritage Resources	●	Potential Negative Impact - Construction has the potential to disrupt archaeological resources. This should be should be confirmed prior to construction.	●	Potential Negative Impact - Construction has the potential to disrupt archaeological resources. This should be should be confirmed prior to construction.	●	Potential Negative Impact - Construction has the potential to disrupt archaeological resources. This should be should be confirmed prior to construction.	●	Potential Negative Impact - Construction has the potential to disrupt archaeological resources. This should be should be confirmed prior to construction.
Technical Environment								
Constructability and Construction Schedule	▼	Potential Negative: Construction will temporally impact existing lagoon operations at Jarvis. There is a longer approvals process required.	▼	Potential Negative: Construction will temporally impact existing lagoon operations at Jarvis. There is a longer approvals process required.	▼	Potential Negative: The forcemain route is relative clear of obstacles (e.g. no river crossings). Construction may disrupt traffic over the 3km forcemain route over the construction period.	▼▼	High Negative: Significant work is required. It may be challenging to keep the existing lagoon in service during construction if built at the existing site.
Phasing and Expandability	▲	Positive: Treatment processes can be constructed/expanded in phases.	●	Neutral/Negative: Construction of the new cell would not likely be phased.	▲▲	High Positive: The forcemain would be designed for the ultimate capacity, the SPS upgrades could occur in phases. In the future, expansion could occur at Jarvis or Townsend.	▲	Positive: The treatment capacity of the plant could be expanded in phases.
Operational Control	▲	Positive: There are a number of factors that can be controlled in the enhanced treatment process; however, the lagoon (relatively uncontrolled process) is still required for treatment.	▼▼	High Negative: There are a limited number of factors that can be controlled in a lagoon treatment process to ensure very high effluent quality is achieved.	▲	Positive: The Townsend lagoon has conventional treatment limits for a lagoon and is operating well below its rated capacity. This decreases the need for operational control.	▲▲	High Positive: There are a number of process variables that can be controlled in this process. The existing lagoon is not required for treatment.
Operational Complexity	▼	Negative: The new process will require regular operator input and review. Mechanical parts will require regular maintenance. It's anticipated that a half time operator will be required to run/monitor operations.	▲▲	High Positive: No change in the operational complexity.	●	Potential Positive or Negative: To minimize operational complexity it is recommended that under normal operation sewage be pumped via one force main. Switching between two for mains may be operationally complex and could led to H2S issues in the pipes and flushing would be required. However, operations could be simplified and it may be possible to discontinue use of the Jarvis lagoons, consolidating treatment operations at one lagoon.	▼▼	High Negative: A plant will be more complex then a lagoon based system to operate. At least one full time operator would be required.
System Redundancy and Resiliency	▲	Positive: Redundancy can be incorporated into the advanced treatment system design.	●	Neutral: The addition cell may add some redundancy to perform maintenance operations and optimize operations and conduct maintenance activities.	▲▲	High Positive: The system is reliant on the Jarvis SPS, however, there are redundant forcemains and treatment. There will be flexibility to direct flows to Jarvis or Townsend during routine or emergency maintenance activities.	▲▲	High Positive: Mechanical treatment plants are highly reliable and design can include redundancy.
Utilizes Existing Infrastructure	▲	Positive: Continues to utilize the lagoon for treatment, however, new treatment cells/tanks are required. Pumping may be required depending on the location of reactor cells. Site electrical servicing may need upgrading.	▲	Positive: Continues to utilize the lagoon for treatment. A new cell is required for treatment, but no other infrastructure upgrades are required on site.	▲▲	High Positive: The existing SPS and lagoons at Jarvis and Townsend are utilized. This option takes advantage of surplus capacity in Townsend.	▼▼	High Negative: Existing lagoons would be decommissioned.
Economic Environment								
Capital Costs*		$5,200,000		$7,400,000		$5,400,000		$10,000,000
Operational Costs (per year)**		$130,000		$30,000		$34,500		$250,000
20-Year Lifecycle Costing		$7,800,000		$8,000,000		$6,100,000		$15,000,000
Overall Rating		▲		▼		▲▲		●

* Costs exclude upgrades to Jarvis SPS that would be common to all options after 20-year flows are reached (70 l/s). Cost to upgrade Townsend SPS not included (review during detailed design).
**Costs exclude biosolids management and pumping costs common to all options